V.S.B ENGINEERING COLLEGE, KARUR – 639 111
DEPARTMENT OF MATHEMATICS

IMPORTANT UNIVERSITY PROBLEMS FOR DISCRETE MATHEMATICS

UNIT I
LOGIC AND PROOFS
PART – A

1. **Express the statement "Good food is not cheap" in symbolic form**.
   Solution : P : food is Good Q : food is Cheap.
   Symbolic form is $P \to \neg Q$

2. **Obtain PDNF for $\neg P \vee Q$.**
   Solution : PDNF is $(P \wedge Q) \vee (\neg P \wedge Q) \vee (\neg P \wedge \neg Q)$

3. **If $P, Q \,\&\, R$ are statement variables , prove that**
   $P \wedge ((\neg P \wedge Q) \vee (\neg P \wedge \neg Q)) \Rightarrow R$.
   Solution : Consider $P \wedge ((\neg P \wedge Q) \vee (\neg P \wedge \neg Q)) \to R$
   $\Leftrightarrow (F \wedge Q) \vee (F \wedge \neg Q) \to R$
   $\Leftrightarrow F \to R$
   $\Leftrightarrow \neg F \vee R$
   $\Leftrightarrow T \vee R$
   $\Leftrightarrow$ T

4. **Prove that whenever $A \wedge B \Rightarrow C$,we also have $A \Rightarrow (B \to C)$ and vice versa**.
   Proof:
   To prove $A \Rightarrow (B \to C)$ we have to prove $A \to (B \to C)$ is a Tautology
   $A \wedge B \to C$ is a Tautology
   $\Leftrightarrow \neg(A \wedge B) \vee C$ is a Tautology
   $\Leftrightarrow \neg A \vee \neg B \vee C$ is a Tautology
   $\Leftrightarrow \neg A \vee (B \to C)$ is a Tautology
   $\Leftrightarrow A \to (B \to C)$ is a Tautology. Hence the proof.

5. **Define functionally complete set of connectives and give an example.**
   A collection of logical operators is called functionally complete if every compound proposition is
   logically equivalent to a compound proposition involving only those logical operators

6. **Define Contra positive of a statement.**
   For any statement formula $P \to Q$, the statement formula $Q \to P$ is called its converse, $\neg P \to \neg Q$ is called its inverse and $\neg Q \to \neg P$ is called its contrapositive.

7. **Give the converse and the Contra positve of the implication " If it is raining then I get wet".**
   Solution :
   P : It is raining Q : I get wet

Converse : $Q \to P$: If I get wet, then it is raining.

Contrapositive : $\neg Q \to \neg P$: If I do not get wet, then it is not raining

8. Show that $\neg(P \wedge Q) \to (\neg P \vee (\neg P \vee Q)) \Leftrightarrow (\neg P \vee Q)$. (Use only the laws).

Solution :

$\neg(P \wedge Q) \to (\neg P \vee (\neg P \vee Q))$

$\Leftrightarrow \neg\neg(P \wedge Q) \vee (\neg P \vee (\neg P \vee Q))$

$\Leftrightarrow (P \wedge Q) \vee (\neg P \vee Q)$ (Associative law)

$\Leftrightarrow (P \vee \neg P \vee Q) \wedge (Q \vee \neg P \vee Q)$ (Distributive law)

$\Leftrightarrow (T \vee Q) \wedge (\neg P \vee Q)$ (Negation law)

$\Leftrightarrow T \wedge (\neg P \vee Q)$ (Domination law)

$\Leftrightarrow (\neg P \vee Q)$ (Identity law)

9. Write the following statement in symbolic form

(a) Mark is poor but unhappy

(b) mark is rich or unhappy

(c)Mark is neither rich nor happy

(d) Mark is poor (or) he is both rich and poor.

Solution :

M : Mark is poor H : Mark is happy

The symbolic forms are

(a) $M \wedge \neg H$ (b) $M \vee \neg H$ (c) $\neg M \vee \neg H$ (d) $M \vee (\neg M \wedge \neg H)$

10. Write the following statement in symbolic form

"x is the father of mother of *y*" .

Solution :

P(x) x is a person

F(x,y) : x is the father of y

M(x,y) : x is the mother of y

The symbolic form is $(\exists z) P(z) \wedge F(x,z) \wedge M(z,y)$

11. Write in symbolic form the statement " The house will be destroyed if there is a flood".

Solution :

P : House will be destroyed Q : There is flood

The symbolic form is $Q \to P$.

12. Construct the truth table for $(P \to Q) \wedge (Q \to P)$.

P	Q	$P \to Q$	$Q \to P$	$(P \to Q) \wedge (Q \to P)$
T	T	T	T	T
T	F	F	T	F
F	T	T	F	F
F	F	T	T	T

13. Write the dual of $P \bar{\vee} Q$.

Solution :

$P \bar{\vee} Q \Leftrightarrow (P \wedge \neg Q) \vee (\neg P \wedge Q)$

Dual of $\boldsymbol{P \bar{\vee} Q}$ is $(P \vee \neg Q) \wedge (\neg P \vee Q)$

14. Represent $\boldsymbol{P \to Q}$ using $\uparrow$ only.

$$P \to Q \Rightarrow \neg P \vee Q$$
$$\Rightarrow \neg(P \wedge \neg Q)$$
$$\Rightarrow P \uparrow \neg Q$$

15. Write the converse, inverse and contra positive of the following
"If today is labour day, then tomorrow is Tuesday".

Solution :

P : Today is Labour day Q : Tomorrow is Tuesday

Converse : $Q \to P$: If tomorrow is Tuesday then today is labour day.

Inverse : $\neg P \to \neg Q$: If today is not labour day then tomorrow is not Tuesday.

Contrapositive : $\neg Q \to \neg P$: If tomorrow is not Tuesday then today is not labour day

16. For any statements $\boldsymbol{P, Q}$ prove that $\boldsymbol{\neg(P \downarrow Q) \Leftrightarrow \neg P \uparrow \neg Q; \neg(P \downarrow Q) \Leftrightarrow \neg P \downarrow \neg Q}$.

Solution :

$$\neg(P \downarrow Q) \Leftrightarrow \neg(\neg(P \vee Q))$$
$$\Leftrightarrow \neg(\neg P \wedge \neg Q)$$
$$\Leftrightarrow \neg P \uparrow \neg Q$$

$$\neg(P \uparrow Q) \Leftrightarrow \neg(\neg(P \wedge Q))$$
$$\Leftrightarrow \neg(\neg P \vee \neg Q)$$
$$\Leftrightarrow \neg P \downarrow \neg Q$$

17. Determine the truth value of the following
a) If 3+4=12 , then 3+2=6.
b) If 3+3=6 , then 3+4=9.

a) Here 3+4=12 : F & 3+2=6 : F. ie $F \to F$ so truth value is <u>True</u>

b) Here 3+3=6 : T & 3+2=6 : F. ie $T \to F$ so truth value is <u>False</u>

18. Write the dual of (a) $\boldsymbol{Q \to P}$ (b) $\boldsymbol{P \to (Q \wedge R)}$ (c) $\boldsymbol{P \leftrightarrow Q}$.

Solution :

a) $\boldsymbol{Q \to P}$

$$\Rightarrow \neg Q \vee P$$

Dual : $\neg Q \wedge P$

b) $\boldsymbol{P \to (Q \wedge R)}$

$$\Rightarrow \neg P \vee (Q \vee R)$$

Dual : $\neg P \wedge (Q \vee R)$

c) $\boldsymbol{P \leftrightarrow Q}$

$$\Rightarrow (P \to Q) \wedge (Q \to P)$$
$$\Rightarrow (\neg P \vee Q) \wedge (\neg Q \vee P)$$

Dual : $(\neg P \wedge Q) \vee (\neg Q \wedge P)$

19. Show that $\{\wedge, \vee\}, \{\vee\}$ & $\{\neg\}$ are not functionally complete set.

Solution :

$\neg P$ cannot be expressed using the connectives $\{\vee, \wedge\}$, since no such contribution of statement exist with $\{\vee, \wedge\}$ as input is T and the output is F.

20. Express $\boldsymbol{P \uparrow Q}$ interms of $\downarrow$ only.

Solution :

$$P \uparrow Q \Leftrightarrow \neg(P \wedge Q)$$
$$\Leftrightarrow \neg P \vee \neg Q \Leftrightarrow (P \downarrow P) \vee (Q \downarrow Q) \Leftrightarrow (P \downarrow P) \downarrow (Q \downarrow Q)$$

21. Show that $P \to (Q \to R) \Leftrightarrow P \to (\neg Q \vee R) \Leftrightarrow (P \wedge Q) \to R$.

$$P \to (Q \to R) \Leftrightarrow P \to (\neg Q \vee R)$$
$$\Leftrightarrow \neg P \vee \neg Q \vee R \Leftrightarrow \neg(P \wedge Q) \vee R \Leftrightarrow (P \wedge Q) \to R$$

22. Demonstrate that R is a valid inference from the premises $P \to Q, Q \to R \,\&\, P$.

Step	Derivation	Rule
(1)	$P \to Q$	P
(2)	$Q \to R$	P
(1,2)	$P \to R$	T
(3)	P	P
(1,2,3)	R	T

23. Show that $\neg Q, P \to Q \Rightarrow \neg P$.

Step	Derivation	Rule
(1)	$\neg Q$	P
(2)	$P \to Q$	P
(1,2)	$\neg Q \to \neg P$	T
(1,2)	$\neg P$	T

24. Show that a) $P \vee (P \wedge Q) \Rightarrow P$ b) $P \vee (\neg P \wedge Q) \Leftrightarrow P \vee Q$.

a) $P \vee (P \wedge Q) \to P \Leftrightarrow [\neg(P \vee (P \wedge Q))] \vee P \Leftrightarrow [\neg P \vee \neg(P \wedge Q)] \vee P$

$\Leftrightarrow [\neg P \vee (\neg P \vee \neg Q)] \vee P \quad \Leftrightarrow (\neg P \wedge \neg P) \vee (\neg P \wedge \neg Q) \vee P$

$\Leftrightarrow \neg P \vee (\neg P \wedge \neg Q) \vee P \Leftrightarrow \neg P \vee P \vee (\neg P \wedge \neg Q)$

$\Leftrightarrow T \vee (\neg P \wedge \neg Q) \Leftrightarrow T$

b) $P \vee (\neg P \wedge Q) \Leftrightarrow (P \vee \neg P) \wedge (P \vee Q) \Leftrightarrow T \wedge (P \vee Q) \Leftrightarrow (P \vee Q)$

25. Give an example to show that $(\exists x)(A(x) \wedge B(x))$ need not be a conclusion from $(\exists x)A(x) \,\&\, (\exists x)B(x)$.

Solution :

Let $A(x): x \in A$. Similarly $B(x)$ is defined.

Let A={1} and B={2}.

Since A and B are non-empty $(\exists x)A(x)$ and $(\exists x)B(x)$ is True.

But $(\exists x)(A(x) \wedge B(x))$ is False.

26. Let p(x) denote the statement "x>4". What are the truth values of P(5) and P(2)?

Solution :

We obtain the statement P(5) by setting x=5 in the statement "x>4". Hence P(5), which is the statement "5>4" is true. However P(2), which is the statement "2>4" is false.

27. Let Q(x,y) denote the statement "x=y+2", what are the truth values of the prepositions Q(1,2) and Q(2,0).

Solution :

To obtain Q(1,2), set x=1 and y=2 in the statement Q(x,y).

Hence Q(1,2) is the statement "1=2+2" which is false.

Similarly for Q(2,0), the statement is "2=0+2" which is True.

28. What are the truth values of the preposition R(1,2,3) and R(0,0,1)?

Solution :

The preposition R(1,2,3) is obtained by setting x=1, y=2 and z=3 in the statement R(x,y,z) which denote "x+y=z".

The preposition R(1,2,3) is "1+2=3" which is True.

The preposition R(0,0,1) is "0+0=1" which is False.

29. Find the truth value of $(x)(P \to Q(x)) \vee (\exists x)R(x)$ where $P: 2>1, Q(x): x>3, R(x): x>4$ with universe of discourse E being E={2,3,4}.

Solution :

$P: 2>1$ is True , $Q(4)$ is False. Therefore $(x)(P \to Q(x))$ is False.

Since R(2), R(3), R(4) are all False, $(\exists x)R(x)$ is also False.

Hence $(x)(P \to Q(x)) \vee (\exists x)R(x)$ is also False.

30. Express the statement " For every *x* there exist a *y* such that $x^2 + y^2 \geq 100$" in symbolic form.

The symbolic form is $(\forall x)(\exists y)(x^2 + y^2 \geq 100)$

31. Define Simple statement function. (OR)

Define statement function of one variable. When it will become a statement?

A simple statement function of a variable is defined to be an expression consisting of a predicate symbol and an individual variable. Such a statement function becomes a statement when the variable is replaced by the name of any object.

Example : If "X is a Teacher" is denoted by T(x), it is a statement function. If X is replaced by John, then "John is a teacher".

32. Give the symbolic form of the statement

"Every book with a blue cover is a Mathematics book".

The symbolic form is $(\forall x)(S(x)) \to P(x)$

where S(x) : x is every book with a blue cover

P(x) : Mathematics book.

33. Define Quantifiers.

Certain declarative sentences involve words that indicate quantity such as "all, some, none, one". These words help to determine the answer to the question "How many?" Since such words indicate quantity they are called quantifiers.

34. Write the following sentence in a symbolic form "Every one who is healthy can do all kinds of work".

H(x) : x is a healthy person

H(y) : y is a kind of work

D(x,y) : x can do y

$(x)(y)[H(x) \wedge H(y) \to D(x,y)]$

35. Symbolize the following statement with and without using the set of positive integer on the universe of discourse

"Given any positive integers , there is a greater positive integer".

Solution:

Let the variable x and y be restricted to the set of positive integers. Then the above statement can be

Paraphrased as follows:

For all x, there exist a y such that y is greater than x. If G(x,y) is "x is greater than y", then the

given statement is $(x)(\exists y)G(y,x)$.

If we do not impose the restriction on the universe of discourse and if we write P(x) for "x is a

positive integer", then we can symbolize the given statement is

$(x)\big(P(x)\to(y)\big(P(y)\wedge G(y,x)\big)\big)$

36. Rewrite the following using quantifiers. "Some men are genius"

M(x) : x is a man G(x) : x is genius

$(\exists x)\big(M(x)\wedge G(x)\big)$

37. Symbolize the expression " All the world loves a lover"

In first note that the quotation really means that everybody loves a lover. Now

Let P(x): x is a person L(x) : x is a lover R(x,y) : x loves y

The required expression is $(x)\big(P(x)\big)\to(y)\big(P(y)\wedge\big(L(y)\to R(x,y)\big)\big)$

38. Identify the bound variables and the free variables in each of the following expressions

(a) $(x)(\exists z)(\cos(x+y))=\sin(z-x)$. **(b)** $(\exists x)(\exists y)(x^2-y^2=z)$.

Solution:

In (a) the scope of $(x)(\exists z)$ is $(\cos(x+y))$, while the occurrence of y is a free occurrence and

$\sin(z-x)$ is free.

In (b) the scope of $(\exists x)(\exists y)$ is x^2-y^2, while the occurrence of z is a free occurrence.

39. Use quantifiers to express the associate law for multiplication of real numbers.

Solution: $\forall x\ \forall y\ \forall z\big((x.y).z=x.(y.z)\big)$ where the universe of discourse for x,y,z is the set of real numbers.

40. Let the universe of discourse be E={5,6,7}. Let A={5,6} and B={6,7}. Let P(x) : x is in A; Q(x) : x is in B and R(x,y) : x+y<12. Find the truth value of $\big((\exists x)\big(P(x)\to Q(x)\big)\big)\to R(5,6)$.

Solution: $R(x,y): x+y<12$ the only possibility is

5 + 6 < 12

$\therefore x\big(P(x)\to Q(x)\big)$ is true.

$\therefore\big((\exists x)\big(P(x)\to Q(x)\big)\big)\to R(5,6)$

41. Give an example in which $(\exists x)\big(P(x)\to Q(x)\big)$ **is true but** $\big((\exists x)P(x)\big)\to\big((\exists x)Q(x)\big)$ **is false.**

Solution : Let E = {2,3,5}

Let P(x) : x < 4, Q(x) : x > 6

P(2) is true. $\therefore(\exists x)P(x)$ is true.

For any x in E, Q(x) is false.

Hence $((\exists x)P(x)) \rightarrow ((\exists x)Q(x))$ is false.

P(5) is false and Q(5) is false.

$\therefore P(5) \rightarrow Q(5)$ is true.

$\therefore (\exists x)(P(x) \rightarrow Q(x))$ is true.

42. Construct a truth table for $(p \rightarrow q) \rightarrow (q \rightarrow p)$

p	q	$p \rightarrow q$	$q \rightarrow p$	$(p \rightarrow q) \rightarrow (q \rightarrow q)$
T	T	T	T	T
T	F	F	T	T
F	T	T	F	F
F	F	T	T	T

UNIT-I
PART-B

1. Prove that $(P \rightarrow Q) \wedge (Q \rightarrow R) \Rightarrow (P \rightarrow R)$.
2. Find the PDNF and PCNF of the formula $S \Leftrightarrow (P \rightarrow (Q \wedge R)) \wedge (\neg P \rightarrow (\neg Q \wedge \neg R))$.
3. Using Conditional proof, prove that $\neg P \vee Q, \neg Q \vee R, R \rightarrow S \Rightarrow P \rightarrow S$.
4. By using truth table verify whether the following specifications are Consistent.

   Whenever the system software is being upgraded users cannot access the file system. If users can access file system , then they can save new files. If users cannot save new files then the system software is not being upgraded.
5. Without using truth tables, show that $\neg P \wedge (\neg Q \wedge R) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$.
6. Obtain PDNF & PCNF of $(\neg P \rightarrow R) \wedge (Q \leftrightarrow P)$.
7. Show that S is a valid inference from the premises $P \rightarrow \neg Q, Q \vee R, \neg S \rightarrow P \,\&\, \neg R$.
8. Without using truth tables , show that $\neg P \wedge (\neg Q \wedge R) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$.
9. Obtain PDNF & PCNF of $(\neg P \rightarrow R) \wedge (Q \leftrightarrow P)$
10. Show that $R \rightarrow S$ is a valid inference from the set of premises $P \rightarrow (Q \rightarrow S), \neg R \vee P \,\&\, Q$.
11. Show that the following premises are inconsistent:
    1. If Jack misses many classes through illness and reads a lot of books.
    2. If Jack fails high school, then he is uneducated.
    3. If Jack reads a lot of books, then he is not uneducated.
    4. Jack misses many classes through illness and reads a lot of book.
12. "If there was a ball game , then traveling was difficult. If arrived on time, then travelling was difficult. If they arrived on time, then traveling was not difficult. They arrived on time. Therefore there was no ball game". Show that these statements constitute a valid argument.
13. Show the validity of the argument:

    If the band could not play rock music (or) the refreshments were not delivered on time, then the new year's party would have been cancelled and Alice would have angry.If the party were cancelled, then refunds would have to be made. No refunds were made. Therefore the band could

play rock music.

14. Establish the validity of the argument.

$$U \to R, (R \wedge S) \to (P \vee T), (Q \to (U \wedge S), \neg T \Rightarrow Q \to P.$$

15. Show that without using truth table

$$((P \vee Q) \wedge \neg(\neg P \wedge (\neg Q \vee \neg R))) \vee (\neg P \vee \neg Q) \vee (\neg P \wedge \neg R)$$ is a tautology

16. Establish the validity of the argument

$$P \to Q, Q \to (R \wedge S), \neg R \vee (\neg T \vee U), P \wedge T \Rightarrow U.$$

17. Establish the validity of the argument

$$P, P \vee Q, Q \to (R \to S), T \to R \Rightarrow \neg S \to \neg T.$$

18. Establish the validity of the argument

$$(\neg P \vee Q) \to R, R \to (S \vee T), \neg S \wedge \neg U, \neg U \to \neg T \Rightarrow P.$$

19. Establish the validity of the argument $\neg P \leftrightarrow Q, Q \to R, \neg R \Rightarrow P$.

20. Use Indirect method of proof show that $(x)(P(x) \vee Q(x)) \Rightarrow (x)P(x) \vee (\exists x)Q(x)$.

21. Prove that $(\exists x)P(x) \to (x)Q(x) \Rightarrow (x)(P(x) \to Q(x))$.

22. Use Conditional proof to prove that $(x)(P(x) \to Q(x)) \Rightarrow (x)P(x) \to (x)Q(x)$.

23. Prove that $(\exists x)(A(x) \vee B(x)) \Leftrightarrow (\exists x)A(x) \vee (\exists x)B(x)$.

24. Show that $(x)(P(x) \to Q(x)) \wedge (x)(Q(x) \to R(x)) \Rightarrow (x)(P(x) \to R(x))$.

25. Is the following conclusion validly derivable from the premises given?

If $(x)(P(x) \to Q(x)), (\exists y)P(y)$ then $(\exists z)Q(z)$.

26. Verify the validity of the inference: If one person is more successful than another, then he has worked harder to deserve success. John not worked harder than Peter. Therefore John is not successful than Peter.

27. Prove that $(\exists x)(P(x) \wedge Q(x)) \Rightarrow (\exists x)P(x) \wedge (\exists x)Q(x)$.Verify Whether the converse is true.

28. Show that

$$(\exists x)(F(x) \wedge S(x)) \to (y)(M(y) \to W(y)), (\exists y)(M(y) \wedge \neg W(y) \Rightarrow (x)(F(x) \to \neg S(x)).$$

29. No junior (or) senior is enrolled in a physical education class.Mary is enrolled in a physical education class. Therefore Mary is

30. Show that $(x)(P(x) \vee Q(x)), (x)(\neg P(x) \wedge Q(x)) \to R(x)) \Rightarrow (x)(\neg R(x) \to P(x))$.

31. Express "$\sqrt{2}$ is an irrational number" using quantifiers.

32. Using CP or otherwise, show that the following implications

(a) $(\exists x)P(x) \to (x)Q(x) \Rightarrow (x)(P(x) \to Q(x))$ (b) $(x)(P(x) \to Q(x)) \Rightarrow (x)P(x) \to (x)Q(x)$.

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UNIT-II
COMBINATORICS

1. Define the product rule.

If one job can be done in m ways and following this another job can be done in n ways then the total number of ways in which both the jobs can be done in the stated order is mn.

2. Define the sum rule.

If one job can be done in m ways and another job can be done in n ways and if there is no way common to both jobs then the total number of ways in which either of the two jobs can be done is equal to m + n.

3.How many different 8-bit strings are there that begin and end with one.

Solution: A 8-bit string that beings and with 1 can be constructed in 6 steps,(i.e.,) By selecting IInd bit,IIIrd bit, IV bit, Vth bit, VIth bit and VIIth bits and each bit Can be selected in 2 ways.

Hence, the total number of 8-bit strings that begins and end with 1 is equal to 2.2.2.2.2= 2^6 =64.

4. How many different 8-bit strings are there that end with 0111?

Solution: A 8-bit strings that end with 0111 can be constructed in 4 steps.

By selection I st bit,IInd bit, IIIrd bit and IVth bit and each bit can be selected in 2 Ways.

The total number of 8-bit strings that end with 0111 is equal to 2.2.2.2= 2^4 =16.

5.What is Inclusion and Exclusion principle.

Let $P_1, P_2, ...P_n$ are finite sets.

Then $\left|P_1 \cup P_2 \cup .....P_n\right| = \sum_{1 \le i \le n} \left|P_i\right| - \sum_{1 \le i < j \le n} \left|P_i \cap P_j\right| + \sum_{1 \le i < j < k \le n} \left|P_i \cap P_j \cap P_k\right| .... + (-1)^{n-1} \left|P_1 \cap P_2 \cap ...P_n\right|$

6.Define Pigeonhole principle.

It states that if there are more pigeons(objects)than the pigeonholes(boxes),then some pigeonhole(box) must contain two or more pigeons(objects).the pigeonhole principle is also called the Dirichlet drawer principle or shoe box principle.

7. Give two example based on pigeonhole principle.

Solution:

1.Among any group of 365 people, there must be atleast two with the same birthday, because there are only 366 maximum possible birthdays.

2. In any group of 27 English words, there must be atleast two that starts with the same letter, since there are 26 letters in English alphabet.

8. Show that among 13 children, there atleast two children who were born in the same month.

Solution: let us assume that 13 children as pigeons and the 12 months (January, …… December)as the pigeonholes then by the pigeonhole principle there will be atleast two children who were born in the same month.

9. Prove the statement: If m= K_{n+1} pigeons(where K $\geq$ 1)occupy n pigeonholes then atleast one pigeonhole must contain K+1 or more pigeons.

Solution: Let us assume that the conclusion of the given statement is false.

Then every pigeonhole contains K or less number of pigeons. Then, the total number of pigeons would be nK. This is a contradiction. Hence, the assumption made is wrong, and the given statement is true.

10.Show that if seven colors are used to paint 50 cars, atleast eight cars will have the same colour.

Solution: Assume that 50 cars (pigeons)are assign 7 colors (pigeonholes).Hence, by the generalised pigeonhole principle, atleast $\left[\frac{50-1}{7}\right]+1=8$ cars will have the same colour.

11.Show that if any 5 numbers from 1 to 8 are chosen, then two of them will have their sum equal to 9.

Solution: let us consider the following sets :

$A_1=\{1,8\}, A_2=\{2,7\}, A_3=\{3,6\}, A_4=\{4,5\}$

These are the only sets containing two numbers from 1 to 8, whose sum is 9.

Because every number from 1 to 8 belongs to one of the above sets, each of the 5 numbers chose

must belong to one of the sets.

Since there are only 4 sets, two of the 5 chosen numbers have to belong to the same set (by the pigeonhole principle. These two numbers have their sum equal to 9.

12. Define permutation:

A permutation of a set of distinct objects is an ordered arrangement of these objects.

Note: Permutation means selection and arrangement of factors.

Notation: nP_r (or) P(n, r) (or) $P_{n,r}$ (or) P_n^r (or) $(n)_r$

13. Define r-permutation.

An r-permutation of n(distinct) elements $x_1, x_2, ...x_n$ is an ordering of an r-elements subset $\{x_1, x_2, ...x_n\}$ .the number of r-permutations of a set of n distinct elements is denoted by P(n.r).

14. Define combinations and give an example.

A combination is a selection of objects without regard to order .(or) A combination is an unordered collection of distinct objects.

Example: abc is the combination of three objects a, b and c.

15. Prove that for let n and r be the non-negative integers with $r \leq n$. **Then** $C(n,r)=C(n,n-r)$ **.**

Proof: We know that $C(n,r)=\frac{n!}{r!(n-r)!}$

$$C(n,n-r)=\frac{n!}{(n-r)!(n-(n-r))!}=\frac{n!}{(n-r)!(r!)}=C(n,r)$$

Hence, C(n , r)=C(n, n -r).

16. Determine the value of n if $20C_{n+1}=20C_{2n-1}$ **.**

Solution: Given: $20C_{n+2}=20C_{2n-1}$

Formula $nC_x = nC_y \Rightarrow n = x + y$ or x=y

n+2=2n-1 $\Rightarrow$ 3=n $\Rightarrow$ n=3

17. How many possibilities are there for the win, place and show (first, second and third) positions in a horse race with 12 horses if all orders of finish are possible?

Solution: The number of ways to pick the three winners is the number of ordered selections of three elements from 12. (i.e.,) P(12,3)=(12)(11)(10)=1320.

18. Determine the value of n if (4) $(nP_3) = (n+1)P_3$

Solution: Given:

$(4)(nP_3) = (n+1)P_3$

$$(4)\left[\frac{n!}{(n-3)!}\right] = \frac{(n+1)!}{(n+1-3)!} = \frac{(n!)(n+1)}{(n-3)!(n-2)!}$$

$$\Rightarrow 4 = \frac{n+1}{n-2} \quad \Rightarrow 4(n-2) = n+1 \quad \Rightarrow 4n-8 = n+1$$

$\Rightarrow$ 3n=9 $\Rightarrow$ n=3

19. In how many ways can a set of five letter to be selected from the English alphabet?

Solution: The positions of r 1s in a b it string of length n from an r-combination of the set $\{1,2,3,...n\}$. Hence, there are C(n ,r) bit strings of length n that contain exactly r 1s.

20. Define Recurrence Relations.

Recurrence Relation:(Sometimes called difference equation).

A recurrence relation for the sequence $\{a_n\}$ is an equation that shows a_n in terms of one or more of the previous terms of the sequence $a_0, a_1, ...a_{n-1}$, for all integers n with n$\geq n_0$,where n_0 is a non-negative integer.

21.Let $\{A_n\}$ be a sequence that satisfies the recurrence relation $a_n = a_{n-2} + a_{n-1}$ for n=1,2,3,4,5,….and suppose that $a_0 = 3$ and $a_1 = 5$ .What are a_2 and a_3 ?

Solution: Given

$a_n = a_{n-2} + a_{n-1}$

$a_2 = a_0 + a_1 = 3 + 5 = 8$

$a_3 = a_1 + a_2 = 5 + 8 = 13$

22. Let $a_n = 2^n + (5)(3^n)$ for n=0, 1,2,….

(a) Find a_0, a_1 and a_2. (b) Show that $a_4 = 5a_3 - 6a_{2.}$

Solution: Given: $a_n = 2^n + (5)(3^n)$

$a_0 = 2^0 + (5)(3^0) = 1 + (5)(1) = 6$

$a_1 = 2^1 + (5)(3^1) = 2 + (5)(3) = 17$

$a_2 = 2^2 + (5)(3^2) = 4 + (5)(9) = 49$

(b) Given: $a_n = 2^n + 5(3^n)$

$a_3 = 2^3 + 5(3^3) = 8 + 5(27) = 143$

To prove: $a_4 = 5a_3 - 6a_2$

$L.H.S = a_4 = 2^4 + 5(3^4) = 16 + 5(81) = 421$

$R.H.S = 5a_3 - 6a_2 = 5(143) - 6(49) = 715 - 294 = 421$

$L.H.S = R.H.S.$

Hence the proof.

23. What are the three methods to solve recurrence relation?

1. Iteration,2. Characteristic roots and 3.Generating functions.

24. What are the solution of the recurrence relation $a_n = 2a_{n-1}$ *for* $n \geq 1, a_0 = 3$

Solution: Given : $a_n = 2a_{n-1}$

(i.e.,) $a_n - 2a_{n-1} = 0$ …… (1)

Let $a_n = r^n$ be a solution of (1)

: $\Rightarrow r^n - 2r^{n-1} = 0 \quad \Rightarrow r^n\left[1 - \frac{2}{r}\right] = 0 \quad \Rightarrow r^n\left[\frac{r-2}{r}\right] = 0$

The characteristic equation is r-2=0

r=2

By theorem $a_n = \alpha 2^n$ ……..(2)

$a_0 = 3 \Rightarrow a_0 = \alpha 2^0 = 3$

Given $\Rightarrow \alpha = 3$

$(2) \Rightarrow a_n = 3(2^n)$

25. Define Generating functions.

The generating function for the sequence $a_0, a_1, ...a_k, ...$ of real numbers is the infinite series.

G(x) = $a_0 + a_1 x + ... + a_k x^k + ... = \sum_{k=0}^{\infty} a_k x^k.$

26. Find the generating function for the finite sequence 2,2,2,2,2.

Solution: The generating function of 2,2,2,2,2. is $2 + 2x + 2x^2 + 2x^3 + 2x^4$

$$= 2\left[1 + x + x^2 + x^3 + x^4\right] = 2\left[\frac{x^5 - 1}{x - 1}\right]$$

When $x \neq 1$.Consequently, G(x)=$2\left[\frac{x^5 - 1}{x - 1}\right]$ is the G.F. of the sequence 2,2,2,2,2.

27. Find the generating function for $(1+x)^{-n}$ **,where n is a positive integer.**

Solution: $(1+x)^{-n} = \sum_{k=0}^{n} (k^{-n}) x^k$ by extended binomial theorem.

We know that $\left(r^{-n}\right) = (-1)^r c(n + r - 1, r)$

$$(1+x)^{-n} = \sum_{k=0}^{n} (-1)^k c(n + k - 1, k) x^k.$$

28. Find a closed form for the generating function of 3,-3,3,-3,3,-3,….

Solution: We have $\frac{3}{1+x} = 3(1+x)^{-1} = 3(1 - x + x^2 - x^3 + ...)$

$$= 3 + (-3)x + 3x^2 + (-3)x^3 + ... = \sum_{n=0}^{\infty} (-3)^n x^n$$

Hence the required G.F is $\frac{3}{1+x}$

29.Find the co-efficient of x^{10} in $(1+x^5+x^{10}+x^{15}+...)^3$

Solution: We know that $(1+x^5+x^{10}+x^{15}+.....)^3=\left[(1-x^5)^{-1}\right]^3=(1-x^5)^{-3}=\sum c(3+r-1,r)x^{5r}$

To find the coefficient of x^{10}, put 5r=10 =>r=2

The required coefficient is c(3+2-1,2)=c(4,2)

$=4c_2=6$

30.Define Inclusion and Exclusion.

Let X and Y be two finite subsets of a universal set U. If X and Y are disjoint, then $|X\cup Y|=|X|+|Y|$. If X and Y are not disjoint then $|X\cup Y|=|X|+|Y|-|X\cap Y|$

This is called the principle of inclusion and exclusion.

31.Give a formula for the number of elements in the union of four sets.

Solution: By the principle of the inclusion and exclusion we get

$$\begin{aligned}|A_1\cup A_2\cup A_3\cup A_4| &= |A_1|+|A_2|+|A_3|+|A_4|-|A_1\cap A_2|\\ &-|A_1\cap A_3|-|A_1\cap A_4|-|A_2\cap A_3|-|A_2\cap A_4|-|A_3\cap A_4|\\ &+|A_1\cap A_2\cap A_3|+|A_1\cap A_2\cap A_4|+|A_1\cap A_3\cap A_4|\\ &+|A_2\cap A_3\cap A_4|-|A_1\cap A_2\cap A_3\cap A_4|\end{aligned}$$

32. Find a formula for the probability of the union of n events in a sample space.

Solution: the probability of n events in a sample space is

$$P\left(\bigcup_{i=1}^{n}E_i\right)=\sum_{1\le i\le n}P(E_i)-\underset{1\le i<j\le n}{E}P(E_i\cap E_j)+\sum_{1\le i<j<k\le n}P(E_i\cap E_j\cap E_k)-.....+(-1)^{n+1}p(\bigcap_{i=1}^{n}E_i)$$

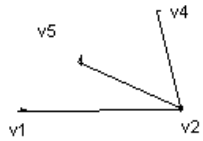
UNIT-III
GRAPHS

1. Define Graph.

A graph G = (V(G),E(G)) consists of V, a non empty set of vertices (nodes or points)and E, a set of edges (also called lines).

2. Define adjacent vertices.

Any pair of vertices which are connected by an edge in a graph is called adjacent vertices.



Here $v_1,v_2;v_2,v_4;v_2,v_3$ are adjacent vertices $v_1,v_3;v_3,v_4;v_1,v_4$ are not adjacent.

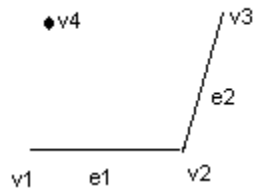
3. Define adjacent edges.

If two distinct edges are incident with a common vertex then they are called adjacent edges.

Here e_1 and e_2 are incident with a common vertex v_2.

4. Define isolated vertex

In any graph , a vertex which is not adjacent to any other vertex is called an isolated vertex. Otherwise the vertex has no incident edge.



Here v_3 has no incident edge. Therefore the vertex v_3 is called isolated vertex.

5. Define Label graph.

A graph in which each vertex is assigned a unique name or label is called a label graph.

6. Define Directed graph and undirected graph.

In a graph G(V,E), an edge which is associated with an ordered pair of vertices is called a directed edge of graph G, While an edge which is associated with an unordered pair of vertices is called an undirected edge.

A graph in which every edge is directed is called a directed graph or simply a digraph.

7. Draw a diagram for the following graph

Solution:

$$G = G(V, E)$$

$$V = \{v_1, v_2, v_3, v_4\}$$

$$E = \{(v_1, v_2), (v_4, v_1), (v_3, v_1), (v_3, v_4)\}$$

8. Define Niche overlap Graphs in Ecology.

A niche overlap graph is a simple graph because no loops or multiple edge are needed in this model.

9. Define the degree of a vertex.

The degree of a vertex in an undirected graph is the number of edges incident with it, except that a loop at a vertex contributes twice to the degree of that vertex.

The degree of the vertex is denoted by deg( ).

10. Define adjacent vertices in undirected graph.

Two vertices u and v in an undirected graph G are called adjacent (or neighbors) in g u, v are endpoints of an edge of G.

11. How many edges are there in a graph with 10 vertices each of degree six?

Solution: Sum of the degree of the 10 vertices is (6)(10)=60 i.e., 2e=60 e=30.

12. Show that the sum of degree of all the vertices in a graph G, is even.

Proof: Each edge contributes two degree in a graph.

Also, each edge contributes one degree to each of the vertices on which it is incident.

Hence, if there are N edges in G, then

$$2N = d(v_1) + d(v_2) + .. + d(v_N)$$

Thus, 2N is always even.

13. Define In degree.

In a directed graph G, the in degree of v denoted by in deg G(v) or $\deg^{-1}{}_G(v)$,is the number of edges ending at v.

14. Define out degree.

In a directed graph G, the out degree of v of G denoted by out $\deg_G(v)$ or $\deg_G^+(v)$, is the number of edges beginning at v.

15.Draw Graphs K_n for $1 \le n \le 4$

Solution:

16. What is the degree sequence of K_n , Where n is a positive integer? Explain your answer.

Solution: Each of the n vertices is adjacent to each of the other n-1 vertices, so the degree sequence is n-1,n-1, ….,n-1(n terms)

17. Define Cycle Graph.

A cycle graph of order 'n' is a connected graph whose edges from a cycle of length 'n' and denoted by C_n .

18. Define Wheel graph.

A Wheel graph of order n is obtained by joining a new vertex called 'Hub' to each vertex of a cycle graph of order n-1, denoted by W_n .

19. Define Regular graph.

A graph in which all vertices are of equal degree is called a regular graph.

If the degree of each vertex is r, then the graph is called a regular graph of degree r.

20. For Which value of n are these graphs regular?

(a) K_n (b) C_n (c) W_n (d) Q_n

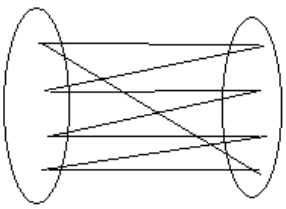
Solution: (a) For all $n \ge 1$ (b) For all $n \ge 3$ (c) For n=3 (d) For all $n \ge 0$

21. Define bipartite graph.

A bipartite graph is an undirected graph whose set vertices can be partitioned into two sets M and N is such a way that each edge joins a vertex in M to a vertex in N and no edge joints either two vertices in M or two vertices in N.

Here $V = M \bigcup N$ $\quad M \bigcap N = \phi$

$M = \{v_1, v_3, v_5, v_7\}$ $\quad V = \{v_2, v_4, v_6, v_8\}$



22. Define Complete Bipartite graph.

A complete bipartite graph is a bipartite graph in which every vertex of M is adjacent to every vertex of N. the complete bipartite graphs that may be partitioned into sets M and N as above s.t M=m and $|N| = n$ are denoted by $K_{m,n}$

23. Define star graph.

Any graph that is $K_{1,n}$ is called a star graph.

24. Prove that a graph which contains a triangle can not be bipartite.

Proof: Atleast two of the three vertices must lie in one of the bipartite sets because there two are joined by edge, he graph can not be bipartite.

25. Define Graph coloring.

The assign of colors to the vertices of G, one color to each vertex, so that adjacent vertices are assigned different color is called the proper coloring of G or simply vertex coloring.

If G has n coloring, then G is said to be n-colorable.

26. Define Subgraph.

A subgraph of a graph G=(V,E) is a graph H=(W,F), where $W \subseteq V$ and $F \subseteq E$. A subgroph H

of G is a proper subgraph of G if $H \neq G$.

27. Define Complement.

The complement $\overline{G}$ of G is defined as a simple graph with the same vertex set as G and value

two vertices u and v are adjacent only when then are not adjacent in G.

28. Define Adjancy matrix.

Let G (V, E) be a simple graph with n. vertices ordered from V_1 and V_n,then the adjacency matrix A=$\left[a_{ij}\right]_{n\times n}$ of G is an n$\times$n symmetric matrix defined by the elements.

$$a_{ij} = \begin{cases} 1 & \text{when } V_1 \text{ is adjacent to } V_j \\ 0 & \text{Otherwise} \end{cases}$$

it is denoted by A(G) or A_G

$$A_G = \begin{array}{c} \\ V_1 \\ V_2 \\ V_3 \\ V_4 \end{array} \begin{array}{c} \begin{array}{cccc} V_1 & V_2 & V_3 & V_4 \end{array} \\ \begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{pmatrix} \end{array}$$

29. Write any properties of adjacency matrix.

1. An adjacency matrix completely defines a simple graph.
2. The adjacency matrix is symmetric.

30. Write the adjacency matrix of C_4.

Solution:

C_4 graph is

$$\begin{array}{c} \\ V_1 \\ V_2 \\ V_3 \\ V_4 \end{array} \begin{array}{c} \begin{array}{cccc} V_1 & V_2 & V_3 & V_4 \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

31. Define Incidence matrix.

Let G be a graph with n vertices, Let $V = \{V_1, V_2, ...V_n\}$ and $E = \{e_1, e_2, ...e_m\}$ .Define $n \times m$ matrix.

$$I_G = \left[m_{ij} \right]_{n \times m} \quad \text{Where} \quad m_{ij} = \begin{cases} 1 & \text{when } V_i \text{ is incident with } e_j \\ 0 & \text{Otherwise} \end{cases}$$

$$I_G = \begin{array}{c} \\ V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_5 \end{array} \begin{array}{c} \begin{array}{ccccc} e_1 & e_2 & e_3 & e_4 & e_5 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \end{array}$$

32. What is the sum of the entries in a row of the incidence matrix for an undirected graph?

Solution: Sum is 2 if e is not a loop, 1 if e is a loop.

33. Define Isomorphic Graphs.

Two graphs D and G' are isomorphic if there is a function $f : V(G) \to V(G')$ from the vertices of G to the vertices of G' such that

(i) f is one-to-one

(ii) f is onto and

(iii) For each pair of vertices u and v of G

$$[u, v] \in E(G) \Leftrightarrow [f(u), f(v)] \in E(G')$$

Any function f with the above three properties is called an isomorphism from G to G'

34. Prove that any 2 simple connected graphs with n vertices all of degree 2 are isomorphic.

Solution: We know that total degree of a graph is given by

$$\sum_{i=1}^{n} d(V_i) = 2|E|$$

then $|V| = number\ of\ vertices\ n$ and $|E| = number$ of edges

Further the degree of every vertex is 2.

Therefore $\sum_{i=1}^{n} 2 = 2|E| \quad \Rightarrow 2((n) - 1 + 1) = 2|E| \quad \Rightarrow n = |E|$

Number of edges=number of vertices. Therefore the graphs are cycle graphs Hence they are isomorphic.

35. Can a simple graph with 7 vertices be isomorphic to its complement?

Solution: A graph with 7 vertices can have a maximum number of edges.

$$= \frac{7(7-1)}{2} = \frac{7 \times 6}{2} = 21 = 21 \quad \text{edges}$$

21 edges cannot be split into 2 equal integers. Therefore, G and $\overline{G}$ cannot equal number of edges. Hence a graph with 7 vertices cannot be isomorphic to its complement.

36. Define path.

A path in a multigraph G consists of an alternating sequence of vertices and edges of the form $V_0, e_1, V_1, e_2, V_2, \ldots e_{n-1}, V_{n-1}, e_n, V_n$ Where each edge e_i contains the length of the V_{i-1} and V_i

The number n of edges is called the length of the path.

37. Define circuit.

A path of length ≥ 1 with no repeated edges and whose end vertices are same is called a circuit.

38. Define path graph.

A path graph of order 'n' is obtained by removing on edge from a C_n graph, denoted by P_n.

39. Define trail.

A trail from v to w is a path from v to w that does not contain a repeated edge.

40. Define connected and disconnected graphs.

A graph G is a connected graph is there is atleast one path between every pair of vertices in G. otherwise G is a disconnected graph.

41. Define Euler circuit.

An Euler circuit in a graph G is a simple circuit containing every edge of G.

42. Define Euler path.

An Euler path in G is a simple path containing every degree of G.

43. Define Euler line and Euler graph.

A closed walk which contains all edges of the graph G is called an Euler line, and the graph containing atleast one Euler line is said to be an Euler graph.

44. Show that values of n is the graph K_n Eulerian?

Solution: We know that K_n ,the complete graph of n vertices is a connected graph in which degree of each vertices is n-1 .Because a graph is Eulerian if and only if it is connected and degree of each vertex is even, we conclude that K_n is an Euler graph if and only if n is odd.

45. Define Hamilton path.

A simple path in a graph G that passes through every vertex exactly once is called a Hamilton path. That is, the simple path $x_0, x_1, ..., x_{n-1}, x_n$ in the graph G=(V,E) is a Hamilton path if V=$\{x_0, x_1, ..., x_{n-1}, x\}$ and $x_i \neq x_j$ for $0 \leq i < j \leq n$.

46. Define Hamilton circuit.

A simple circuit in a graph G that passes through every vertex exactly once is called a Hamilton circuit. And the simple circuit $x_0, x_1, ..., x_{n-1}, x_n, x_0$ (*with* n>0) is a Hamilton circuit if $x_0, x_1, ..., x_{n-1}, x_n$ is a Hamilton path.

47. Show that K_n has a Hamilton circuit whenever $n \geq 3$.

Solution: Now we can form a Hamilton circuit in K_n beginning at any vertex.

Such a circuit can be built by visiting vertices in any order we choose, as long as the path begins and ends at the same vertex and visits each other vertex exactly once

It is possible since there are edges in K_n between any two vertices.

48. State Dirac's theorem.

If G is a simple graph with r. vertices with $n \geq 3$ such that the degree of every vertex in G is at least n/2, then G has a Hamilton circuit.

49. State Ore's theorem.

If G is a simple graph with number of vertices n(≥ 3) and if

deg (u)+ deg(v) $\geq$ n ……(1)

for every pair of non-adjacent vertices u and v ,then G is Hamiltonian.

50. Define Gray code.

A Gray code is a labeling of the arcs of the circles such that adjacent arcs are labeled with bit strings that differ in exactly one bit.

ALGEBRIC STRUCTURES
PART-A

1. If S denotes the set of positive integers ≤ 100 for $x, y \in S$ define $x * y = min\{x, y\}$. Verify whether $(S,*)$ is a monoid assuming that $*$ is associative.

   Solution :

   100 is the identity element in (s,x).

   since 100*x = min {x,100}=x since x$\leq$ 100 for all $x \in S$.

   Therefore (s,x) is a monoid.

2. If H is a sub-group of a group G ,among the right coset of H in G ,Prove that there is only one subgroup H .

   Solution :

   Let Ha be a right coset of H and G where $a \in G$. If Ha is a subgroup of G, then $e \in Ha$ where e is the identity element in G.

3. Give an example of subsemigroup.

   Solution :

   For the semi-group (N,+) , the set E of all even non negative integers is a sub semi group (E,+) of (N,+).

4. Define Normal subgroup of a group.

   A subgroup H of a group G is called a normal sub group if for every $a \in G,\ aH = Ha$

5. Find all the cosets of the subgroup $H = \{1,-1\}$ in $G = \{1,-1,i,-i\}$ with the operation Multiplication.

   Solution :

   Let us find the right cosets of H in G.

$$H(1) = \{1,-1\} = H$$

$$H(-1) = \{-1,1\} = H$$

$$H(i) = \{i,-i\} \quad and \quad H(-i) = \{-i,i\} = Hi$$

$$H\square 1 = H = H\square -1 = \{1,-1\}$$

$$\text{and } Hi = H\square -i = \{i,-i\}$$

   are the two right cosets of H in G. Similarly we can find the left coset of H in G.

6. A semigroup homomorphism preserves property of associativity.

   Solution :

   Let $a \in S$ be an idempotent element.

   There fore a*a = a

$$\Rightarrow g(a*a) = g(a)$$

$$g(a) \circ g(a) = g(a)$$

   This shows that $g(a)$ is an idempotent element in T.

There fore the property of idempotenct is preserved under semi group homomorphism.

7. A semigroup homomorphism preserves commutativity.

   Proof :

Let $a,b \in S$

Assume that $a*b = b*a$

$$g(a*b) = g(b*a)$$

$$g(a) \circ g(b) = g(b) \circ g(a)$$

This means that the operation $\circ$ is commutative in T.

There fore the semi group homomorphism preserves commutativity.

8. Define abelian group and subgroup.

Definition : Abelian group

A group (G,*) is said to be abelian if a*b=b*a for all a,b$\in G$.

Definition : Subgroup

Let (G,*) be a group and let H be a non-empty subset of G. Then H is said to be a sub group of G if H itself is a group with the operation *.

9. Define ring and give an example of a ring with zero-divisors.

Definition : An algebraic system $(S,+,*)$ is called a ring if the binary operations + and * on S satisfy the following 3 properties.

i) (S,+) is an abelian group.

ii) (S,*) is a semi group.

iii) The operation * is distributive over + that is for any $a,b,c \in S$

$$a.(b+c) = a.b + a.c \text{ and}$$

$$(b+c).a = b.a + c.a$$

Example : The ring $(Z_{10}, +_{10}, \times_{10})$ not an integral domain. Since $5 \times_{10} 2 = 0,$ yet $5 \neq 0, 2 \neq 0$ in Z_{10}.

10. State Cayley's theorem on Permutation groups.

Every finite group of order 'n' is isomorphic to a permutation group of degree n.

11. Prove that the only idempotent element of a group is its identity element.

Idempotent element : An element $a \in G$ is said to be idempotent with respect to * if a*a=a

Identity element : An element e of G is said to be identity element if

$$e*a = a*e = a, \text{ for every } a \in G$$

In a group the identity element e only satisfies the idempotent condition e*e=e.

12. What do you call a homomorphism of a semi group into itself?

Solution :

A homomorphism of a semi group into itself is called a semi group endomorphism.

13. Show that if every element in a group is its own inverse, then the group must be abelian.

Solution :

Let $(G,*)$ be a group.

Given : $a^{-1} = a, \forall a \in G$

To prove : a*b=b*a (Abelian)

Let $a, b \in G$

$\Rightarrow a^{-1} = a$ and $b^{-1} = b$

$a * b \in G$ $\quad [Since\ (G,*)$ be a group$]$

$(a*b)^{-1} = a*b$ $\quad [Since$ if every element in a group is its own inverse$]$

$b^{-1} * a^{-1} = a*b$ $\quad [Since (a*b)^{-1} = b^{-1} * a^{-1}]$

$b*a = a*b$ $\quad [by\ \ (1)]$

$Since\ (G,*)$ is an abelian group.

14. Give an example of a Monoid which is not a group.

$(Z^+,*)$ is a monoid which is not a group. $\left[Since\ a \in G, \frac{1}{a} \notin G\right]$

15. Show that $(Z_5, +_5)$ is a cyclic group.

$+_5$	[0]	[1]	[2]	[3]	[4]
[0]	0	1	2	3	4
[1]	1	2	3	4	0
[2]	2	3	4	0	1
[3]	3	4	0	1	2
[4]	4	0	1	2	3

16. Define Semi group and monoid. Give an example of a semi group which is not a monoid

Definition : Semi group

Let S be a non empty set and $\circ$ be a binary operation on S. The algebraic system (S, $\circ$) is called a semigroup if the operation $\circ$ is associative. In other words (S, $\circ$) is semi group if for any x,y,z $\in G$, (x$\circ$y) $\circ$z = x$\circ$(y$\circ$z).

Definition : Monoid

An algebraic system (M, $\circ$) is a Monoid if

i) $\circ$ is binary

ii) $\circ$ is associative

iii) the set M has an identity with respect to the operation $\circ$.

Example : (Z, $\circ$) is a semi group.

The inverse property does not exist.

There fore (Z, $\circ$) is not a monoid.

17. A semigroup homomorphism preserves property of idempotency.

Let $f = (M,*) \to (H, \Delta)$ be semi group homomorphism.

x idempotent element in M.

$Therefore\ \ x*x = x,\ \ f(x*x) = f(x) \square f(x)$

$Then\ \ f(x) = f(x) \square f(x)$

Therefore idempotency is preserved.

18. Define a semigroup.

Solution:

If a non empty set S together with the binary operation '*' satisfying the following two properties:

a) a*b=b*a, $a,b \in S$ (Closure Property)

b) (a*b)*c=a*(b*c), $a,b,c \in S$ (Associative Property)

is called a semigroup. It is denoted by (S,*).

19. If 'a' is the generator of the cyclic group G, then show that a^{-1} is also a generator of G.
Solution:
Now $(a^{-1}) = \left\{\left(a^{-1}\right)^n ; n \in z\right\} = \left\{a^{-n}; n \in z\right\} = \left\{a^m; m \in z\right\} = a$

UNIT- IV

PART- B

1. Show that the mapping g from the algebraic system $(S,+)$ to the system $(T,\times)$ defined by $g(a) = s^a$,where S is the set of all rational numbers under $+$ and T is the set of non-zero real numbers under multiplication operation $\times$, is a homomorphism but not an isomorphism.
2. The intersection of any two subgroups of a group G is again a subgroup of G -Prove.
3. State & prove Lagrange's theorem for finite groups.
4. Find all the non-trivial subgroups of $(Z_6,+_6)$.
5. If every element of a group is its own inverse, prove that G is abelian. Is the converse true?
6. Prove that the direct product of two (or) more groups is again a group.
7. Show that monoid homomorphism preserves invertibility and monoid epimorphism preserves zero element (if it exist).
8. State and prove Fundamental theory on Homomorphism of groups

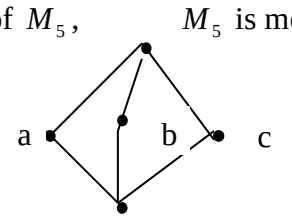
UNIT-V

LATTICES AND BOOLEAN ALGBRA

PART- A

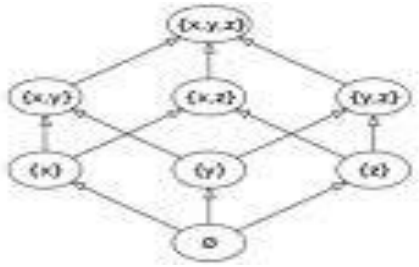
1. **Is the lattice of divisors of 32 a Boolean algebra.**
No. the divisors of 32 is a chain and hence it is not complemented.

2. **Give an example of a lattice which is modular but not distributive**.
$M_5 \rightarrow$ Diamond lattice
In M_5, $a \vee (b \wedge c) = a \vee 0 = a$ while $(a \vee b) \wedge (a \vee c) = |\wedge| = 1$
So M_5 is not distributive.
As N_5 is not a sublattice of M_5, M_5 is modular.



3. **Obtain the Hasse diagram of $\langle \rho(A_3), \leq \rangle$ where $A_3 = \{x, y, z\}$.**
Solution :
Given S={x,y,z}
P(S) = {{x},{y},{z},{x,y},{y,z},{z,x},{x,y,z},{}}
We know that {P(S), $\subseteq$} is a poset
Since empty set is a subset of every set in P(S), { } is the least set of P(S).
Similarly S={x,y,z} contains all elements of P(S) ie an element of P(S) is a subset of {x,y,z}.

Therefore S is the greatest element in P(S).
Hence {P(S), $\subseteq$} is a lattice.
The Hasse diagram is



4. In a lattice (L, $\leq$), prove that $a \wedge (a \vee b) = a$, for all a,b $\in$ L.

   Solution:
   Since $a \wedge b$ is the GLB of {a,b}, we have
   $a \wedge b \leq a$ …….(1)
   Obviously a $\leq$ a …..(2)
   From (1) and (2), we have $a \vee (a \wedge b) \leq a$ ……(3)
   By definition of LUB, we have $a \leq a \vee (a \wedge b)$ …..(4)
   By combining (3) and (4), we have $a \vee (a \wedge b) = a$. Similarly we can prove $a \wedge (a \vee b) = a$.
5. Give an example of a relation which is symmetric but not reflexive.
6. Give an example of a relation which is reflexive but not symmetric.
7. Give an example of a relation which is both reflexive and symmetric.
8. Give an example of a relation which is neither reflexive nor symmetric.
9. Give an example of a relation which is both symmetric and anti-symmetric.
9. Give an example of a relation which is neither reflexive nor irreflexive.
10 Give an example of a relation which is neither symmetric nor anti-symmetric.
11 Let $X = \{1,2,3,4\}$ & $\boldsymbol{R = \{\langle 1,1\rangle, \langle 4,1\rangle, \langle 1,4\rangle, \langle 4,4\rangle, \langle 2,2\rangle, \langle 2,3\rangle, \langle 3,2\rangle, \langle 3,3\rangle\}}$.
   Write the matrix of *R* and sketch its graph.
   Show that $\boldsymbol{A \subseteq A \cup B}$ and $\boldsymbol{A \subseteq B \Leftrightarrow A \cup B = B}$ $\boldsymbol{A \cap B \subseteq A}$.

UNIT – V
PART- B

1. Let *R* denote a relation on the set of ordered pairs of positive integers such that $\langle x,y\rangle \boldsymbol{R} \langle u,v\rangle$ iff $\boldsymbol{xv = yu}$. Show that *R* is an equivalence relation.
2. Prove that the relation " Congruence modulo m" given by
   $\equiv = \{\langle x,y\rangle / \, x - y \text{ is divisible by } m\}$ over the set of positive integers is an equivalence relation. Show also that if $\boldsymbol{x_1 = y_1 \;\&\; x_2 = y_2}$ then $\boldsymbol{(x_1 + x_2) = (y_1 + y_2)}$.
3. Prove that distinct equivalence classes are disjoint.
4. In a lattice show that $\boldsymbol{a \leq b \;\&\; c \leq d}$ implies $\boldsymbol{a * c \leq b * d}$.
5. In a distributive lattice prove that $\boldsymbol{a * b = a * c}$ & $\boldsymbol{a \oplus b = a \oplus c}$ implies $\boldsymbol{b = c}$.
6. Let $\boldsymbol{P = \{\{1,2\},\{3,4\},\{5\}\}}$ be a patition of the set $\boldsymbol{S = \{1,2,3,4,5\}}$.Construct an equivalence R on S so that the equivalent classes with respect to R are precisely the members of
7. Show that a chain with two or more elements is not complemented.
8. Establish De Morgan's laws in a Boolean algebra.
9. In a distribute lattice, prove that the following are equivalent.

(a) $a \wedge b \leq x \leq a \vee b$

(b) $x = (a \wedge x) \vee (b \wedge x) \vee (a \wedge b)$

10. Prove that any chain ‘a’ is modular lattice.
11. In the Boolean algebra of all divisors of 70, find all sub algebras.
12. For any Boolean, prove
    1. $x \vee y = x \vee z, \bar{x} \vee y = \bar{x} \vee z \Rightarrow y = z.$
    2. $x \vee y = 0 \Leftrightarrow x = 0, y = 0.$
    3. $x \leq \bar{y} \Leftrightarrow x \wedge y = 0.$
    4. $x \wedge y = 1 \Leftrightarrow x = 1, y = 1.$
13. Prove that in a distributive lattice every element has unique complement.
14. In any lattice prove that $a \wedge (b \vee c) \geq (a \wedge b) \vee (a \wedge c)$.
15. Let R be a relation on a set A. Then define $R^{-1} = \{\langle a,b \rangle \in A \times A / \langle b,a \rangle \in R\}$.Prove that if $\langle A, R \rangle$ is a poset then $\langle A, R^{-1} \rangle$ is also a poset.
16. Show that $\langle Z^{+}, / \rangle$ is distributive.
17. Show that every finite partial ordered set has a maximal and minimal element.
18. Show that if L is a distributive lattice then for all $a,b,c \in L$
    $(a * b) \oplus (b * c) \oplus (c * a) = (a \oplus b) * (b \oplus c) * (c \oplus a)$.
19. In a Boolean algebra , Prove that $(a \wedge b)' = a' \vee b'$ for all $a,b \in L$.

V.S.B. ENGINEERING COLLEGE, KARUR
Department of Information and Technology
Academic Year: 2018-2019 (ODD Semester)
Assignment Questions

Class: II Year / III Semester B.Tech IT.,
Subject Code/ Subject Name: MA8351/ Discrete Mathematics
Name of the faculty: N.Bhuvana

Sl. No.	Reg. No.	Questions
1.	922517205001	Prove that $(\exists x)(p(x)\wedge q(x)) \Rightarrow (\exists(x)p(x)\wedge(\exists x)q(x)$.
2.	922517205002	Prove that the following equivalence by proving the equivalence of the duals (i) $\neg((\neg p\wedge q)\vee(\neg p\vee\neg q))\vee(p\wedge q)\equiv p$ (ii) $(p\wedge(p\leftrightarrow q))\rightarrow q\equiv T$
3.	922517205003	Find the sequence whose generating function is $\frac{6-29x}{30x^2-11x+1}$ using partial fraction.
4.	922517205004	Prove the following implication $(P\rightarrow Q)\wedge\neg Q\Rightarrow\neg P$.
5.	922517205005	Use mathematical induction to show that, $n!\geq 2^{n-1}$ for n=1,2,3.....
6.	922517205006	Show that a^n-b^n is divisible by (a-b) all $n\in N$
7.	922517205007	Identify the sequence having the expression having the expression $\frac{5+2X}{1-4x^2}$ as a generating function.
8.	922517205008	Find the number of positive integers that can be formed from the digits 1,2,3,4&5 and if no digit is repeated in any one integer.
9.	922517205009	Any positive integer n $\geq$ 2 is either a prime or a product of primes. To prove this we use the principle of strong mathematical induction.
10	922517205011	If A, B&C are three subsets of sets S then, $\lvert A\cup B\cup C\rvert=\lvert A\rvert+\lvert B\rvert+\lvert C\rvert-\lvert A\cap B\rvert-\lvert B\cap C\rvert-\lvert A\cap C\rvert+\lvert A\cap B\cap C\rvert$.
11	922517205012	Determine the value of n if (i) (4) (nP_3) = $(n+1)P_3$ (ii) 20 C_{n+2} = 20 C_{2n-1}
12	922517205013	How many ways are there to select five card hand from a 52 cards such that the hand contains at least on card in each suit?
13	922517205015	Find the solution to $a_n=2a_{n-1}+5a_{n-2}-6a_{n-3}$ with $a_0=7, 4a_1=-4, a_2=8$.
14	922517205016	How many positive integers n can be formed using the digits 3,4,4,5,5,6,7 if n has to exceed 5000000?
15	922517205017	Use Mathematics induction to prove the inequality 2^n < n! for all positive integer n with n≥4.
16	922517205018	Find the number of integers between 1 and 250 that are not divisible by any of the integers 2,3,5&7.
17	922517205019	Use generating functions to find an explicit formulae for the Fibonacci numbers.
18	922517205021	How many positive integers n can we form using the digits 3,4,4,5,5,6,7 if we want n to exceed 5,00,000?
19	922517205022	What is the solution of recurrence relation? $a_n=5a_{n-1}-6a_{n-2}$ for n $\geq$ 2, $a_0=1, a_1=0$
20	922517205023	In how many ways can be letters of the word "ARRANGE" be arranged so that

		(a) the two R's are never together (b) the two A's are together but not two R's (c) Night two A's nor the two R's are together.
21	922517205024	Write down the following statements in symbolic form using quantifiers; (i) Every real numbers has a additive inverse (ii) the set of real numbers has a multiplicative identity.
22	922517205025	Prove the following implication $p \to (p \to r) \Rightarrow (p \to q) \to (p \to r)$ is a tautology.
23	922517205026	How many words of four letters can be formed from the letters of the word "EXAMINATION"?.
24	922517205027	Find the number of positive integers not exceeding 100 that are not divisible by 7 or by 11.
25	922517205028	Find the recurrence relation for the number of binary sequence of length n that have no two consecutive 0^s.
26	922517205029	Using generating function solve $a_n - 3a_{n-1} = n$, $n \geq 1$, $a_0 = 1$.
27	922517205030	Conjecture a formula for the sum of the first n positive odd integers. then prove by using mathematical induction.
28	922517205031	Identify the sequence having the expression having the expression $\frac{5+2X}{1-4x^2}$ as a generating function.
29	922517205032	Find the number of distinct permutations that can be formed from all the letters of each word (i) RADAR (ii) UNUSUAL
30	922517205033	Establish the validity of the following argument : "All integers are rational numbers. Some integers are powers of 2. Therefore some rational numbers are powers of 2."
31	922517205034	Find the number of positive integers less than or equal to 1000 and not divisible by any of 3,5,7 and 22.
32	922517205035	Using generating function solve the recurrence relation corresponding to the Fibonacci sequence.$a_n = a_{n-1+} a_{n-2,} n \geq 2$ with $a_0 = a_1 = 1$.
33	922517205036	Show that the following is valid : Raju is in this class watches whale watching. Everyone who watches whale watching cares about ocean pollution. Therefore, someone in the class cares about ocean pollution.
34	922517205037	Use Mathematics induction to prove the inequality $n<2^n$ for all positive integer n**.**
35	922517205039	Prove that the sum of an irrational number and a rational number is irrational.
36	922517205038	Prove by mathematical induction that $6^{n+2}+7^{2n+1}$ is divisible by 43 for each positive integer n.
37	922517205040	Show that the following argument is valid: ''In a triangle XYZ, there is no pair of angles o equal measure''. If a triangle has two sides of equal lengths, then it is isosceles. If a triangle is isosceles, then it has two angles, of equal measure.
38	922517205041	If n Pigeonholes are occupied by (kn+1) pigeons, where k is positive integer, prove that atleast one pigeonhole is occupied by k+1 or more pigeons. Hence, find the minimum number of m integers to be selected from S={1,2,…,9} so that the sum of the m integers are even.
39	922517205042	Use induction to prove that, If $n \geq 1$, then $1.1! + 2.2! + \cdots + n.n! = (n+1)! - 1$.
40	922517205043	How many prime numbers not exceeding 100 are there?

41	922517205044	How many positive integers n can be formed using the digits 3,4,4,5,5,6,7 if n has to exceed 5000000?
42	922517205045	A team of 11 players is to be chosen from 15 members. In how many ways can it be done if (i) one particular player is always included? (ii) Two such players have always to be included?
43	922517205046	Show that $\sim(P \wedge Q) \rightarrow (\sim P \vee (\sim P \vee Q)) \equiv \sim P \vee Q$.
44	922517205048	Prove that $(P \rightarrow Q) \Rightarrow P \rightarrow (P \wedge Q)$.
45	922517205050	Find the number of positive integers less than or equal to 1000 that are divisible by any of 3,5,7 and 22.
46	922517205051	How many of these 2500 students have taken a course in any of these three courses C, Pascal and Networking? (ii) How many of these 2500 students have not taken a course in any of these three courses C, Pascal and Networking?
47	922517205052	Test the truth value of the statement "Every positive integer is the sum of the squares of three integers".
48	922517205053	Prove the following implication $(P \rightarrow Q) \wedge \neg Q \Rightarrow \neg P$.
49	922517205054	Show that the following two statements are logically equivalent: "It is not true that all Comedians are funny" and "There are some comedians who are not funny" .
50	922517205055	Solve the recurrence relation $a_n - 7a_{n-1} + 10a_{n-2} = 0$ for $n \geq 2$, given that $a_0 = 10, a_1 = 41$ using generating function.
51	922517205056	How many prime numbers not exceeding 100 are there?
52	922517205057	There are 2500 students in a college, of these 1700 have taken a course in C,1000 have taken a course Pascal and 550 have taken a course in Networking. Further 750 have taken courses in both C and Pascal. 400 have taken courses in both C and Networking, and 275 have taken courses in both Pascal and Networking. If 200 of these students have taken courses in C, Pascal and Networking.
53	922517205058	Test the validity of the following argument: If an integer is divisible by 10, then it is divisible by 2. If an integer is divisible by 2, then it is divisible by 3. Therefore the integer divisible by 10 is also divisible by 3.
54	922517205060	Use Mathematics induction to prove the inequality $n<2^n$ for all positive integer n.

QUESTION BANK

Subject Name: Digital Electronics
Subject Code: EC6302
Year / Branch / Semester: II / ECE / III Semester

PART – A (2 MARKS)

UNIT – I

MINIMIZATION TECHNIQUES AND LOGIC GATES

1) Define binary logic?

Binary logic consists of binary variables and logical operations. The variables are designated by the alphabets such as A, B, C, x, y, z, etc., with each variable having only two distinct values: 1 and 0. There are three basic logic operations: AND, OR, and NOT.

2) Convert (634) 8 to binary

6 3 4

110 011 100

Ans = 110011100

3) Convert (9B2 - 1A) H to its decimal equivalent.

$N = 9 \times 16^2 + B \times 16^1 + 2 \times 16^0 + 1 \times 16^{-1} + A\ (10) \times 16^{-2}$

$= 2304 + 176 + 2 + 0.0625 + 0.039$

$= \mathbf{2482.1_{10}}$

4) State the different classification of binary codes?

1. Weighted codes
2. Non - weighted codes
3. Reflective codes
4. Sequential codes
5. Alphanumeric codes
6. Error Detecting and correcting codes.

5) Convert 0.640625 decimal numbers to its octal equivalent.

0.640625 x 8 = 5.125

0.125 x 8 = 1.0

= 0.640 625 10 = **(0.51) 8**

6) Convert 0.1289062 decimal numbers to its hex equivalent

0.1289062 x 16 = 2.0625

0.0625 x 16 = 1.0

$= \mathbf{0.21_{16}}$

7) Convert 22.64 to hexadecimal number.

16 22 -6

16 1 -1

0

0.64 x 16 = 10.24

0.24 x 16 = 3.84

0.84 x 16 = 13.44

.44 x 16 = 7.04

Ans = (16. A 3 D 7) 16

8) State the steps involved in Gray to binary conversion?

The MSB of the binary number is the same as the MSB of the gray code number. So write it down. To obtain the next binary digit, perform an exclusive OR operation between the bit just written down and the next gray code bit. Write down the result.

9) Convert gray code 101011 into its binary equivalent.

Gray Code: 1 0 1 0 1 1

Binary Code: **1 1 0 0 1 0**

10) Substract (0 1 0 1) 2 from (1 0 1 1) 2

1 0 1 0

0 1 0 1

Answer = 0 1 1 0

11) Add (1 0 1 0) 2 and (0 0 1 1) 2

1 0 1 0

0 0 1 1

Answer = (1 1 0 1) 2

12) Using 10's complement subtract 72532 - 3250

M = 72532

10's complement of N = + 96750

Sum = 169282

Discard end carry

Answer = 69282

13) Find 2'S complement of (1 0 1 0 0 0 1 1) 2

0 1 0 1 1 1 0 0 1 - 1's Complement

\+ 1

0 1 0 1 1 1 0 1 0 - 2's complement.

14) Substract 1 1 1 0 0 1 2 from 1 0 1 0 1 1 2 using 2's complement method

1 0 1 0 1 1

\+ 0 0 0 1 1 1 - 2's comp. of 1 1 1 0 0 1

1 1 0 0 1 0 in 2's complement form

Answer (0 0 1 1 1 0)2

15) Find the excess -3 code and 9's complement of the number 403_{10}

4 0 3

0 1 0 0 0 0 0 0 0 0 1 1

0 0 1 1 0 0 1 1 0 0 1 1 +

0 1 1 1 0 0 1 1 0 1 1 0 ----- excess 3 code

9's complement 1 0 0 0 1 1 0 0 1 0 0 1

16) What is meant by bit?

A binary digit is called bit

17) Define byte?

Group of 8 bits.

18) List the different number systems?

i) Decimal Number system

ii) Binary Number system

iii) Octal Number system

iv) Hexadecimal Number system

19) State the abbreviations of ASCII and EBCDIC code?

ASCII-American Standard Code for Information Interchange.

EBCDIC-Extended Binary Coded Decimal Information Code.

20) What are the different types of number complements?

i) r's Complement

ii) (r-1)'s Complement.

21) Given the two binary numbers X = 1010100 and Y = 1000011, perform the subtraction (a) X -Y and (b) Y - X using 2's complements.

a) X = 1010100

2's complement of Y = 0111101

Sum = 10010001

Discard end carry

***Answer:* X - Y = 0010001**

b) Y = 1000011

2's complement of X = + 0101100

Sum = 1101111

There is no end carry, The MSB BIT IS 1.

Answer is Y-X = -(2's complement of 1101111) = - 0010001

22) Given the two binary numbers X = 1010100 and Y = 1000011, perform the subtraction (a) X -Y and (b) Y - X using 1's complements.

a) X - Y = 1010100 - 1000011

X = 1010100

1's complement of Y = + 0111100

Sum = 10010000

End -around carry = + 1

***Answer:* X - Y = 0010001**

b) Y - X = 1000011 - 1010100

Y = 1000011

1's complement of X = + 0101011

Sum = + 1101110

There is no end carry.

Therefore the answer is Y - X = -(1's complement of 1101110) = -0010001

23) Write the names of basic logical operators.

1. NOT / INVERT
2. AND
3. OR

24) What are basic properties of Boolean algebra?

The basic properties of Boolean algebra are commutative property, associative property and distributive property.

25) State the associative property of boolean algebra.

The associative property of Boolean algebra states that the OR ing of several variables results in the same regardless of the grouping of the variables. The associative property is stated as follows:

A+ (B+C) = (A+B) +C

26) State the commutative property of Boolean algebra.

The commutative property states that the order in which the variables are OR ed makes no difference. The commutative property is:

A+B=B+A

27) State the distributive property of Boolean algebra.

The distributive property states that AND ing several variables and OR ing the result with a single variable is equivalent to OR ing the single variable with each of the the several variables and then AND ing the sums. The distributive property is:

A+BC= (A+B) (A+C)

28) State the absorption law of Boolean algebra.

The absorption law of Boolean algebra is given by X+XY=X, X(X+Y) =X.

29) Simplify the following using De Morgan's theorem [((AB)'C)" D]'

[((AB)'C)" D]' = ((AB)'C)" + D' [(AB)' = A' + B']

= (AB)' C + D'

= (A' + B')C + D'

30) State De Morgan's theorem.

De Morgan suggested two theorems that form important part of Boolean algebra.

They are,

1) The complement of a product is equal to the sum of the complements.

(AB)' = A' + B'

2) The complement of a sum term is equal to the product of the complements.

$(A + B)' = A'B'$

31) Reduce $A.A'C$

$A.A'C = 0.C$ [$A.A' = 1$]

$= 0$

31) Reduce $A(A + B)$

$A(A + B) = AA + AB$

$= A(1 + B)$ [$1 + B = 1$]

$= A.$

32) Reduce $A'B'C' + A'BC' + A'BC$

$A'B'C' + A'BC' + A'BC = A'C'(B' + B) + A'B'C$

$= A'C' + A'BC$ [$A + A' = 1$]

$= A'(C' + BC)$

$= A'(C' + B)$ [$A + A'B = A + B$]

33) Reduce $AB + (AC)' + AB'C(AB + C)$

$AB + (AC)' + AB'C(AB + C) = AB + (AC)' + AAB'BC + AB'CC$

$= AB + (AC)' + AB'CC$ [$A.A' = 0$]

$= AB + (AC)' + AB'C$ [$A.A = 1$]

$= AB + A' + C' =AB'C$ [$(AB)' = A' + B'$]

$= A' + B + C' + AB'C$ [$A + AB' = A + B$]

$= A' + B'C + B + C'$ [$A + A'B = A + B$]

$= A' + B + C' + B'C$

$=A' + B + C' + B'$

$=A' + C' + 1$

$= 1$ [$A + 1 =1$]

34) Simplify the following expression $Y = (A + B)(A + C')(B' + C')$

$Y = (A + B)(A + C')(B' + C')$

$= (AA' + AC +A'B +BC)(B' + C')$ [$A.A' = 0$]

$= (AC + A'B + BC)(B' + C')$

$= AB'C + ACC' + A'BB' + A'BC' + BB'C + BCC'$

$= AB'C + A'BC'$

35) Show that (X + Y' + XY)(X + Y')(X'Y) = 0

(X + Y' + XY)(X + Y')(X'Y) = (X + Y' + X)(X + Y')(X' + Y) [A + A'B = A + B]

= (X + Y')(X + Y')(X'Y) [A + A = 1]

= (X + Y')(X'Y) [A.A = 1]

= X.X' + Y'.X'.Y

= 0 [A.A' = 0]

36) Prove that ABC + ABC' + AB'C + A'BC = AB + AC + BC

ABC + ABC' + AB'C + A'BC=AB(C + C') + AB'C + A'BC

=AB + AB'C + A'BC

=A(B + B'C) + A'BC

=A(B + C) + A'BC

=AB + AC + A'BC

=B(A + C) + AC

=AB + BC + AC

=AB + AC +BC ...Proved

37) Convert the given expression in canonical SOP form Y = AC + AB + BC

Y = AC + AB + BC

=AC(B + B') + AB(C + C') + (A + A')BC

=ABC + ABC' + AB'C + AB'C' + ABC + ABC' + ABC

=ABC + ABC' +AB'C + AB'C' [A + A =1]

38) Define duality property.

Duality property states that every algebraic expression deducible from the postulates of Boolean algebra remains valid if the operators and identity elements are interchanged. If the dual of an algebraic expression is desired, we simply interchange OR and AND operators and replace 1's by 0's and 0's by 1's.

39) Find the complement of the functions F1 = x'yz' + x'y'z and F2 = x(y'z' + yz). By applying De-Morgan's theorem.

F1' = (x'yz' + x'y'z)' = (x'yz')'(x'y'z)' = (x + y' + z)(x + y +z')

F2' = [x(y'z' + yz)]' = x' + (y'z' + yz)'

= x' + (y'z')'(yz)'

= x' + (y + z)(y' + z')

40) Simplify the following expression

Y = (A + B) (A = C) (B + C)

= (A A + A C + A B + B C) (B + C)

= (A C + A B + B C) (B + C)

= A B C + A C C + A B B + A B C + B B C + B C C

= A B C

41) What are the methods adopted to reduce Boolean function?

i) Karnaug map

ii) Tabular method or Quine Mc-Cluskey method

iii) Variable entered map technique.

42) State the limitations of karnaugh map.

i) Generally it is limited to six variable map (i.e) more then six variable involving expression are not reduced.

ii) The map method is restricted in its capability since they are useful for simplifying only Boolean expression represented in standard form.

43) What is a karnaugh map?

A karnaugh map or k map is a pictorial form of truth table, in which the map diagram is made up of squares, with each squares representing one minterm of the function.

44) Find the minterms of the logical expression Y = A'B'C' + A'B'C + A'BC + ABC'

Y = A'B'C' + A'B'C + A'BC + ABC'

=m0 + m1 +m3 +m6

=_m(0, 1, 3, 6)

45) Write the maxterms corresponding to the logical expression

Y = (A + B + C')(A + B' + C')(A' + B' + C)

= (A + B + C')(A + B' + C')(A' + B' + C)

=M1.M3.M6

=_ M(1,3,6)

46) What are called don’t care conditions?

In some logic circuits certain input conditions never occur, therefore the corresponding output never appears. In such cases the output level is not defined, it can be either high or low. These output levels are indicated by ‘X’ or‘d’ in the truth tables and are called don’t care conditions or incompletely specified functions.

47) What is a prime implicant?

A prime implicant is a product term obtained by combining the maximum possible number of adjacent squares in the map.

48) What is an essential implicant?

If a min term is covered by only one prime implicant, the prime implicant is said to be essential

UNIT – II

COMBINATIONAL CIRCUITS

1) What is a Logic gate?

Logic gates are the basic elements that make up a digital system. The electronic gate is a circuit that is able to operate on a number of binary inputs in order to perform a particular logical function.

2) Give the classification of logic families

logic families

- 1. Bipolar
  - 1. Saturated
    - 1.1 RTL
    - 1.2 ECL
    - 1.3 I I C
    - 1.4 TTL
  - 2. Non Saturated
    - 2.1.Schottky TTL
    - 2.2. DTL
- 2.Unipolar
  - 1. PMOS
  - 2. NMOS
  - 3. CMOS

3) What are the basic digital logic gates?

The three basic logic gates are

1. AND gate
2. OR gate
3. NOT gate

4) Which gates are called as the universal gates? What are its advantages?

The NAND and NOR gates are called as the universal gates. These gates are used to perform any type of logic application.

5) Classify the logic family by operation?

The Bipolar logic family is classified into

1. Saturated logic

2. Unsaturated logic.

The RTL, DTL, TTL, I2L, HTL logic comes under the saturated logic family.

The Schottky TTL, and ECL logic comes under the unsaturated logic family.

6) State the classifications of FET devices.

FET is classified as

1. Junction Field Effect Transistor (JFET)
2. Metal oxide semiconductor family (MOS).

7) Mention the classification of saturated bipolar logic families.

The bipolar logic family is classified as follows:

1. RTL- Resistor Transistor Logic
2. DTL- Diode Transistor logic
3. I2L- Integrated Injection Logic
4. TTL- Transistor Transistor Logic
5. ECL- Emitter Coupled Logic

8) Mention the different IC packages?

1. DIP- Dual in line package
2. LCC- Leadless Chip Carrier
3. PLCC- Plastic Leaded Chip carrier
4. PQFP- Plastic Quad Flat Pack
5. PGA- Pin Grid Array

9) Mention the important characteristics of digital IC's?

1. Fan out
2. Power dissipation
3. Propagation Delay
4. Noise Margin
5. Fan In
6. Operating temperature
7. Power supply requirements

10) Define Fan-out?

Fan out specifies the number of standard loads that the output of the gate can drive with out impairment of its normal operation.

11) Define Power dissipation.

Power dissipation is measure of power consumed by the gate when fully driven by all its inputs.

12) What is propagation delay?

Propagation delay is the average transition delay time for the signal to propagate from input to output when the signals change in value. It is expressed in ns.

13) Define noise margin?

It is the maximum noise voltage added to an input signal of a digital circuit that does not cause an undesirable change in the circuit output. It is expressed in volts.

14) Define fan in?

Fan in is the number of inputs connected to the gate without any degradation in the voltage level.

15) What is Operating temperature?

All the gates or semiconductor devices are temperature sensitive in nature. The temperature in which the performance of the IC is effective is called as operating temperature. Operating temperature of the IC vary from 00 C to 700 c.

16) What is High Threshold Logic?

Some digital circuits operate in environments, which produce very high noise signals. For operation in such surroundings there is available a type of DTL gate which possesses a high threshold to noise immunity. This type of gate is called HTL logic or High Threshold Logic.

17) What are the types of TTL logic?

1. Open collector output
2. Totem-Pole Output
3. Tri-state output.

18) What is depletion mode operation MOS?

If the channel is initially doped lightly with p-type impurity a conducting channel exists at zero gate voltage and the device is said to operate in depletion mode.

19) What is enhancement mode operation of MOS?

If the region beneath the gate is left initially uncharged the gate field must induce a channel before current can flow. Thus the gate voltage enhances the channel current and such a device is said to operate in the enhancement mode.

20) Mention the characteristics of MOS transistor?

1. The n- channel MOS conducts when its gate- to- source voltage is positive.

2. The p- channel MOS conducts when its gate- to- source voltage is negative
3. Either type of device is turned of if its gate- to- source voltage is zero.

21) How schottky transistors are formed and state its use?

A schottky diode is formed by the combination of metal and semiconductor. The presence of schottky diode between the base and the collector prevents the transistor from going into saturation. The resulting transistor is called as schottky transistor. The use of schottky transistor in TTL decreases the propagation delay without a sacrifice of power dissipation.

22) List the different versions of TTL

1.TTL (Std.TTL) 2.LTTL (Low Power TTL)
3.HTTL (High Speed TTL) 4.STTL (Schottky TTL)
5.LSTTL (Low power Schottky TTL)

23) Why totem pole outputs cannot be connected together.

Totem pole outputs cannot be connected together because such a connection might produce excessive current and may result in damage to the devices.

24) State advantages and disadvantages of TTL

Adv:

Easily compatible with other ICs

Low output impedance

Disadv:

Wired output capability is possible only with tristate and open collector types Special circuits in Circuit layout and system design are required.

25) When does the noise margin allow digital circuits to function properly.

When noise voltages are within the limits of VNA(High State Noise Margin) and VNK for a particular logic family.

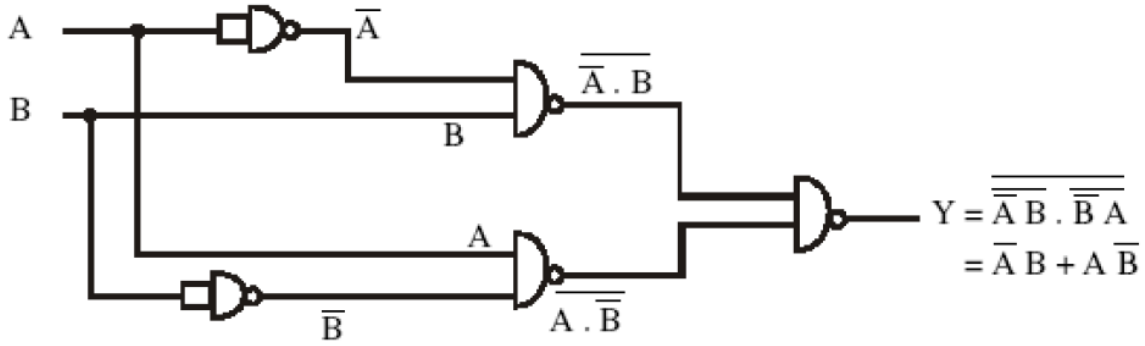
26) What happens to output when a tristate circuit is selected for high impedance.

Output is disconnected from rest of the circuits by internal circuitry.

27) What is 14000 series.

It is the oldest and standard CMOS family. The devices are not pin compatible or electrically compatible with any TTL Series.

28) Implement the Boolean Expression for EX – OR gate using NAND Gates.



29) Define combinational logic

When logic gates are connected together to produce a specified output for certain specified combinations of input variables, with no storage involved, the resulting circuit is called combinational logic.

30) 78. Explain the design procedure for combinational circuits

1. The problem definition
2. Determine the number of available input variables & required O/P variables.
3. Assigning letter symbols to I/O variables
4. Obtain simplified Boolean expression for each O/P.
5. Obtain the logic diagram.

31) Define Half adder and full adder

The logic circuit that performs the addition of two bits is a half adder. The circuit that performs the addition of three bits is a full adder.

32) Draw the logic Symbol and construct the truth table for the two input EX – OR gate.

Logic Symbol

Truth Table

Inputs		Output
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

33) Define Decoder

A decoder is a multiple - input multiple output logic circuit that converts coded inputs into coded outputs where the input and output codes are different.

34) What is binary decoder?

A decoder is a combinational circuit that converts binary information from n input lines to a maximum of 2n out puts lines.

35) Define Encoder

An encoder has 2n input lines and n output lines. In encoder the output lines generate the binary code corresponding to the input value.

36) What is priority Encoder?

A priority encoder is an encoder circuit that includes the priority function. In priority encoder, if 2 or more inputs are equal to 1 at the same time, the input having the highest priority will take precedence.

37) Define multiplexer

Multiplexer is a digital switch. If allows digital information from several sources to be routed onto a single output line.

38) What do you mean by comparator?

A comparator is a special combinational circuit designed primarily to compare the relative magnitude of two binary numbers.

39) List basic types of programmable logic devices.

1. Read only memory
2. Programmable logic Array
3. Programmable Array Logic

40) Define ROM

Read only memory is a device that includes both the decoder and the OR gates within a single IC package.

41) Define address and word:

In a ROM, each bit combination of the input variable is called on address. Each bit combination that comes out of the output lines is called a word.

42) State the types of ROM

1. Masked ROM.
2. Programmable Read only Memory
3. Erasable Programmable Read only memory.

4. Electrically Erasable Programmable Read only Memory.

43) What is programmable logic array? How it differs from ROM?

In some cases the number of don't care conditions is excessive, it is more economical to use a second type of LSI component called a PLA. A PLA is similar to a ROM in concept; however it does not provide full decoding of the variables and does not generates all the minterms as in the ROM.

44) Which gate is equal to AND-invert Gate?

NAND gate.

45) Which gate is equal to OR-invert Gate?

NOR gate.

46) Bubbled OR gate is equal to----------

- NAND gate

47) Bubbled AND gate is equal to----------

- NOR gate

UNIT –III

SEQUENTIAL CIRCUITS

1) What are the classifications of sequential circuits?

The sequential circuits are classified on the basis of timing of their signals into two types. They are,

1)Synchronous sequential circuit.

2)Asynchronous sequential circuit.

2) Define Flip flop.

The basic unit for storage is flip flop. A flip-flop maintains its output state either at 1 or 0 until directed by an input signal to change its state.

3) What are the different types of flip-flop?

There are various types of flip flops. Some of them are mentioned below they are,

RS flip-flop, SR flip-flop D flip-flop JK flip-flop T flip-flop

4) What is the operation of RS flip-flop?

- When R input is low and S input is high the Q output of flip-flop is set.
- When R input is high and S input is low the Q output of flip-flop is reset.
- When both the inputs R and S are low the output does not change
- When both the inputs R and S are high the output is unpredictable.

5) What is the operation of SR flip-flop?

- When R input is low and S input is high the Q output of flip-flop is set.
- When R input is high and S input is low the Q output of flip-flop is reset.
- When both the inputs R and S are low the output does not change.
- When both the inputs R and S are high the output is unpredictable.

6) What is the operation of D flip-flop?

In D flip-flop during the occurrence of clock pulse if D=1, the output Q is set and if D=0, the output is reset.

7) What is the operation of JK flip-flop?

- When K input is low and J input is high the Q output of flip-flop is set.
- When K input is high and J input is low the Q output of flip-flop is reset.
- When both the inputs K and J are low the output does not change
- When both the inputs K and J are high it is possible to set or reset the flip-flop (ie) the output toggle on the next positive clock edge.

8) What is the operation of T flip-flop?

T flip-flop is also known as Toggle flip-flop.

- When T=0 there is no change in the output.
- When T=1 the output switch to the complement state (ie) the output toggles.

9) Define race around condition.

In JK flip-flop output is fed back to the input. Therefore change in the output results change in the input. Due to this in the positive half of the clock pulse if both J and K are high then output toggles continuously. This condition is called ‘race around condition’.

10) What is edge-triggered flip-flop?

The problem of race around condition can solved by edge triggering flip flop. The term edge triggering means that the flip-flop changes state either at the positive edge or negative edge of the clock pulse and it is sensitive to its inputs only at this transition of the clock.

11) What is a master-slave flip-flop?

A master-slave flip-flop consists of two flip-flops where one circuit serves as a master and the other as a slave.

12) Define rise time.

The time required to change the voltage level from 10% to 90% is known as rise time(tr).

13) Define fall time.

The time required to change the voltage level from 90% to 10% is known as fall time(tf).

14) Define skew and clock skew.

The phase shift between the rectangular clock waveforms is referred to as skew and the time delay between the two clock pulses is called clock skew.

15) Define setup time.

The setup time is the minimum time required to maintain a constant voltage levels at the excitation inputs of the flip-flop device prior to the triggering edge of the clock pulse in order for the levels to be reliably clocked into the flip flop. It is denoted as t_{setup} .

16) Define hold time.

The hold time is the minimum time for which the voltage levels at the excitation inputs must remain constant after the triggering edge of the clock pulse in order for the levels to be reliably clocked into the flip flop. It is denoted as t_{hold}.

17) Define propagation delay.

A propagation delay is the time required to change the output after the application of the input.

18) Define registers.

A register is a group of flip-flops flip-flop can store one bit information. So an n-bit register has a group of n flip-flops and is capable of storing any binary information/number containing n-bits.

19) Define shift registers.

The binary information in a register can be moved from stage to stage within the register or into or out of the register upon application of clock pulses. This type of bit movement or shifting is essential for certain arithmetic and logic operations used in microprocessors. This gives rise to group of registers called shift registers.

20) What are the different types of shift type?

There are five types. They are,

Serial In Serial Out Shift Register

Serial In Parallel Out Shift Register

Parallel In Serial Out Shift Register

Parallel In Parallel Out Shift Register

Bidirectional Shift Register

21) Explain the flip-flop excitation tables for RS FF.

RS flip-flop

In RS flip-flop there are four possible transitions from the present state to the next state.

They are,

0 ⟶ 1transition: This can happen either when R=S=0 or when R=1 and S=0.

0 ⟶ 1 transition: This can happen only when S=1 and R=0.

1 ⟶ 0 transition: This can happen only when S=0 and R=1.

2 ⟶ 1 transition: This can happen either when S=1 and R=0 or S=0 and R=0.

22) Explain the flip-flop excitation tables for JK flip-flop

In JK flip-flop also there are four possible transitions from present state to next state.

They are,

0 ⟶ 1 transition: This can happen when J=0 and K=1 or K=0.

0 ⟶ 1 transition: This can happen either when J=1 and K=0 or when J=K=1.

1 $\longrightarrow$ 0 transition: This can happen either when J=0 and K=1 or when J=K=1.

2 $\longrightarrow$ 1 transition: This can happen when K=0 and J=0 or J=1.

23) Explain the flip-flop excitation tables for D flip-flop

In D flip-flop the next state is always equal to the D input and it is independent of the present state. Therefore D must be 0 if Q_{n+1} has to 0,and if Q_{n+1} has to be 1 regardless the value of Q_n.

24) Explain the flip-flop excitation tables for T flip-flop

When input T=1 the state of the flip-flop is complemented; when T=0,the state of the flip-flop remains unchanged. Therefore, for $\rightarrow$ 0 and 1 $\rightarrow$ 1 transitions T must be 0 and or 0 $\rightarrow$ 1 and 0 transitions must be 1.

25) Define sequential circuit?

In sequential circuits the output variables dependent not only on the present input variables but they also depend up on the past history of these input variables.

26) Give the comparison between combinational circuits and sequential circuits.

Combinational circuits	Sequential circuits
1. Memory unit is not required	1. Memory unity is required
2. Parallel adder is a combinational circuit	2. Serial adder is a sequential circuit

27) What do you mean by present state?

The information stored in the memory elements at any given time define.s the present state of the sequential circuit.

28) What do you mean by next state?

The present state and the external inputs determine the outputs and the next state of the sequential circuit.

29) State the types of sequential circuits?

1. Synchronous sequential circuits
2. Asynchronous sequential circuits

30) Define synchronous sequential circuit

In synchronous sequential circuits, signals can affect the memory elements only at discrete instant of time.

31) Define Asynchronous sequential circuit?

In asynchronous sequential circuits change in input signals can affect memory element at any instant of time.

32) Give the comparison between synchronous & Asynchronous sequential circuits?

Synchronous sequential circuits	Asynchronous sequential circuits.
1.Memory elements are clocked flip-flops	1.Memory elements are either unlocked flip - flops or time delay elements.
2. Easier to design	2. More difficult to design

33) Define flip-flop

Flip - flop is a sequential device that normally samples its inputs and changes its outputs only at times determined by clocking signal.

34) What is race around condition?

In the JK latch, the output is feedback to the input, and therefore changes in the output results change in the input. Due to this in the positive half of the clock pulse if J and K are both high then output toggles continuously. This condition is known as race around condition.

35) What are the types of shift register?

1. Serial in serial out shift register?
2. Serial in parallel out shift register
3. Parallel in serial out shift register
4. Parallel in parallel out shift register
5. Bidirectional shift register shift register

36) State the types of counter?

1. Synchronous counter
2. Asynchronous Counter

37) Give the comparison between synchronous & Asynchronous counters.

Asynchronous counters	Synchronous counters
In this type of counter flip-flops are connected in such a way that output of 1st flip-flop drives the clock for the next flip- flop.	In this type there is no connection between output of first flip-flop and clock input of the next flip - flop
All the flip-flops are Not clocked simultaneously	All the flip-flops are clocked Simultaneously

UNIT-IV

MEMORY DEVICES

1) Explain ROM

A read only memory(ROM) is a device that includes both the decoder and the OR gates within a single IC package. It consists of n input lines and m output lines. Each bit combination of the input variables is called an address. Each bit combination that comes out of the output lines is called a word. The number of distinct addresses possible with n input variables is 2_n

2) What are the types of ROM?

1.PROM

2.EPROM

3.EEPROM

3) Explain PROM.

PROM (Programmable Read Only Memory) It allows user to store data or program. PROMs use the fuses with material like nichrome and polycrystalline. The user can blow these fuses by passing around 20 to 50 mA of current for the period 5 to 20µs.The blowing of fuses is called programming of ROM. The PROMs are one time programmable. Once programmed, the information is stored permanent.

4) Explain EPROM.

EPROM(Erasable Programmable Read Only Memory)

EPROM use MOS circuitry. They store 1's and 0's as a packet of charge in a buried layer of the IC chip. We can erase the stored data in the EPROMs by exposing the chip to ultraviolet light via its quartz window for 15 to 20 minutes. It is not possible to erase selective information. The chip can be reprogrammed.

5) Explain EEPROM.

EEPROM(Electrically Erasable Programmable Read Only Memory)

EEPROM also use MOS circuitry. Data is stored as charge or no charge on an insulated layer or an insulated floating gate in the device. EEPROM allows selective erasing at the register level rather than erasing all the information since the information can be changed by using electrical signals.

6) What is RAM?

Random Access Memory. Read and write operations can be carried out.

7) Define ROM

A read only memory is a device that includes both the decoder and the OR gates within a single IC package.

8) Define address and word:

In a ROM, each bit combination of the input variable is called on address. Each bit combination that comes out of the output lines is called a word.

9) What are the types of ROM.

1. Masked ROM.
2. Programmable Read only Memory
3. Erasable Programmable Read only memory.
4. Electrically Erasable Programmable Read only Memory.

10) What is programmable logic array? How it differs from ROM?

In some cases the number of don't care conditions is excessive, it is more economical to use a second type of LSI component called a PLA. A PLA is similar to a ROM in concept; however it does not provide full decoding of the variables and does not generates all the minterms as in the ROM.

11) What is mask - programmable?

With a mask programmable PLA, the user must submit a PLA program table to the manufacturer.

12) What is field programmable logic array?

The second type of PLA is called a field programmable logic array. The user by means of certain recommended procedures can program the EPLA.

13) List the major differences between PLA and PAL

PLA:

1. Both AND and OR arrays are programmable and Complex
   Costlier than PAL PAL
2. AND arrays are programmable OR arrays are fixed
   Cheaper and Simpler

14) Define PLD.

Programmable Logic Devices consist of a large array of AND gates and OR gates that can be programmed to achieve specific logic functions.

15) Give the classification of PLDs.

PLDs are classified as PROM (Programmable Read Only Memory), Programmable Logic Array(PLA), Programmable Array Logic (PAL), and Generic Array Logic(GAL)

16) Define PROM.

PROM is Programmable Read Only Memory. It consists of a set of fixed AND gates connected to a decoder and a programmable OR array.

17) Define PLA

PLA is Programmable Logic Array(PLA). The PLA is a PLD that consists of a programmable AND array and a programmable OR array.

18) Define PAL

PAL is Programmable Array Logic. PAL consists of a programmable AND array and a fixed OR array with output logic.

19) Why was PAL developed?

It is a PLD that was developed to overcome certain disadvantages of PLA, such as longer delays due to additional fusible links that result from using two programmable arrays and more circuit complexity.

20) Define GAL.

GAL is Generic Array Logic. GAL consists of a programmable AND array and a fixed OR array with output logic.

21) Why the input variables to a PAL are buffered?

The input variables to a PAL are buffered to prevent loading by the large number of AND gate inputs to which available or its complement can be connected.

22) What does PAL 10L8 specify?

PAL - Programmable Logic Array

10 - Ten inputs

L - Active LOW Ouput

8 - Eight Outputs

23) What is CPLD?

CPLDs are Complex Programmable Logic Devices. They are larger versions of PLDs with a centralized internal interconnect matrix used to connect the device macro cells together.

24) Define bit, byte and word.

The smallest unit of binary data is bit. Data are handled in a 8 bit unit called byte. A complete unit of information is called a word which consists of one or more bytes.

25) How many words can a 16x8 memory can store?

A 16x8 memory can store 16,384 words of eight bits each

26) Define address of a memory.

The location of a unit of data in a memory is called address.

27) Define Capacity of a memory.

It is the total number of data units that can be stored.

28) What is Read and Write operation?

The Write operation stores data into a specified address into the memory and the Read operation takes data out of a specified address in the memory.

29) Why RAMs are called as Volatile?

RAMs are called as Volatile memories because RAMs lose stored data when the power is turned OFF.

30) Define ROM.

ROM is a type of memory in which data are stored permanently or semi permanently. Data can be read from a ROM, but there is no write operation

31) Define RAM.

RAM is Random Access Memory. It is a random access read/write memory. The data can be read or written into from any selected address in any sequence.

32) List the two categories of RAMs.

The two categories of RAMs are static RAM (SRAM) and dynamic RAM (DRAM).

33) Define Static RAM and dynamic RAM.

Static RAM uses flip flops as storage elements and therefore store data indefinitely as long as dc power is applied. Dynamic RAMs use capacitors as storage elements and cannot retain data very long without capacitors being recharged by a process called refreshing.

34) List the two types of SRAM.

1. Asynchronous SRAMs
2. Synchronous Burst SRAMs

35) List the basic types of DRAMs

Fast Page Mode DRAM, Extended Data Out DRAM (EDO DRAM), Burst EDO DRAM and Synchronous DRAM.

36) Define a bus.

A bus is a set of conductive paths that serve to interconnect two or more functional components of a system or several diverse systems.

37) Define Cache memory

It is a relatively small, high-speed memory that can store the most recently used instructions or data from larger but slower main memory.

38) What is the technique adopted by DRAMs.

DRAMs use a technique called address multiplexing to reduce the number of address lines.

39) Give the feature of UV EPROM

UV EPROM is electrically programmable by the user, but the store data must be erased by exposure to ultra violet light over a period of several minutes.

40) Give the feature of flash memory.

The ideal memory has high storage capacity, non-volatility; in-system read and write capability, comparatively fast operation. The traditional memory technologies such as ROM, PROM, EEPROM individually exhibits one of these characteristics, but no single technology has all of them except the flash memory.

41) What are Flash memories?

They are high density read/write memories that are non-volatile, which means data can be stored indefinitely without power.

42) List the three major operations in a flash memory.

Programming, Read and Erase operation

43) What is a FIFO memory?

The term FIFO refers to the basic operation of this type of memory in which the first data bit written into the memory is to first to be read out.

44) List basic types of programmable logic devices.

1. Read only memory
2. Programmable logic Array
3. Programmable Array Logic

45) Define ROM.

A read only memory is a device that includes both the decoder and the OR gates within a single IC package.

46) Define address and word:

In a ROM, each bit combination of the input variable is called on address. Each bit combination that comes out of the output lines is called a word.

47) What are the types of ROM?

1. Masked ROM.
2. Programmable Read only Memory
3. Erasable Programmable Read only memory.
4. Electrically Erasable Programmable Read only Memory.

48) What is programmable logic array? How it differs from ROM?

In some cases the number of don't care conditions is excessive, it is more economical to use a second type of LSI component called a PLA. A PLA is similar to a ROM in concept; however it does not provide full decoding of the variables and does not generates all the min-terms as in the ROM.

49) What is mask - programmable?

With a mask programmable PLA, the user must submit a PLA PLA program table to the manufacturer.

50) Give the comparison between PROM and PLA.

PROM	PLA
And array is fixed and OR array is programmable.	Both AND and OR arrays are Programmable.
Cheaper and simple to use.	Costliest and complex than PROMS.

UNIT-V

SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS

1) What are secondary variables?

-present state variables in asynchronous sequential circuits

2) What are excitation variables?

-next state variables in asynchronous sequential circuits

3) What is fundamental mode sequential circuit?

a. -input variables changes if the circuit is stable
b. -inputs are levels, not pulses
c. -only one input can change at a given time

4) What are pulse mode circuits?

a. -inputs are pulses

b. -width of pulses are long for circuit to respond to the input

c. -pulse width must not be so long that it is still present after the new state is reached

5) What is the significance of state assignment?

a. In synchronous circuits-state assignments are made with the objective of circuit reduction

b. Asynchronous circuits-its objective is to avoid critical races

6) When do race conditions occur?
-Two or more binary state variables change their value in response to the change in i/p variable

7) What is non critical race?
-final stable state does not depend on the order in which the state variable changes
-race condition is not harmful

8) What is critical race?

a. -final stable state depends on the order in which the state variable changes

b. -race condition is harmful

9) When does a cycle occur?

-asynchronous circuit makes a transition through a series of unstable state

10) What are the different techniques used in state assignment?

a. -shared row state assignment

b. -one hot state assignment

11) What are the steps for the design of asynchronous sequential circuit?

a. -construction of primitive flow table

b. -reduction of flow table

c. -state assignment is made

d. -realization of primitive flow table

12) What is hazard?

-unwanted switching transients

13) What is static 1 hazard?

-output goes momentarily 0 when it should remain at 1

14) What is static 0 hazard?

-output goes momentarily 1 when it should remain at 0

15) What is dynamic hazard?

-output changes 3 or more times when it changes from 1 to 0 or 0 to 1

16) What is the cause for essential hazards?

-unequal delays along 2 or more path from same input

17) What is flow table?

-state table of an synchronous sequential network

18) What is SM chart?

a. -describes the behavior of a state machine
b. -used in hardware design of digital systems

19) What are the advantages of SM chart?

a. -easy to understand the operation
b. -east to convert to several equivalent forms

20) What is primitive flow chart?

-One stable state per row

21) What is combinational circuit?

Output depends on the given input. It has no storage element.

22) What is state equivalence theorem?

Two states SA and SB, are equivalent if and only if for every possible input X sequence, the outputs are the same and the next states are equivalent

i. i.e., if SA (t + 1) = SB (t + 1) and ZA = ZB then SA = SB.

23) What do you mean by distinguishing sequences?

Two states, SA and SB of sequential machine are distinguishable if and only if their exists at least one finite input sequence. Which, when applied to sequential machine causes different output sequences depending on whether SA or SB is the initial state.

24) Prove that the equivalence partition is unique

Consider that there are two equivalence partitions exists : PA and PB, and PA) PB. This states that, there exist 2 states Si & Sj which are in the same block of one partition and not in the same block of the other. If Si & Sj are in different blocks of say PB, there exists at least on input sequence which distinguishes Si & Sj and therefore, they cannot be in the same block of PA.

25) Define compatibility.

States Si and Sj said to be compatible states, if and only if for every input sequence that affects the two states, the same output sequence, occurs whenever both outputs are specified and regardless of whether Si on Sj is the initial state.

26) Define merger graph.

The merger graph is defined as follows. It contains the same number of vertices as the state table contains states. A line drawn between the two state vertices indicates each compatible state pair. It two states are incompatible no connecting line is drawn.

27) Define incompatibility.

The states are said to be incompatible if no line is drawn in between them. If implied states are incompatible, they are crossed & the corresponding line is ignored.

28) Explain the procedure for state minimization.

a. Partition the states into subsets such that all states in the same subsets are 1 - equivalent.
b. Partition the states into subsets such that all states in the same subsets are 2 - equivalent.
c. Partition the states into subsets such that all states in the same subsets are 3 - equivalent.

29) Define closed covering.

A Set of compatibles is said to be closed if, for every compatible contained in the set, all its implied compatibles are also contained in the set. A closed set of compatibles, which contains all the states of M, is called a closed covering.

30) Define machine equivalence.

Two machines, M1 and M2 are said to be equivalent if and only if, for every state in

M1, there is a corresponding equivalent state in M2 & vice versa.

31) Define state table.

For the design of sequential counters we have to relate present states and next states. The table, which represents the relationship between present states and next states, is called state table.

32) Define total state

The combination of level signals that appear at the inputs and the outputs of the delays define what is called the total state of the circuit.

33) What are the steps for the design of asynchronous sequential circuit?

1. Construction of a primitive flow table from the problem statement.
2. Primitive flow table is reduced by eliminating redundant states using the state reduction
3. State assignment is made

4. The primitive flow table is realized using appropriate logic elements.

34) Define primitive flow table :

It is defined as a flow table which has exactly one stable state for each row in the table. The design process begins with the construction of primitive flow table.

35) What are the types of asynchronous circuits?

1. Fundamental mode circuits
2. Pulse mode circuits

36) Give the comparison between state Assignment Synchronous circuit and state assignment asynchronous circuit.

In synchronous circuit, the state assignments are made with the objective of circuit reduction. In asynchronous circuits, the objective of state assignment is to avoid critical races.

37) What are races?

When 2 or more binary state variables change their value in response to a change in an input variable, race condition occurs in an asynchronous sequential circuit. In case of unequal delays, a race condition may cause the state variables to change in an unpredictable manner.

38) Define non critical race.

If the final stable state that the circuit reaches does not depend on the order in which the state variable changes, the race condition is not harmful and it is called a non critical race.

39) Define critical race.

If the final stable state depends on the order in which the state variable changes, the race condition is harmful and it is called a critical race.

40) What is a cycle?

A cycle occurs when an asynchronous circuit makes a transition through a series of unstable states. If a cycle does not contain a stable state, the circuit will go from one unstable to stable to another, until the inputs are changed.

41) List the different techniques used for state assignment.

1. Shared row state assignment
2. One hot state assignment.

42) Write a short note on fundamental mode asynchronous circuit.

Fundamental mode circuit assumes that. The input variables change

only when the circuit is stable. Only one input variable can change at a given time and inputs are levels and not pulses.

43) Write a short note on pulse mode circuit.

Pulse mode circuit assumes that the input variables are pulses instead of level. The width of the pulses is long enough for the circuit to respond to the input and the pulse width must not be so long that it is still present after the new state is reached.

44) Define secondary variables

The delay elements provide a short term memory for the sequential circuit. The present state and next state variables in asynchronous sequential circuits are called secondary variables.

45) Define flow table in asynchronous sequential circuit.

In asynchronous sequential circuit state table is known as flow table because of the behavior of the asynchronous sequential circuit. The stage changes occur in independent of a clock, based on the logic propagation delay, and cause the states to .flow. From one to another.

46) What is fundamental mode?

A transition from one stable state to another occurs only in response to a change in the input state. After a change in one input has occurred, no other change in any input occurs until the circuit enters a stable state. Such a mode of operation is referred to as a fundamental mode.

47) Write short note on shared row state assignment.

Races can be avoided by making a proper binary assignmentto the state variables. Here, the state variables are assigned with binary numbers in such a way that only one state variable can change at any one state variable can change at any one time when a state transition occurs. To accomplish this, it is necessary that states between which transitions occur be given adjacent assignments. Two binary are said to be adjacent if they differ in only one variable.

48) Write short note on one hot state assignment.

The one hot state assignment is another method for finding a race free state assignment. In this method, only one variable is active or hot for each row in the original flow table, ie, it requires one state variable for each row of the flow table. Additional row are introduced to provide single variable changes between internal

state transitions.

PART – B

UNIT-I

1) Simplify the Boolean function using tabulation method.
   F= (0, 1, 2, 8, 10, 11, 14, 15)

2) Determine the prime implicants of the function.
   F= (1,4,6,7,8,9,10,11,15)

3) Simplify the Boolean function using K-map.

   F(A,B,C,D,E) = (0,2,4,6,9,13,21,23,25,29,31)

4) Obtain the canonical sum of products of the function Y = AB + ACD Y = AB (C + C')(D + D') + ACD (B + B')

   Y = ABCD + ABCD' + ABC'D + ABC'D' + AB'CD

5) Explain about TTL with neat diagrams.

6) Discuss all the characteristics of digital IC's.

7) Explain with neat diagram how an open collector TTL operates.

8) Explain the different applications of open collector TTL.

9) Explain in detail about schottky TTL.

10) Explain in detail about three state gate.

11) Explain with necessary diagrams MOS & CMOS.

12) Design a 4-bit binary adder/subtractor circuit.

UNIT-II

1) Explain the working of BCD Ripple Counter with the help of state diagram and logic diagram.

2) Design a logic circuit to convert the BCD code to Excess – 3 code.

3) Design and explain a comparator to compare two identical words. Two numbers represented by A = A3A2A1A0 & B = B3B2B1B0

4) Design a sequential detector which produces an output 1 every time the input sequence 1011 is detected.

5) Explain in detail about serial in serial out shift register.

6) Implement the switching function F= ∑ (0,1,3,4,7) using a 4 input MUX and explain

7) Explain how will build a 64 input MUX using nine 8 input MUXs

8) Implement the switching function F= ∑ (0,1,3,4,12,14,15) using an 8 input MUX

9) Explain how will build a 16 input MUX using only 4 input MUXs

10) Explain the operation of 4 to 10 line decoder with necessary logic diagram

11) Design full adder and full sub tractor.

12) Design a 4 bit magnitude comparator to compare two 4 bit number

13) Construct a combinational circuit to convert given binary coded decimal number into an Excess 3 code for example when the input to the gate is 0110 then the circuit should generate output as 1001

14) Using a single 7483, draw the logic diagram of a 4 bit adder/sub tractor

15) Realize a Binary to BCD conversion circuit starting from its truth table

16) Design a combinational circuit which accepts 3 bit binary number and converts its

equivalent excess 3 codes

17) Explain carry look ahead adder.

18) Draw and explain BCD adder.

UNIT-III

1) Explain the operation of JK and clocked JK flip-flops with suitable diagrams
2) Draw the state diagram of a JK flip- flop and D flip – flop
3) Design and explain the working of a synchronous mod – 3 counter
4) Design and explain the working of a synchronous mod – 7 counter
5) Design a synchronous counter with states 0,1, 2,3,0,1 ……. Using JK FF
6) Using SR flip flops, design a parallel counter which counts in the sequence 000,111,101,110,001,010,000 …….
7) Using JK flip flops, design a parallel counter which counts in the sequence 000,111,101,110,001,010,000 …….
8) Draw and explain Master-Slave JK flip-flop.

9) Draw as asynchronous 4 bit up-down counter and explain its working
10) Using D flip –flop ,design a synchronous counter which counts in the sequence 000, 001, 010, 011, 100, 1001,110,111,000
11) Design a binary counter using T flip – flops to count in the following sequences: 000,001,010,011,100,101,110,111,000 - 000,100,111,010,011,000
12) Design a 3 bit binary Up-Down counter
13) Draw and explain the operation of four bit Johnson counter.

UNIT-IV

1) Explain in detail about PLA with a specific example.
2) Implement the following using a mux. F(a,b,c,d) = (0,1,3,4,8,9,15) Obtain the truth table
3) Explain with neat diagrams a RAM architecture.
4) Explain in detail about PLA and PAL.
5) Explain with neat diagrams a ROM architecture.

6) Draw a RAM cell and explain its working.
7) Write short notes on (i) RAM (ii) Types of ROM's.
8) List the PLA program table for BCD to Excess -3-code convertor circuits and show its implementation for any two output functions.
9) Generate the following Boolean functions with PAL with 4inputs and 4outputs
10) Y_3=A'BC'D+A'BCD'+A'BCD+ABC'D Y_2=A'BCD'+A'BCD+ABCD
Y_1=A'BC'+A'BC+AB'C+ABC' Y_0=ABCD.
11) Implement the following functions using PLA.
12) $F_1=\sum m(1,2,4,6)$; $F_2=\sum m(0,1,6,7)$ $F_3=\sum m(2,6)$
13) Implement the given functions using PROM and PAL
14) $F_1=\sum m(0,1,3,5,7,9)$; $F_2=\sum m(1,2,4,7,8,10,11)$
15) Implement the given functions using PAL, PLA
16) $F_1=\sum m(0,1,2,4,6,7)$; $F_2=\sum m(1,3,5,7)$; $F_3=\sum m(0,2,3,6)$
17) Draw the block diagram of a PLA device and briefly explain each block.
18) Design a 16 bit ROM array and explain the operation
19) Write short note on Field Programmable Gate Array (FPGA).

UNIT-V

1) Explain with neat diagram the different hazards and the way to eliminate them.

2) State with a neat example the method for the minimization of primitive flow table.

3) Design a asynchronous sequential circuit with 2 inputs T and C. The output attains a value of 1 when T = 1 & c moves from 1 to 0. Otherwise the output is 0.

4) Explain in detail about Races.

5) Explain the different methods of state assignment

6) What is the objective of state assignment in asynchronous circuit? Give hazard – free realization for the following Boolean function $f(A,B,C,D) = \sum m(0,2,6,7,8,10,12)$
7) Summarize the design procedure for asynchronous sequential circuit
Discuss on Hazards and races
8) Develop the state diagram and primitive flow table for a logic system that has 2 inputs, x

and y and an output z. And reduce primitive flow table. The behavior of the circuit is stated as follows. Initially x=y=0. Whenever x=1 and y = 0 then z=1, whenever x = 0 and y = 1 then z = 0.When x=y=0 or x=y=1 no change in z ot remains in the previous state. The logic system has edge triggered inputs without having a clock .the logic system changes

State on the rising edges of the 2 inputs. Static input values are not to have any effect in changing the Z output

9) Design an asynchronous sequential circuit with two inputs X and Y and with one output Z. Whenever Y is 1, input X is transferred to Z.When Y is 0, the output does not change for any change in X.

10) Obtain the primitive flow table for an asynchronous circuit that has two inputs x,y and one output Z. An output z =1 is to occur only during the input state xy = 01 and then if the only if the input state xy =01 is preceded by the input sequence.

11) A pulse mode asynchronous machine has two inputs. It produces an output whenever two consecutive pulses occur on one input line only .The output remains at '1' until a pulse has occurred on the other input line. Draw the state table for the machine.

12) Construct the state diagram and primitive flow table for an asynchronous network that has two inputs and one output. The input sequence X1X2 = 00,01,11 causes the output to become 1.The next input change then causes the output to return to 0.No other inputs will produce a 1 output.

13) Discuss on the different types of Hazards that occurs in asynchronous sequential circuits.

14) Write short note on races and cycles that occur in fundamental mode circuits.

15) Define the following terms:

a. Critical race

b. non-critical race.

c. hazard

d. flow table.

V S B Engineering College, Karur
Department of Computer Science Engineering
CS8351-Digital Principles and System Design
Assignment Questions for 2018 - 2019 (ODD Semester)

Name of the Faculty: M.Ponkarthika **Class : II IT**

Sl no	Reg no	Name	Assignment Topics
1	922517205001	ABITHA.R	Use Boolean Algebra to show that A'BC'+AB'C'+AB'C+ABC'+ ABC = A+BC'
2	922517205002	ARUNKUMAR.S	Using K'Map simplify the Boolean function F (w, x, y, z) = Σm (2, 3, 10, 11, 12, 13, 14, 15)
3	922517205003	AVINASH.K	Explain 4-bit full adders with look ahead carry generator.
4	922517205004	BHARATH.S	Discuss 3×8 Decoder and 8×3 Encoder circuits.
5	922517205005	BOOPATHI.D	Design 8-bit BCD adder using four 4-bit binary parallel adders IC.
6	922517205006	DEEPAK.M	Design 16:1 multiplexer using two 8:1 multiplexer with enable input.
7	922517205007	DEVAMATHANIKA.G	Give classification of Logic Families and compare CMOS and TTL families.
8	922517205008	DINAKAR.B	With sketch realize the expression X = AB + CD using NAND and NOR gates.
9	922517205009	GAYATHRI.M	Simplify the following functions using karnaugh map, (i) F(a,b,c,d) = Σ(3,5,6,7,11,13,14,15) (ii) F(x,y,z) = Σ(2,3,4,5,7)
10	922517205011	HARIHARASUTHAN.M	Draw Karnaugh maps for following three variables A,B,C and simplify it: (i) F=Σm(0,3,4,5,7) (ii) F=Σm(0,1,2,6) (iii) F=Σm(0,12,5,6)
11	922517205012	HARSHAVARDHINI.A	Design 16:1 multiplexer using two 8:1 multiplexer with enable input.
12	922517205013	HEMA.R	Explain the Master-Slave operation of a flip flop
13	922517205015	KALAIARASI.D	Draw the circuit of a BCD adder using 4-bit binary adders.
14	922517205016	KAMALNATH.S	Obtain the excitation table of the JK' flip-flop, i.e. A JK flip-flop with an inverter between external input K' and

			internal input K.
15	922517205017	KANITHA.V	Discuss 4-bit magnitude comparator in detail.
16	922517205018	KARTHIKA.M	Write short note on EEPROM, EPROM and PROM.
17	922517205019	KARTHIKEYAN.S	Design combinational circuit that generates an even parity for 4 bit input.
18	922517205021	KAUSALYA.R	Design a combinational circuit that generates the 9's complement of a BCD digit
19	922517205022	KAVINKUMAR.R	Construct a BCD adder-subtractor circuit. Use block diagrams for the different components.
20	922517205023	KAVIYA.E	Given a two input MUX, write down its truth table. Use it to implement an AND gate.
21	922517205024	KAVIYA.G	Define Binary Code. Describe in detail about different types of Binary codes.
22	922517205025	KAVYA.T	State and Prove properties of Boolean Algebra in detail.
23	922517205026	KESAVAKUMAR.R	Simplify the Boolean function using Quine-McCluskey method F=(1,2,3,7,8,9,10,11,14,15).
24	922517205027	KRISHNA.S	.Explain about Encoder with an implementation of Boolean Function.
25	922517205028	LAKSHMANAN.G	Explain about different types of Flipflops with neat sketch
26	922517205029	MANISHALINI.K	Explain about State Reduction Principle and State Assignment with an example.
27	922517205030	MANOJ.R	Discuss in detail about working concept of write and read operation of Random Access Memory.
28	922517205031	MOUNIKA.K	Explain about different error detection and correction techniques with an example.
29	922517205032	NAVEENA.M	Explain about Combinational PLDs in detail.
30	922517205033	NAVEENKUMAR.S	Implement the following two Boolean Functions with a PLA. F1 = AB′ + AC + A′BC′ F2 = (AC + BC)
31	922517205034	NITHYA.P	Briefly discuss the Sequential programmable devices.

32	922517205035	PADMAPRIYA.M	Describe the process involved in converting 8421 BCD code to Excess 3 code with neat sketch.
33	922517205036	PRABHAKARAN.T	Design 2-bit magnitude comparator and write a verilog HDL code.
34	922517205037	PRABU.B	Construct a Full adder, Full subtractor, Multiplexer and write a HDL program module for the same.
35	922517205038	PRAVEEN.T	Write the HDL description of T flip-flop and JK flip-flop from D flip-flops and gates.
36	922517205039	PRAVEEN KUMAR.I	Discuss with suitable example state reduction and state assignment.
37	922517205040	PRAVIN KUMAR.M	Implement the switching function F=∑m(1,3,5,7,8,9,14,15) by a static hazard free two level AND-OR gate network.
38	922517205041	PRIYADHARSHINI.K	State with a neat example the method for minimization of primitive flow table
39	922517205042	PRIYANGA.D	Explain the hazards in combinational circuit and sequential circuit and also demonstrate a hazards and its removal with example.
40	922517205043	RAGAVI.K	Draw the ASM chart for a 3-bit up/down counter.
41	922517205044	SABITHA.R	Discuss the various types of RAM and ROM with architecture.
42	922517205045	SABITHA.V	Describe ASIC with its types.
43	922517205046	SABITHA.S	Design a 4-bit magnitude comparator using basic gates.
44	922517205048	SANDHIYA.D	Implement the following functions using PLA,F1=∑m(1,2,4,6); F2=∑m(0,1,6,7) F3=∑m(2,6).
45	922517205050	SHALINI.G	Write and verify an HDL behavioral description of a positive-edge-sensitive D flip-flop with asynchronous preset and clear.
46	922517205051	SIVAGANESH.S	Write and verify a Verilog model of a D flip-flop having asynchronous reset.
47	922517205052	SNEHA.S	Draw a PLA circuit to implement the functions F1 = A B + AC + A BC F2 = (AC + AB + BC)
48	922517205053	SOWNDHARYA.K	Prove that the multiplication of two n-bit numbers gives a product of

			length less than or equal to 2 n bits.
49	922517205054	SRINIVASAN.S	Explain about State Reduction Principle and State Assignment with an example.
50	922517205055	SRIRAMYA.S	Explain the Master-Slave operation of a flip flop
51	922517205056	SURIYAKALA.S	Use Boolean Algebra to show that A’BC’+AB’C’+AB’C+ABC’+ ABC = A+BC’
52	922517205057	SURUTHI.S	Design 16:1 multiplexer using two 8:1 multiplexer with enable input.
53	922517205058	SWATHI.V	Design a combinational circuit that generates the 9’s complement of a BCD digit
54	922517205060	VALLI PREETHI.G	Explain about Encoder with an implementation of Boolean Function.

CS8391 DATA STRUCTURES
UNIT I LINEAR DATA STRUCTURES – LIST
PART – A

1. Write the definition of data structures.

A data structure is a mathematical or logical way of organizing data in the memory that consider not only the items stored but also the relationship to each other and also it is characterized by accessing functions.

2. List any four applications of data structures.

- Compiler design
- Operating System
- Database Management system
- Network analysis
-

3. What is meant by an abstract data type (ADT)?

An ADT is a set of operation. A useful tool for specifying the logical properties of a datatype is the abstract data type. ADT refers to the basic mathematical concept that defines the datatype. Eg. Objects such as list, set and graph along their operations can be viewed as ADT's.

4. What are the operations of ADT and types of ADT's?

Union, Intersection, size, complement and find are the various operations of ADT.
Now we'll define three ADTs namely List ADT, Stack ADT, Queue ADT.

ListADT

1. get()
2. insert()
3. remove()
4. removeAt()
5. replace()
6. size()
7. isEmpty()
8. isFull()

5. What is meant by list ADT?

List ADT is a sequential storage structure. General list of the form a1, a2, a3….., an and the size of the list is 'n'. Any element in the list at the position I is defined to be ai, ai+1 the successor of ai and ai-1 is the predecessor of ai.

6. What are the various operations done under list ADT?

- Print list
- Insert
- Make empty
- Remove
- Next

- Previous
- Find kth

7. What is a linked list and singly linked list?

Linked List is a linear data structure and it is very common data structure which consists of group of nodes in a sequence which is divided in two parts. Each node consists of its own data and the address of the next node and forms a chain. Linked Lists are used to create trees and graphs.

Singly linked lists contain nodes which have a data part as well as an address part i.e. next, which points to the next node in sequence of nodes. The operations we can perform on singly linked lists are insertion, deletion and traversal.

8. Define double linked list.

- It is linear data structure which consists of two links or pointer fields
- Next pointer points to the address of the next (successor) node.
- Previous pointer points to the address of the previous (predecessor) node.
- That means,In a doubly linked list, each node contains two links the first link points to the previous node and the next link points to the next node in the sequence.

9. What is meant by dummy header?

It is ahead node in the linked list before the actual data nodes.

Header of the linked list is the first element in the list and it stores the number of elements in the list.

It points to the first data element of the list.

10. Difference between Arrays and Linked List?

Arrays	**Linked List**
Size of any array is fixed	Size of list is variable
It is necessary to specify the number of elements during declaration	It is not necessary to specify the number of elements during declaration
Insertion and deletions are difficult and Costly	Insertions and deletions are done in less time
It occupies less memory than a linked List	It occupies more memory
Coding is easy	Careful coding is needed to avoid memory errors.

11. List three examples that uses linked list.

- Polynomial ADT
- Radix sort
- Multi lists

12. What are the advantages in the array implementation of list?

- Print list operation can be carried out at the linear time
- Find Kth operation takes a constant time

13. What is the basic idea behind ADT?

The various operation of ADT such as union, intersection, sizes etc. are written once in the program and any other part of the program that needs to Perform an operation on ADT can do so by calling the appropriate function.

14. What is circularly linked list?

The circular linked list is a kind of linked list in which the last node is connected to the first node or head node of the linked list.

15. Advantages of ADT.

- Change,
- Understandability,
- Reusability,
- Flexibility.

16. Should arrays of linked lists be used for the following type of applications. Justify your answer.

a) Many search operations in sorted list

b) Many search operations in unsorted list.

ANS:

A) If the list is sorted then using linked list the desired element can be searched, simply by moving forward using next pointer

B) If a list is not sorted then using arrays the desired element can be searched. The arrays facilitate the access to random element.

17. Advantages of DLL over SLL

- The DLL has two pointer fields. One field is previous link field and another is next link field.
- But SLL have one pointer. So the DLL can access any node efficiently.

18. Why linked list used for polynomial arithmetic?

Following reasons,

We can have separate coefficient and exponent fields for representing each term of polynomial. Hence there is no limit for exponent. We can have any number as an exponent.
The arithmetic operation on any polynomial of arbitrary length is possible using linked list.

19. Define double circularly linked list.

(N – 14) In the circular linked list the last node of the list contains the address of the first node and forms a circular chain.

20. What is the need for the header?

Header of the linked list is the first element in the list and it stores the number of elements in the list. It points to the first data element of the list.

21. Define Polynomial ADT

A polynomial <exponent, coefficient>, where each coefficient is unique

Operations include returning the degree, extracting the coefficient for a given exponent, addition, multiplication, evaluation for a given input 10x4+5x2+1.

22. How to search an element in list?

Searching can be initiated from first node and it is compared with given element one after the other until the specified key is found or until the end of the list is encountered.

23. Define Dequeue.

Dqueue is also data structure where elements can be inserted from both ends and deleted from both ends. To implement a dqueue operations using singly linked list operations performed insert_front, delete_front, insert_rear, delete_rear and display functions.

24. How to implement stack using singly linked list?

Stack is an Last In First Out (LIFO) data structure. Here , elements are inserted from one end called push operation and the same elements are deleted from the same end called pop operation. So, using singly linked list stack operations are performed in the front or other way ew can perform rear end also.

25. What are the types of Linear linked list?

- Singly linked lists
- Circular singly linked lists
- Doubly linked lists
- Circulardoubly linked lists

PART – B

1. Write a C program to perform addition, subtraction and multiplication operations on polynomial using linked list.
2. Write a C code for circular linked list with create, insert, delete, display operation using structure pointer
3. Describe the creation of doubly linked list and appending the list. Give relevant code in C.
4. Write an algorithm to perform insertion and deletion on a doubly linked list.
5. Explain the following a) Polynomial manipulation. b) Write some application of List .
6. Write a c code for Circular link list with create, insert, delete display operation using structure pointer.
7. Write an algorithm to perform insertion and deletion on a doubly linked list.
8. Consider an array A[1:n].Given a position, write an algorithm to insert an element in the array. If the position is empty, the element is inserted easily. If the position is already occupied the elements should be inserted with minimum number of shifts.
9. Write an algorithm to convert an infix expression to a postfix expression .Trace the algorithm to convert the infix expression "(a+b)*c/d+e/f" to postfix expression. Explain the need for infix and postfix expressions.

10.

UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES

PART – A

1. **Write down the algorithm for solving Towers of Hanoi problem?**
   - Push parameters and return address on stack.
   - If the stopping value has been reached then pop the stack to return to previous level else move all except the final disc from starting to intermediate needle.
   - Move final discs from start to destination needle.
   - Move remaining discs from intermediate to destination needle.
   - Return to previous level by popping stack.

2. **Define Stack.**

   A stack is an ordered list in which all insertions and deletions are made at one end, called the top. It is an abstract data type and based on the principle of LIFO (Last In First Out).

3. **What are the operations of the stack?**
   - CreateStack/ InitStack(Stack) – creates an empty stack
   - Push(Item) – pushes an item on the top of the stack
   - Pop(Item) – removes the top most element from the stack
   - Top(Stack) – returns the first element from the stack
   - IsEmpty(Stack) – returns true if the stack is empty

4. **Write the routine to push a element into a stack**

```
Push(Element X, Stack S)
{ if(IsFull(S)
{ Error("Full Stack");
{
else S→Array[++S→TopOfStack]=X;
 }
```

5. **How the operations performed on linked list implementation of stack?**

   - Push and pop operations at the head of the list
   - New nodes should be inserted at the front of the list, so that they become the top of the stack
   - Nodes are removed from the front(top) of the stack

   Applications of Stack
   - The following are the applications of stacks
   - Evaluating arithmetic expressions
   - Balancing the parenthesis
   - Towers of Hanoi
   - Function calls
   - Tree traversal

6. **What are the methods to implement stack in C?**

   The methods to implement stacks are :

- Array based
- Linked list based

7. **How the stack is implemented by linked list?**

It involves dynamically allocating memory space at run time while performing stack operations. Since it consumes only that much amount of space is required for holding its data elements , it prevents wastage of memory space.

```
struct stack { int element; struct stack *next; }*top;
```

8. **Write the routine to pop a element from a stack.**

```
int pop()
 { if(top==NULL)
{ printf("\n Stack is empty.\n");
getch();
exit(1);
} else {
int temp; temp=top→element;/* retreiving the top element*/ top=top→next;/* Updating the stack pointer */ return temp;/* returning the popped value */ }
}
```

9. **Define queue.**

It is a linear data structure that maintains a list of elements such that insertion happens at rear end and deletion happens at front end. FIFO – First In First Out principle.

10. **What are the operations of a queue?**

The operations of a queue are

- isEmpty()
- isFull()
- insert()
- delete()
- display()

11. **Write the routine to insert a element onto a queue**

```
void insert(int element) { if(front==-1 )
{ front = rear = front +1;
queue[front] = element; return;
} if(rear==99)
 { printf("Queue is full");
getch(); return; } rear = rear +1;
 queue[rear]=element; }
```

12. **What are the types of queue?**

The following are the types of queue:

- Double ended queue
- Circular queue
- Priority queue

13. Define double ended queue.

It is a special type of queue that allows insertion and deletion of elements at bothends It is also termed as DEQUE.

14. How the queue is implemented by linked list?

It is based on the dynamic memory management techniques which allow allocation andde-allocation of memory space at runtime.

Insert operation

- Reserving memory space of the size of a queue element in memory
- Storing the added value at the new location • Linking the new element with existing queue
- Updating the rear pointer Delete operation
- Checking whether queue is empty
- Retrieving the front most element of the queue
- Updating the front pointer
- Returning the retrieved value

15. Write the routine to delete an element from a queue.

```
int del()
 { inti; if(front == NULL) /*checking whether the queue is empty*/ { return(-9999); }
else { i = front→element; front = front→next; returni; } }
```

16. What are the applications of queue?

The following are the areas in which queues are applicable

- Simulation
- Batch processing in an operating systems
- Multiprogramming platform systems
- Queuing theory
- Printer server routines
- Scheduling algorithms like disk scheduling , CPU scheduling g. I/O buffer requests.

17. Define circular queue.

A Circular queue is a queue whose start and end locations are logically connected witheach other. That means the start location comes after the end location.

18. What are push and pop operations?

- Push – adding an element to the top of stack
- Pop – removing or deleting an element from the top of stack

19. What are enqueue and dequeue operations?

- Enqueue - adding an element to the queueat the rear end
- Dequeue – removing or deleting an element from the queue at the front end.

PART – B

1. Discuss about stack ADT in detail. Explain any one application of stack.
2. Write a C program to implement queues functions using arrays and macros.
3. Illustrate the algorithm to create singly linked list and perform the operations on the created list.
4. Write a C program to add two polynomial using linked list.
5. Write C program that checks if expression is correctly parenthesized using stack.
6. Write the function to check for stack status as Full() or Empty().
7. Write the C program to implement queue using arrays and macros.
8. Explain about Queue ADT in detail. Explain any one application of queue with example.
9. Write an algorithm to perform four operation in a double ended queue that is implemented using array.
10. Show the simulation using stack for the following expression 12+3*14-(5*16)+7.
11. Write algorithm to implement the circular queue using arrays.
12. List the application of queues.

UNIT III NON LINEAR DATA STRUCTURES – TREES

PART – A

1. Define a tree.

A tree is a collection of nodes. The collection can be empty; otherwise, a tree consists of a distinguished node r, called the root, and zero or more nonempty (sub) trees T1, T2,…,Tk, each of whose roots are connected by a directed edge from r.

2. State root.

This is the unique node in the tree to which further sub-trees are attached. Here, A is the root.

Oval: A

3. Define degree of the node.

The total number of sub-trees attached to that node is called the degree of the Oval: A O val: B node. For node A, the degree is 2 and for B and C, the degree is 0.

4. Define leaves.

- These are the terminal nodes of the tree.
- The nodes with degree 0 are always the Oval: BOval: AOval:
- Cleaves.Here, B and C are leaf nodes.

5. Define depth and height of a node

- For any node ni, the depth of ni is the length of the unique path from the root to ni.
- The height of ni is the length of the longest path from ni to a leaf.

6. What is depth and height of a tree?

The depth of the tree is the depth of the deepest leaf. The height of the tree is equal to the height of the root. Always depth of the tree is equal to height of th

7. Define a binary tree.

A binary tree is a finite set of nodes which is either empty or consists of a root and two disjoint binary trees called the left sub-tree and right sub-tree.

8. Define a path in a tree.

A path in a tree is a sequence of distinct nodes in which successive nodes are connected by edges in the tree.

9. State terminal nodes in a tree.

A node that has no children is called a terminal node. It is also referred to as leaf node.

10 Define Heap.

A heap is defined to be a complete binary tree with the property that the value of each node is atleastas small as the value of its child nodes, if they exist. The root node of the heap has the smallest value in the tree.

11. Define a full binary tree

A full binary tree is a tree in which all the leaves are on the same level and every non-leaf node has exactly two children.

12. Define a complete binary tree

A complete binary tree is a tree in which every non-leaf node has exactly two children not necessarily to be on the same level.

13. Define a right-skewed binary tree.

A right-skewed binary tree is a tree, which has only right child nodes.

14. State the properties of a binary tree.

The maximum number of nodes on level n of a binary tree is 2n-1, where n≥1.

The maximum number of nodes in a binary tree of height n is 2n-1, where n≥1.

For any non-empty tree, nl=nd+1 where nl is the number of leaf nodes and nd is the number of nodes of degree 2.

15. What is meant by binary tree traversal?

Traversing a binary tree means moving through all the nodes in the binary tree, visiting each node in the tree only once.

16. What are the different binary tree traversal techniques?

- Preorder traversal
- In order traversal
- Post order traversal
- Level order traversal

17. Define splay tree.

A splay tree is a binary search tree in which restructuring is done using a scheme called splay. The play is a heuristic method which moves a given vertex v to the root of the splay tree using a sequence of rotations.

18. List the types of rotations available in Splay tree.

Let us assume that the splay is performed at vertex v, whose parent and grandparent are p and g respectively. Then, the three rotations are named as: Zig: If p is the root and v is the left child of p, then left-left rotation at p would suffice. This case always terminates the splay as v reaches the root after this rotation.

Zig-Zig: If p is not the root, p is the left child and v is also a left child, then a left-left rotation at g followed by a left-left rotation at p, brings v as an ancestor of g as well as p.

Zig-Zag: If p is not the root, p is the left child and v is a right child, perform a left-right rotation at g and bring v as an ancestor of p as well as g.

19. What are the tasks performed during inorder traversal?

- Traverse the left sub-tree
- Process the root node
- Traverse the right sub-tree

20. What do you mean by balanced trees?

Balanced trees have the structure of binary trees and obey binary search tree properties. Apart from these properties, they have some special constraints, which differ from one data structure to another. However, these constraints are aimed only at reducing the height of the tree, because this factor determines the time complexity.

Eg: AVL trees, Splay trees.

21 What are the categories of AVL rotations?

Let A be the nearest ancestor of the newly inserted nod which has the balancing factor ±2. Then the rotations can be classified into the following four categories:

Left-Left: The newly inserted node is in the left subtree of the left child of A. Right-Right: The newly inserted node is in the right subtree of the right child of A. Left-Right: The newly inserted node is in the right subtree of the left child of A. Right-Left: The newly inserted node is in the left subtree of the right child of A.

22. State the demerit of linear representation of binary trees.

Insertions and deletions in a node take an excessive amount of processing time due to data movement up and down the array.

23. State the merit of linked representation of binary trees.

Insertions and deletions in a node involve no data movement except the rearrangement of pointers, hence less processing time.

24. State the demerits of linked representation of binary trees.

- Given a node structure, it is difficult to determine its parent node
- Memory spaces are wasted for storing null pointers for the nodes, which have one or no sub-trees
- It requires dynamic memory allocation, which is not possible in some programming language

25. Define a binary search tree.

A binary search tree is a special binary tree, which is either empty or it should satisfy the following characteristics:

- Every node has a value and no two nodes should have the same value i.e) thevalues in the binary search tree are distinct
- The values in any left sub-tree is less than the value of its parent node
- The values in any right sub-tree is greater than the value of its parent node
- The left and right sub-trees of each node are again binary search trees

26. What do you mean by general trees?

General tree is a tree with nodes having any number of children.

27. What is a threaded binary tree? Explain its operation with example?

- Definition of threaded binary tree
- Operations of threaded binary tree: insertion

28. Define AVL Tree.

An empty tree is height balanced. If T is a non-empty binary tree with TL and TR as its left and right subtrees, then T is height balanced if

i) TL and TR are height balanced and

ii) $|hL - hR| \leq 1$ Where hL and hR are the heights of TL and TR respectively.

PART – B

1. What is a binary search tree? Explain with example?
   - Definition of binary search tree
   - Operations of binary search tree: Insertion and Deletion
   - Example

2. Explain binary tree traversals?
   - Definition of tree traversal
   - Types of traversals
   - Example

3. What is a threaded binary tree? Explain its operation with example?
   - Definition of threaded binary tree
   - Operations of threaded binary tree: insertion
   - Example

4. Explain the expression trees?
   - Procedure to construct expression tree
   - Example

5. What is a Binary heap? Explain binary heap?
   - Definition of Binary heap
   - Properties of binary heap
   - Example

6. Explain Splay tree in detail
   - Definition
   - Creation
   - Types of rotation

7. Explain B-tree representation?
   - Node representation of B-tree
   - Implicit array representation of B-tree
   - Implementation of various operations

8. What is a Priority Queue? What are its types? Explain.
   - Definition of Priority queue
   - Types: Ascending and Descending priority queue
   - Implementation of priority queue

9. Explain AVL tree in detail.
   - DefinitionCreation Types of rotation Deletion

UNIT IV NON LINEAR DATA STRUCTURES – GRAPHS

PART – A

1. Define Graph.

A graph G consist of a nonempty set V which is a set of nodes of the graph, a set E which is the set of edges of the graph, and a mapping from the set for edge E to a set of pairs of elements of V. It can also be represented as G= (V, E).

2. Define adjacent nodes.

Any two nodes which are connected by an edge in a graph are called adjacent nodes. For example, if an edge x ε E is associated with a pair of nodes (u,v) where u, v ε V, then we say that the edge x connects the nodes u and v.

3. What is a directed graph?

A graph in which every edge is directed is called a directed graph.

4. What is an undirected graph?

A graph in which every edge is undirected is called a directed graph.

5. What is a loop?

An edge of a graph which connects to itself is called a loop or sling.

6. What is a simple graph?

A simple graph is a graph, which has not more than one edge between a pair of nodes than such a graph is called a simple graph.

7. What is a weighted graph?

A graph in which weights are assigned to every edge is called a weighted graph.

8. Define out degree of a graph.

In a directed graph, for any node v, the number of edges which have v as their initial node is called the out degree of the node v.

9. Define in degree of a graph.

In a directed graph, for any node v, the number of edges which have v as their terminal node is called the in degree of the node v.

10. Define path in a graph.

The path in a graph is the route taken to reach terminal node from a starting node.

11. What is a simple path?

A path in a diagram in which the edges are distinct is called a simple path. It is also called as edge simple.

12. What is a cycle or a circuit?

A path which originates and ends in the same node is called a cycle or circuit.

13. What is an acyclic graph?

A simple diagram which does not have any cycles is called an acyclic graph.

14. What is meant by strongly connected in a graph?

An undirected graph is connected, if there is a path from every vertex to every other vertex. A directed graph with this property is called strongly connected.

15. When is a graph said to be weakly connected?

When a directed graph is not strongly connected but the underlying graph is connected, then the graph is said to be weakly connected.

16. Name the different ways of representing a graph.

- Adjacency matrix
- Adjacency list

17. What is an undirected acyclic graph?

When every edge in an acyclic graph is undirected, it is called an undirected acyclic graph. It is also called as undirected forest.

18. What are the two traversal strategies used in traversing a graph?

- Breadth first search
- Depth first search

19. What is a minimum spanning tree?

A minimum spanning tree of an undirected graph G is a tree formed from graph edges that connects all the vertices of G at the lowest total cost.

20. Name two algorithms two find minimum spanning tree.

- Kruskal’s algorithm
- Prim’s algorithm

21. Define graph traversals.

Traversing a graph is an efficient way to visit each vertex and edge exactly once.

22. List the two important key points of depth first search.

- If path exists from one node to another node, walk across the edge – exploring the edge.
- If path does not exist from one specific node to any other node, return to the previous node where we have been before – backtracking.

23. What do you mean by breadth first search (BFS)?

BFS performs simultaneous explorations starting from a common point and spreading out independently.

24. What do you mean by tree edge?

If w is undiscovered at the time vw is explored, then vw is called a tree edge and v becomes the parent of w.

25. What do you mean by back edge?

If w is the ancestor of v, then vw is called a back edge.

26. Define biconnectivity.

A connected graph G is said to be biconnected, if it remains connected after removal of any one vertex and the edges that are incident upon that vertex. A connected graph is biconnected, if it has no articulation points.

27. What do you mean by articulation point?

If a graph is not biconnected, the vertices whose removal would disconnect the graph are known as articulation points.

28. What do you mean by shortest path?

A path having minimum weight between two vertices is known as shortest path, in which weight is always a positive number.

PART – B

1. Explain shortest path algorithm with example.
   - Shortest path algorithm
   - Example

2. Explain depth first and breadth first traversal?
   - Depth first traversal
   - Breadth first traversal
   - Examples
3. Explain spanning and minimum spanning tree?
   - Spanning tree
   - Minimum spanning tree

4. Explain kruskal's and prim's algorithm?
   - Kruskal's algorithm
   - Prim's algorithm

5. Explain topological sorting?
   - Definition
   - Algorithm and example
   - Implementation

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES

PART – A

1. Define sorting

- Sorting arranges the numerical and alphabetical data present in a list in a specific order or sequence.
- There are a number of sorting techniques available. The algorithms can be chosen based on the following factors
- Size of the data structure, Algorithm efficiency
- Programmer's knowledge of the technique.

2. What do you mean by internal and external sorting?

An internal sort is any data sorting process that takes place entirely within the main memory of a computer. This is possible whenever the data to be sorted is small enough to all be held in the main memory. External sorting is a term for a class of sorting algorithms that can handle massive amounts of data. External sorting is required when the data being sorted do not fit into the main memory of a computing device (usually RAM) and instead they must reside in the slower external memory (usually a hard drive)

3. Define bubble sort.

Bubble sort is a simple sorting algorithm that works by repeatedly stepping through the list to be sorted, comparing each pair of adjacent items and swapping them if they are in the wrong order. The pass through the list is repeated until no swaps are needed, which indicates that the list is sorted. The algorithm gets its name from the way smaller elements "bubble" to the top of the list.

4. How the insertion sort is done with the array?

It sorts a list of elements by inserting each successive element in the previously sorted sub list. Consider an array to be sorted A[1],A[2],….A[n] a. Pass 1 : A[2] is compared with A[1] and placed them in sorted order. b. Pass 2 : A[3] is compared with both A[1] and A[2] and inserted at an appropriate place. This makes A[1], A[2],A[3] as a sorted sub array. c. Pass n-1 : A[n] is compared with each element in the sub array A[1],A[2],……A[n-1] and inserted at an appropriate position.

5. What are the steps for selection sort?

The algorithm divides the input list into two parts: the sublist of items alreadysorted, which is built up from left to right at the front (left) of the list, and the sublist of items remaining to be sorted that occupy the rest of the list.

- Initially, the sorted sublist is empty and the unsorted sublist is the entire input list.
- The algorithm proceeds by finding the smallest (or largest, depending on sorting order) element in the unsorted sublist, exchanging it with the leftmost unsorted element (putting it in sorted order), and moving the sublist boundaries one element to the right.

6. What is meant by shell sort?

Shell sort, also known as Shell sort or Shell's method, is an in-place comparison sort. It can either be seen as a generalization of sorting by exchange (bubble sort) or sorting by insertion (insertion sort).

The method starts by sorting elements far apart from each other and progressively reducing the gap between them. Starting with far apart elements can move some out-of-place elements into position faster than a simple nearest neighbor exchange. Donald Shell published the first version of this sort in

1959. The running time of Shell sort is heavily dependent on the gap sequence it uses

7. What are the steps in quick sort?

The steps are:

- Pick an element, called a pivot, from the list.
- Reorder the list so that all elements with values less than the pivot come before the pivot, while all elements with values greater than the pivot come after it (equalvalues can go either way). After this partitioning, the pivot is in its final position. This is called the partition operation.
- Recursively apply the above steps to the sub-list of elements with smaller values and separately to the sub-list of elements with greater values.

8. Define radix sort.

Radix Sort is a clever and intuitive little sorting algorithm. Radix sort is a non comparative integer sorting algorithm that sorts data with integer keys by grouping keys by the individual digits which share the same significant position and value. Radix Sort puts the elements in order by comparing the digits of the numbers.

9. What are the advantages of insertion sort Advantages?

- Simplest sorting technique and easy to implement
- It performs well in the case of smaller lists.
- It leverages the presence of any existing sort pattern in the list Disadvantages
- Efficiency of O(n) is not well suited for large sized lists
- It requires large number of elements to be shifted

10. Define searching.

Searching refers to determining whether an element is present in a given list of elements or not. If the element is present, the search is considered as successful, otherwise it is considered as an unsuccessful search. The choice of a searching technique is based on the following factors Order of elements in the list i.e., random or sorted Size of the list

11. Mention the types of searching.

The types are

- Linear search
- Binary search

12. What is meant by linear search?

Linear search or sequential search is a method for finding a particular value in a list that consists of checking every one of its elements, one at a time and in sequence, until the desired one is found.

13. What is binary search?

For binary search, the array should be arranged in ascending or descending order. In each step, the algorithm compares the search key value with the middle element of the array. If the key match, then a matching element has been found and its index, or position, is returned. Otherwise, if the search key is less than the middle element, then the algorithm repeats its action on the sub-array to the left of the middle element or, if the search key is greater, on the sub-array to the right.

14. Define hashing function.

A hashing function is a key-to-transformation, which acts upon a given key to compute the relative position of the key in an array. A simple hash function HASH(KEY_Value)= (KEY_Value)mod(Table-size)

15. What is open addressing?

Open addressing is also called closed hashing, which is an alternative to resolve the collisions with linked lists. In this hashing system, if a collision occurs, alternative cells are tired until an empty cell is found. There are three strategies in open addressing

- Linear probing
- Quadratic probing
- Double hashing

16. What are the collision resolution methods?

The following are the collision resolution methods

- Separate chaining
- Open addressing
- Multiple hashing

17. Define separate chaining.

It is an open hashing technique. A pointer field is added to each record location, when an overflow occurs, this pointer is set to point to overflow blocks making a linked list. In this method, the table can never overflow, since the linked lists are only extended upon the arrival of new keys.

18. Define Hashing.

Hashing is the transformation of string of characters into a usually shorter fixed length value or key that represents the original string. Hashing is used to index and retrieve items in a database because it is faster to find the item using the short hashed key than to find it using the original value.

19. What do you mean by hash table?

The hash table data structure is merely an array of some fixed size, containing the keys. A key is a string with an associated value. Each key is mapped into some number in the range 0 to tablesize-1 and placed in the appropriate cell.

20. What do you mean by hash function?

A hash function is a key to address transformation which acts upon a given key to compute the relative position of the key in an array. The choice of hash function should be simple and it must distribute the data evenly. A simple hash function is hash_key=key mod tablesize.

21. Write the importance of hashing.

- Maps key with the corresponding value using hash function.
- Hash tables support the efficient addition of new entries and the time spent on searching for the required data is independent of the number of items stored.

22. What do you mean by collision in hashing?

When an element is inserted, it hashes to the same value as an already inserted element, and then it produces collision.

23. What are the collision resolution methods?

- Separate chaining or External hashing
- Open addressing or Closed hashing

24. What do you mean by separate chaining?

Separate chaining is a collision resolution technique to keep the list of all elements that hash to the same value. This is called separate chaining because each hash table element is a separate chain (linked list). Each linked list contains all the elements whose keys hash to the same index.

25. Write the advantage of separate chaining.

- More number of elements can be inserted as it uses linked lists.

26. Write the disadvantages of separate chaining.

- The elements are evenly distributed. Some elements may have more elements and some may not have anything.
- It requires pointers. This leads to slow the algorithm down a bit because of the time required to allocate new cells, and also essentially requires the implementation of a second data structure.

27. What do you mean by open addressing?

Open addressing is a collision resolving strategy in which, if collision occurs alternative cells are tried until an empty cell is found. The cells h0(x), h1(x), h2(x),…. are tried in succession, where hi(x)=(Hash(x)+F(i))mod Tablesize with F(0)=0. The function F is the collision resolution strategy.

28. What are the types of collision resolution strategies in open addressing?

- Linear probing
- Quadratic probing
- Double hashing

29. What do you mean by Probing?

Probing is the process of getting next available hash table array cell.

30. What do you mean by linear probing?

Linear probing is an open addressing collision resolution strategy in which F is a linear function of i, F(i)=i. This amounts to trying sequentially in search of an empty cell. If the table is big enough, a free cell can always be found, but the time to do so can get quite large.

31. What do you mean by primary clustering?

In linear probing collision resolution strategy, even if the table is relatively empty, blocks of occupied cells start forming. This effect is known as primary clustering means that any key hashes into the cluster will require several attempts to resolve the collision and then it will add to the cluster.

32. What do you mean by quadratic probing?

Quadratic probing is an open addressing collision resolution strategy in which F(i)=i2. There is no guarantee of finding an empty cell once the table gets half full if the table size is not prime. This is because at most half of the table can be used as alternative locations to resolve collisions.

33. What do you mean by secondary clustering?

Although quadratic probing eliminates primary clustering, elements that hash to the same position will probe the same alternative cells. This is known as secondary clustering.

34. What do you mean by double hashing?

Double hashing is an open addressing collision resolution strategy in which F(i)=i.hash2(X). This formula says that we apply a second hash function to X and probe at a distance hash2(X), hash2(X),….,and so on. A function such as hash2(X)=R-(XmodR), with R a prime smaller than Table size.

35. What do you mean by rehashing?

If the table gets too full, the running time for the operations will start taking too long and inserts might fail for open addressing with quadratic resolution. A solution to this is to build another table that is about twice as big with the associated new hash function and scan down the entire original hash table, computing the new hash value for each element and inserting it in the new table. This entire operation is called rehashing.

36. What is the need for extendible hashing?

If either open addressing hashing or separate chaining hashing is used, the major problem is that collisions could cause several blocks to be examined during a Find, even for

a well-distributed hash table. Extendible hashing allows a find to be performed in two disk accesses. Insertions also require few disk accesses.

37. List the limitations of linear probing.

- Time taken for finding the next available cell is large.
- In linear probing, we come across a problem known as clustering.

38. Mention one advantage and disadvantage of using quadratic probing.

Advantage: The problem of primary clustering is eliminated.

Disadvantage: There is no guarantee of finding an unoccupied cell once the tableis nearly half full.

39. Define a Relation.

A relation R is defined on a set S if for every pair of elements (a,b), a,b ε S, aRb is either true or false. If aRb is true, then we say that a is related to b.

40. Define an equivalence relation.

An equivalence relation is a relation R that satisfies three properties:

1. (Reflexive) aRa, for all a ε S.
2. (Symmetric) aRb if and only if bRa.
3. (Transitive) aRb and bRc implies that aRc.

41. List the applications of set ADT.

- Maintaining a set of connected components of a graph
- Maintain list of duplicate copies of web pages
- Constructing a minimum spanning tree for a graph

42. What do you mean by disjoint set ADT?

A collection of non-empty disjoint sets S=S1,S2,….,Ski.e) each Si is a non- empty set that has no element in common with any other Sj. In mathematical notation this is: Si∩Sj=Φ. Each set is dentified by a unique element called its representative.

43. Define a set.

A set S is an unordered collection of elements from a universe. An element cannot appear more than once in S. The cardinality of S is the number of elements in S. An empty set is a set whose cardinality is zero. A singleton set is a set whose cardinality is one.

44. List the abstract operations in the set.

Let S and T be sets and e be an element.

- SINGLETON (e) returns {e}
- UNION(S,T) returns S Ụ T
- INTERSECTION(S,T) returns S ∩ T
- FIND returns the name of the set containing a given element

45. What do you mean by union-by-weight?

`Keep track of the weight ie)size of each tree and always append the smaller tree to the larger one when performing UNION.

46. What is the need for path compression?

Path compression is performed during a Find operation. Suppose if we want to perform Find(X), then the effect of path compression is that every node on the path from X to the root has its parent changed to the root.

PART – B

1. Write the different types of hashing techniques? Explain them in detail using example
2. Sort the following numbers in sequence using quick sort -2,13,45,56,27,18,24,30,87,9.
3. Write a algorithm to search the number in a list using binary search.
4. Sort the given integers and show the intermediate results using shell sort 35,12,14,9,15,45,95,40,5.
5. Write a C code to sort an integer array using shell sort.
6. Write a C Code for binary search.
7. Explain rehashing technique.
8. Explain the open addressing and chaining methods of collision resolution techniques in hashing.
9. Explain all sorting techniques with the example.
10. Explain all searching techniques with example.

V.S.B. ENGINEERING COLLEGE, KARUR
DEPARTMENT OF INFORMATION TECHNOLOGY
Academic Year 2018-19(ODD Semester)

Class: II Year/ III Semester B.Tech Information Technology
Name of the Subject: CS8391/Datastructures
Name of Faculty Member: A.Mohanraj

ASSIGNMENT TOPICS

Sl. No.	Register Number	Name of the Student	Assignment topics
1.	922517205001	ABITHA R	**QUESTIONS:** 1. Distinguish between best, worst and average case complexities of an algorithm. 2. What do you mean by Time and Space complexity and how to represent these complexity?
2.	922517205002	ARUNKUMAR S	
3.	922517205003	AVINASH K	**QUESTIONS:** 1. Explain efficiency of algorithm with ex. 2. Write a short note on asymptotic notations.
4.	922517205004	BHARATH S	
5.	922517205005	BOOPATHI D	**QUESTIONS:** 1. Explain any one method to calculate memory location for different position in two-dimensional array. 2. What are the applications of an array? Explain each with examples.
6.	922517205006	DEEPAK M	
7.	922517205007	DEVAMATHANIKA G	**QUESTIONS:** 1. Explain sparse matrix. What are the benefits of the sparse matrix? 2. Explain order-list matrix. What are the benefits of the order-list matrix?
8.	922517205008	DINAKAR B	
9.	922517205009	GAYATHRI M	**QUESTIONS:** 1. Write an algorithm to implement sparse matrix. 2. Write an algorithm to search, insert and delete element in array.
10.	922517205011	HARIHARASUTHAN M	
11.	922517205012	HARSHAVARDHINI A	**QUESTIONS:** 1. Explain three-dimensional array. How three dimensional arrays can be represented in memory? 2. Explain any one method to calculate memory location for different position in two-dimensional array.
12.	922517205013	HEMA R	
13.	922517205015	KALAIARASI D	**QUESTIONS:** 1. Write a program to find second highest value from array elements. 2. Write a program to delete an element of array at position of user choice.
14.	922517205016	KAMALNATH S	

15.	922517205017	KANITHA V	**QUESTIONS:** 1. Distinguish between the row major and column major ordering of an array. 2. Suppose A is linear array with n numeric values. Write procedure which finds the average of the values in A
16.	922517205018	KARTHIKA M	
17.	922517205019	KARTHIKEYAN S	**QUESTIONS:** 1. Convert following postfix expression to prefix expression: a) 4,2$3*3-8,4/1,1+/+ b) PQ+R+-S↑UV+*
18.	922517205021	KAUSALYA R	
19.	922517205022	KAVINKUMAR R	**QUESTIONS:** 1. Convert following postfix expression to infix expression: a) 4,2$3*3-8,4/1,1+/+ b) PQ+R+-S↑UV+*
20.	922517205023	KAVIYA E	
21.	922517205024	KAVIYA G	**QUESTIONS:** 1. Convert following infix expression to prefix expression: a) ((a+b)/d-((e-f)+g) b) 12/3*6+6-6+8/2
22.	922517205025	KAVYA T	
23.	922517205026	KESAVAKUMAR K	**QUESTIONS:** Evaluate following expression. a) 10+3-2-8/2*6-7 b) (12-(2-3)+10/2+4*2)
24.	922517205027	KRISHNA S	
25.	922517205028	LAKSHMANAN G	**QUESTIONS:** 1. Explain Evaluation of expressions on stack. 2. Write pseudo-code for factorial computation.
26.	922517205029	MANISHALINI K	
27.	922517205030	MANOJ R	**QUESTIONS:** 1. Write a pseudo code for implementing stack using linked list. 2. Write a pseudo code for implementing queue using linked queue.
28.	922517205031	MOUNIKA K	
29.	922517205032	NAVEENA M	**QUESTIONS:** 1. Write algorithm for push/pop operation on a linked stack. 2. What are merit of linked stack and queues over their sequential counterparts?
30.	922517205033	NAVEENKUMAR S	
31.	922517205034	NITHYA P	**QUESTIONS:** 1. Explain array representation of binary tree with example? 2. Explain linked representation of binary tree with example?
32.	922517205035	PADMAPRIYA M	
33.	922517205036	PRABHAKARAN T	**QUESTIONS:** 1. Explain traversal technique of binary tree. 2. Explain application of binary tree.
34.	922517205037	PRABU B	
35.	922517205038	PRAVEEN T	**QUESTIONS:** 1.Create a binary tree using inorder and preorder traversal Inorder: D B H E A I F J C G,
36.	922517205039	PRAVEEN KUMAR I	

			Preorder: A B D E H C F I J G
37.	922517205040	PRAVIN KUMAR M	**QUESTIONS:** 1. Create a binary tree using inorder and postorder traversal Inorder: D B H E A I F J C G, Postorder: D H E B I J F G C A
38.	922517205041	PRIYADHARSHINI K	
39.	922517205042	PRIYANGA D	**QUESTIONS:** 1. Create a binary tree from the following sequence: 14, 34, 22, 44, 11, 24, 33
40.	922517205043	RAGAVI K	
41.	922517205044	SABITHA R	**QUESTIONS:** 1. Consider the following tree. **A** / \ **B C** / \ / \ **D E H I** / /\ **F J K** \ **L** a) How many leaves does it have? b) How many of the nodes have at least one sibling? c) What is the value stored in the parent node of the node containing 30? d) How many descendants does the root have? e) What is the depth of the tree? f) How many children does the root have? g) What is inorder traversal of binary tree?
42.	922517205045	SABITHA V	
43.	922517205046	SAMRIN S	**QUESTIONS:** 1. Trace quick sort on the list L= {11, 34, 67, 78, 78, 78, 99}. What are your observations?
44.	922517205048	SANDHIYA D	
45.	922517205050	SHALINI G	**QUESTIONS:** 1. Which sorting techniques are an example of divide and conquer? 2. Which sorting techniques is an application of recursion?
46.	922517205051	SIVAGANESH S	
47.	922517205052	SNEHA S	**QUESTIONS:** 1. If the starting address of array a[-2,23] is 100 then what will be the address of 16th element? 2. If the starting address of array a[1:5,1:6] is 100 then what will be the address of a[3,4] element?
48.	922517205053	SOWNDHARYA K	
49.	922517205054	SRINIVASAN S	**QUESTIONS:** 1. Describe Tail recursion. 2. Identify the types of expression whether it is infix, prefix or postfix. a. 4,2$3*3-8,4/1,1+/+
50.	922517205055	SRIRAMYA S	

			b. PQ+R+-S↑UV+*
51.	922517205056	SURIYAKALA S	**QUESTIONS:** 1. Explain threaded binary tree with own example. 2. Draw red black tree in the given list L= {11, 34, 67, 78, 78, 78, 99}. What are your observations?
52.	922517205057	SURUTHI S	
53.	922517205058	SWATHI V	**QUESTIONS:** 1.If the starting address of array a[1:5,1:6,1:4] is 100 then what will be the address of a[3,4,5] element? 2.Explain red black tree with own example.
54.	922517205060	VALLI PREETHI G	

UNIT I –INRODUCTION TO OOPS AND JAVA FUNDAMENTALS

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members - Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.

TWO MARKS QUESTION & ANSWER

1. Define OOP.

Object-Oriented Programming (OOP) is a methodology or paradigm to design a program using classes and objects. It simplifies the software development and maintenance by providing some concepts:

- Object
- Class
- Inheritance
- Polymorphism
- Abstraction
- Encapsulation

2. Define Object and Class.

Any entity that has state and behavior is known as an object. For example: chair, pen, table, keyboard, bike etc. It can be either physical or logical.

A class is the basic building block of an object-oriented language. It is a template that describes the data and behavior associated with instances of that class. The data associ-ated with a class or object is stored in variables and the behavior associated with a class or object is implemented with methods.

3. How can we create an instance of a class in Java?

To create an instance of a class:

- Declare an instance identifier (instance name) of a particular class.

- Construct the instance (i.e., allocate storage for the instance and initialize the instance) using the “new” operator.

4. Define Inheritance.

When one object acquires all the properties and behaviours of parent object, it is known as inheritance. It provides code reusability. It is used to achieve runtime polymorphism.

5. What are the types of inheritance in Java?

1. Single Inheritance
2. Multilevel Inheritance
3. Hierarchical Inheritance
4. Hybrid Inheritance

6. Define Polymorphism.

Polymorphism means taking many forms, where 'poly' means many and 'morph' means forms. It is the ability of a variable, function or object to take on multiple forms.

7. Define Abstraction.

Hiding internal details and showing functionality is known as abstraction.
For example: phone call, we don't know the internal processing.

8. Define Encapsulation.

- Binding (or wrapping) code and data together into a single unit is known as encapsulation. For example: capsule, it is wrapped with different medicines.
- A java class is the example of encapsulation.

9. List the advantage of OOPs over Procedure-oriented programming language

OOPs makes development and maintenance easier. But in Procedure-oriented program-ming language, it is not easy to manage if code grows as project size grows.

OOPs provides data hiding whereas in Procedure-oriented programming language, global data can be accessed from anywhere.

OOPs provides ability to simulate real-world event much more effectively.

We can provide the solution of real word problem if we are using the Object-

Oriented Programming language.

10. What is difference between object-oriented programming language and object-based programming language?

Object oriented language

- Object-oriented language supports all the features of OOPs.
- Object-oriented language doesn't has in-built object.
- Object-oriented languages are C++, C#, Java etc.

Object based language

- Object-based language doesn't support all the features of OOPs like Polymorphism and Inheritance
- Object-based language has in-built object like javascript has window object.
- Object-based languages are Javascript, VB etc.

10. What are the three major sections of java source file?

The source consists of three major sections:

- The package
- The import
- Class definition

11. List out the Source File Declaration Rules.

- There can be only one public class per source file.
- A source file can have multiple non-public classes.
- The public class name should be the name of the source file which should have
  - .java extension at the end.
- For eg, if the class name is public class Employee{}, then the source file should be as Employee.java.
- If the class is defined inside a package, then the package statement should be the first statement in the source file.
- If import statements are present, then they must be written between the package statement and the class declaration. If there are no package statements, then the import statement should be the first line in the source file.
- Import and package statements will imply to all the classes present in the source file. It is not possible to declare different import and/or package statements to different classes in the source file.

12. Define JVM.

The JVM is an interpreter for the bytecode form of the program. It steps through one byte-code instruction at a time. It is an abstract computing machine that enables a computer to run a Java program.

13. What is bytecode?

Bytecode is a highly optimized set of instructions designed to be executed by the java run-time system, which is called as java virtual machine (JVM). JVM is an interpreter for bytecode.

14. Write a note on integer data types in Java.

Integers are used for storing integer values. There are four kinds of integer types in Java. Each of these can hold a different range of values. The values can either be positive or negative.

Type	Size
Byte	8 bits
Short	16 bits
Int	32 bits
long	64 bits

16. Write a note on float data types in Java.

Float is used to store numbers with decimal part. There are two floating point data types in Java namely, the float and the double.

Type	Size
float	32 bits
double	64 bits

17. Give any three OOP concepts.

- Encapsulation
- Inheritance
- Polymorphism

18. Write a note on import statement?

Classes external to a program must be imported before they can be used. To import a class, the *import* keyword should be used as given below:

import <classname>

The whole path of the class must be specified to import a class from the Java library, For instance, to import the Date class from the util package, the following code is used:

import java.util.Date;

It is also possible to import all classes that belong to a package using the * symbol.

19. List out the features of Java.

- Simple
- Secure
- Portable
- Object-oriented
- Robust
- Multithreaded
- Architecture-neutral
- Interpreted
- High performance
- Distributed & Dynamic

20. What is the use of comment?

The contents of a comment are ignored by the compiler. Instead, a comment can be used to describe or explain the operation of the program to anyone who is reading its source code.

21. What is a variable? How to declare variable in java?

The variable is the basic unit of storage in a java program. A variable is defined by the combination of an identifier, a type, and an optional initialize. All variables must be de-clared before they can be used. The basic form of a variable declaration is shown have

Type identifier [= value],[,identifier [=value]]

The type in one of java's atomic types. The identifier is the name of the variable. For example int a,b,c;

```
int d=3,c=5;
```

22. What is a variable? What are the different types of variables?

Variable are locations in the memory that can hold values. Java has three kinds of variable namely,

- Instance variable
- Local variable
- Class variable

23. What are the difference between static variable and instance variable?

The data or variables, defined within a class are called instance variables.Instance vari-ables declared as static are, essentially, global variables. When objects of its class are declared, no copy of a static variable is made.

24. Write a note on conditional operator in Java.

The conditional operator is otherwise known as the ternary operator and is considered to be an alternative to the if else construct. It returns a value and the syntax is:

```
<test> ? <pass> : <fail>
```

Where,<test> is the condition to be tested. If the condition returns true then the state-ment given in <pass> will be executed. Otherwise, the statement given in <fail> will be executed.

25. List out the operator in Java

- Arithmetic Operators
- Increment and Decrement Operators
- Bitewise Operators
- Relational Operators
- Logical Operators
- Assignment Operators

26. What are jump statements in Java?

In java have three jump statements

- return
- continue
- break

27. Differentiable between break and continue statements?

The break keyword halts the execution of the current loop and forces control out of the loop. The term break refers to the act of breaking out of a b lock of code. Continue is similar to break, except that instead of halting the execution of the loop, it starts the next iteration.

28. What is a class? Give an example?

A class defines the shape and behavior of an object and is a template for multiple objects with similar features.

or

A class is a new data type. Once defined, this new type can be used to create objects of that type. Thus, a class is a template for an object, and an object is an instance of

a class.

29. What are constructors?

A constructor initializes an object immediately upon creation. It has the same name as the class in which it resides and is syntactically similar to a method. Once defined, the con-structor is automatically called immediately after the object is created, before the ***new*** op-erator completes.

30. What's the difference between constructors and other methods?

Constructors must have the same name as the class and cannot return a value. They are only called once while regular methods could be called many times.

31. What is a package?

A Package is a container that groups related types (classes, interfaces, enumerations and annotations). It is similar to folders in computer. It is generally used to control access and to avoid naming collision. The syntax for creating package is

Syntax:

```
package pkg_name;
```

32. What is static variable?

Variable declared with keyword *static* is a static variable. It is a class level variable commonly shared by all objects of the class.

- Memory allocation for such variables only happens once when the class is loaded in the memory.
- scope of the static variable is class scope (accessible only inside the class)
- lifetime is global (memory is assigned till the class is removed by JVM).
- Automatically initialized to 0.

Example:

```
static int no;
```

33. Write short notes on static method.

The method declared with static keyword is known as static method. *main()* is most com-mon static method.

- It belongs to the class and not to object of a class.
- A static method can directly access only static variables of class and directly invoke only static methods of the class.
- It can be called through the name of class without creating any instance of that class. For example, ClassName.methodName()

Example:

```
static void show(){
        System,out.println("Hello");
}
```

34. What do you mean by static import?

The static import allows the programmer to access any static members of imported class directly. There is no need to qualify it by its name.

Syntax:

```
import static package_name;
```

35. What is a static block?

A static block is a block of code enclosed in braces, preceded by the keyword *static*.

- The statements within the static block are first executed automatically before main when the class is loaded into JVM.
- A class can have any number of static blocks.
- JVM combines all the static blocks in a class as single block and executes them.

Syntax:

```
static{

        ……————————

}
```

36. What is a method?

A method is a collection of statement that performs specific task. In Java, each method is a part of a class and they define the behavior of that class.

Example:

```
public void show(){

        System,out.println("Hello");

}
```

37. Define method overloading?

Method overloading is the process of having multiple methods with same name that dif-fers in parameter list. The number and the data type of parameters must differ in overload-ed methods. It is one of the ways to implement polymorphism in Java. When a method is called, the overloaded method whose parameters match with the arguments in the call gets invoked.

Example:

```
void add(int,int){}

void add(int,int,int){}

void add(double,double){}
```

38. List the access specifier available in Java.

There are 4 types of java access specifiers:

1. Private - accessible only inside the class

2. Default (no speciifer) – accessible by all within same package

3. Protected- accessible by same class, subclass in same package and sub class in other packages

4. Public- accessible by all in same package and other packages.

39. Write a note on import statement?

Java provides import statement to include the classes and interfaces of existing packages into our programs.

Example:

```
import java.awt.*;
```

40. Define Array? How to declare an array?

Array is a collection of elements of similar data type stored in contiguous memory loca-tion. The array size is fixed i.e we can't increase/decrease its size at runtime. It is index based and the first element is stored at 0th index. The syntax for declaring an array variable is

Syntax:

```
dataType[] arrayName;
```

Example:

```
int [] a={1,2,3};
```

41. What are the differences between static variable and instance variable?

Static Variables	Instance Variables
1. Memory for static variable is allocated only once when class is loaded	1. Memory for instance variable is allocated each time when an ob-ject is created
2. The memory is commonly shared by all objects of the class	2. Each object memory is indepen-dent

3. Static variables are accessible without Objects	3. Instance variables are accessible only using objects
4. They are automatically initialized to default values	4. Not initialized automatically
5. Example: static int no;	5. Example: int no=10;

42. What is an Jagged Array?

Jagged array is an array of arrays with different row size i.e. with different dimensions.

Example:

int[][] a = { {11, 3, 43}, {3, 5, 8, 1}, {9} };

43. Explain the usage of Java packages.

- Prevent naming conflicts - It is generally used to avoid naming conflicts. For example, there can be two classes with same name in different packages, company.branch1. Employee and company.branch2.Employee

- Make searching/locating and usage of classes, interfaces, enumerations and annotations easier, etc.

- Provide access protection based on the access specifier used.

44. Name any three tags used in Java Doc Comment

Java supports three types of comments. The first two are the // and the /*. The third type is called a documentation comment. It begins with the character sequence /**. It ends with*/.

Java have javadoc tags

Tag	Meaning
@author	Identifies the author of a class
@deprecated	Specifies that a class or member is deprecated
@param	Documents a method’s parameter
@return	Documents a method’s return value

UNIT 1 - ANNA UNIVERSITY PREVIOUS YEAR QUESTIONS

PART-A

1. List out the features of object oriented programming. (CS1261 MAY/JUNE 2016)

2. List the eight basic datatypes used in Java. Give examples. (CS1261 MAY /JUNE 2016)

3. Specify the different levels of access protection available in Java.

(CS1261 MAY /JUNE 2016)

4. Why is Java language called as “robust”? (CS1261 NOV /DEC 2016)

5. How does Java make an executable file? (CS1261 NOV /DEC 2016)

6. How is a constant defined in java? (IT2301 APR/MAY-2015)

7. What is Java package and how it is used?

(IT2301 APR/MAY-2015) (CS1361 MAY/JUNE-2013)

8. Differentiate static binding and dynamic binding. (IT2301 APR/MAY-2015)

9. Enumerate two situations in which static methods are used. (IT2301 MAY/JUNE-2014)

10. Consider a loan processing system in a bank. Identify the classes and objects in the sys-tem and list them. (IT2301 MAY/JUNE-2014)

11. How to create one dimensional array? (IT2301 NOV/DEC-2012)

12. What is the significance of Java Virtual Machine? (CS2311 NOV/DEC-2014)

13. Give the significance of using Byte code. (CS2311 APR/MAY-2015)

14. What is the advantage of using packages in Java programming?

(CS2311 APR/MAY-2015)

15. Define byte code in Java. (CS2311 MAY/JUNE-2014)

16. What is API package? (CS2311 MAY/JUNE-2014)

17. Define an object. (CS1361 NOV/DEC-2014)

18. What is an array? (CS1361 NOV/DEC-2014)
19. What is a constructor function? How do you invoke the constructor function?

(CS1361 NOV/DEC-2014)

20. Define polymorphism. (CS1361 NOV/DEC-2014)

21. What is the default base class for all classes in Java. (CS1361 NOV/DEC-2013)

22. Define the class 'book' in Java with one data member and one member function of your choice. (CS1361 MAY/JUNE-2013)

23. Write the syntax for declaring object array in Java. (CS1361 MAY/JUNE-2013)

PART-B

1. Explain about packages. Give an example program which uses packages. (16) (CS1261 NOV /DEC 2016) (IT2301 NOV/DEC-2012)

2. Explain with the help of a program how object oriented programming overcomes the shortcomings of procedure oriented programming.(8) (IT2301 APR/MAY-2015)

3. Given two one dimensional arrays A and B which are sorted in ascending order. Write a Java program to merge them into a single sorted array, see that is contains every item from array A and B, in ascending order. (8) (IT2301 APR/MAY-2015)

4. With an example, describe in detail about how polymorphism plays a useful role in Java.

   (8) (IT2301 APR/MAY-2015)

5. Elaborate on the various object oriented concepts, with necessary illustrations. (16) (IT2301 MAY/JUNE-2014)

6. Write a program to perform the following functions using classes, objects, constructors and destructors where essential. (IT2301 MAY/JUNE-2014)

a. Get as input the marks of 5 students in 5 subjects. (4)

b. Calculate the total and average. (8)

c. Print the formatted result on the screen. (4)

7. With suitable examples explain how packages can be created, imported and used. Also elaborate on its scope. (16) (IT2301 MAY/JUNE-2014)
8. Write a program to perform following functions on a given matrix.

(IT2301 MAY/JUNE-2014)

a. Find the row and column sum. (8)

b. Interchange rows and columns. (8)

9. Describe the structure of Java program. (8) (IT2301 NOV/DEC-2012)

10. Explain the features of Java. (8) (IT2301 NOV/DEC-2012)

11. Write a simple Java program to implement basic Calculator operations. (16) (CS2311 NOV/DEC-2014)
12. How packages are used to resolve naming conflicts in Java? With an example show to add classes to packages and how to import packages in classes. (16)

(CS2311 NOV/DEC-2014)

13. Write a program in Java that interchanges the odd and even components of an array in Java. (16) (CS2311 APR/MAY-2015)

14. Write a Java program to sort set of names stored in an array in alphabetical order. (16) (CS2311 APR/MAY-2015)
15. Explain the arrays and its types in detail with example program.

(CS2311 MAY/JUNE-2014)

16. Briefly explain about the key elements of Object Oriented Programming.(16)

(CS1361 NOV/DEC-2014)

17. Explain about Class, Objects and Methods in Java with an example program. (16) (CS1361 NOV/DEC-2014)

18. Describe the following: (CS1361 NOV/DEC-2014)

a. Features of Java (8)

b. Data types in Java (8)

19. Explain about Package in Java. List built in Java API packages. (16)

(CS1361 NOV/DEC-2014)

20. Discuss the various parameter passing methods in Java. Illustrate with examples. (CS1361 NOV/DEC-2014)

UNIT II INHERITANCE AND INTERFACES

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes-the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, Array Lists - Strings

TWO MARKS QUESTION & ANSWER

1. What is finalize () method?

The finalize() method is called just before an object is garbage collected. It is used to dispose system resources, perform clean-up activities and minimize memory leaks.

***Syntax*:**

```
 protected void finalize()
 // finalize() is called just once on an object
 {
……————————
  }
```

2. What is meant by Inheritance?

Inheritance is the mechanism in java by which one class is allow to inherit the features (fields and methods) of another class. It is process of deriving a new class from an exist-ing class.

Syntax:

```
class Subclass-name extends Superclass-name

{

//methods and fields

}
```

List out the types of inheritance.

- Single inheritance
- Multilevel inheritance
- Multiple inheritance
- Hybrid inheritance

- Hierarchical inheritance

4. How do you implement multiple inheritance in Java?

Java does not allow multiple inheritance:

- To reduce the complexity and simplify the language
- To avoid the ambiguity caused by multiple inheritance It can be implemented using Interfaces.

5. Define super class and subclass.

The process of deriving a new class from an existing class is inheritance. A class that is inherited is called a *superclass* and the class that does the inheriting is called a *subclass.*

Example:

```
class A{
…..     Superclass
}
class B extends A{
……
}       Subclass
```

6. State the use of keyword super.

- It an be used to refer immediate parent class instance variable when both parent and child class have member with same name
- It can be used to invoke immediate parent class method when child class has overridden that method.
- super() can be used to invoke immediate parent class constructor.

7. What is the use of Inheritance and what are its advantages?

Inheritance is the process of inheriting all the features from a class. The advantages of inheritance are reusability of code and accessibility of variables and methods of the super class by subclasses.

8. Write short notes on Object class.

The Object class is the parent class of all the classes in java by default (directly or indirectly). The java.lang.Object class is the root of the class hierarchy. Some of the Object class are Boolean, Math, Number, String etc

9. Define abstract class?

Abstract classes are classes from which instances are usually not created. It is basically used to contain common characteristics of its derived classes. Abstract classes generally act as super classes. Methods can also be declared as abstract. This implies that non-abstract classes must implement these methods.

10. When to use Abstract Methods & Abstract Class?

Abstract methods are usually declared where two or more subclasses are expected to do a similar thing in different ways through different implementations. These subclasses extend the same Abstract class and provide different implementations for the abstract methods.

Abstract classes are used to define generic types of behaviors at the top of an object-oriented programming class hierarchy, and use its subclasses to provide implementation details of the abstract class.

11. List out the rules in defining abstract classes.

- An abstract class may have concrete (complete) methods.
- An abstract class may or may not have an abstract method. But if any class has one or more abstract methods, it must be compulsorily labeled abstract.
- Abstract classes can have Constructors, Member variables and Normal methods.
- Abstract classes are never instantiated.
- For design purpose, a class can be declared abstract even if it does not contain any abstract methods.
- Reference of an abstract class can point to objects of its sub-classes thereby achieving run-time polymorphism Ex: Shape obj = new Rectangle();
- A class derived from the abstract class must implement all those methods that are declared as abstract in the parent class.
- If a child does not implement all the abstract methods of abstract parent class, then the child class must need to be declared abstract as well.

12. Define final class.

When a class is declared with *final* keyword, it is called a final class. A final class cannot be extended (inherited).

13. What are the uses of a final class?

- To prevent inheritance, as final classes cannot be extended. For example, all Wrapper Classes like Integer, Float etc. are final classes. We cannot extend them.

- To create an immutable class like the predefined String class. We cannot make a class immutable without making it final.

14. What are the benefits of final keyword in Java?

- Final keyword improves performance. Not just JVM can cache final variable but also application can cache frequently use final variables.

- Final variables are safe to share in multi-threading environment without additional synchronization overhead.

- Final keyword allows JVM to an optimized method, variable or class.

15. Is final method inherited?

Yes, final method is inherited but we cannot override it.

For Example:

```
class Bike{

final void run()

{

System.out.println("running...");

}

}

public class Honda2 extends Bike

{
public static void main(String args[]){

new Honda2().run();

}

}
```

16. What is blank or uninitialized final variable?

A final variable that is not initialized at the time of declaration is known as blank final variable.

If we want to create a variable that is initialized at the time of creating object and once initialized may not be changed, it is useful.

It can be initialized only in constructor.

17. Define static blank final variable.

A static final variable that is not initialized at the time of declaration is known as static blank final variable. It can be initialized only in static block.
Example of static blank final variable

```
public class A{

static final int data;//static blank final variable

static{ data=50;}

public static void main(String args[]){

System.out.println(A.data);

}

}
```

18. What is meant by interface?

An interface is a reference type in Java. It is similar to class. It is a collection of abstract methods. Along with abstract methods, an interface may also contain constants, default methods, static methods, and nested types.

19. What's the difference between an interface and an abstract class?

An abstract class may contain code in method bodies, which is not allowed in an interface. With abstract classes, we have to inherit our class from it and Java does not allow multiple inheritance. On the other hand, we can implement multiple interfaces in your class.

20. What are the uses of interface?

- Interfaces are used to implement abstraction.
- Since java does not support multiple inheritance in case of class, it can be achieved by using interface.

- It is also used to achieve loose coupling.

21. Define nested interface.

An interface which is declared inside another interface or class is called nested inter-face. They are also known as inner interface. Since nested interface cannot be accessed directly, the main purpose of using them is to resolve the namespace by grouping related interfaces (or related interface and class) together.

22. How will you find out the length of a string in java? Give an example? The length ( ) method is used to number of characters is string. For example,

String str=”Hello”;

System.out.println(“Length of string is “+str.length( ));

23. How would you make a copy of an entire Java object with its state?

Have this class implement Cloneable interface and call its method clone().

24. What is the basic difference between string and stringbuffer object? –

String is an immutable object. StringBuffer is a mutable object.

25. What is inner class?

If the methods of the inner class can only be accessed via the instance of the inner class, then it is called inner class.

26. What’s the difference between an interface and an abstract class?

An abstract class may contain code in method bodies, which is not allowed in an inter-face. With abstract classes, you have to inherit your class from it and Java does not allow multiple inheritance. On the other hand, you can implement multiple interfaces in your class.

27. What would you use to compare two String variables - the operator == or the method equals()?

I’d use the method equals() to compare the values of the Strings and the = = to check if two variables point at the same instance of a String object.

28. Can an inner class declared inside of method access local variables of this method?

It’s possible if these variables are final.

29. What’s the main difference between a Vector and an ArrayList ?

Java Vector class is internally synchronized and ArrayList is not.

UNIT II - ANNA UNIVERSITY PREVIOUS YEAR QUESTIONS

PART-A

1. What is meant by interface? (CS1261 NOV /DEC 2016) (CS2311 APR/MAY-2015)

2. How super() is used with constructor? (IT2301 APR/MAY-2015)

3. What is an inner class? Give an example for it. (IT2301 APR/MAY-2015)

4. Mention the purpose of keyword “final”. (IT2301 MAY/JUNE-2014)

5. What is the significance of abstract class? (IT2301 MAY/JUNE-2014)

6. Differentiate between shallow and deep copy in object cloning.

(IT2301 MAY/JUNE-2014)

7. What is inheritance? How will you call parameterized constructor and overrided method from parent class in sub class? (8) (IT2301 APR/MAY-2015)

8. Write down the syntax for defining interface? (IT2301 NOV/DEC-2012)

9. What is meant by abstract base class? (IT2301 NOV/DEC-2012)

10. How dynamic initialization of variables is achieved in Java? (IT2301 NOV/DEC-2012)

11. What is the use of final keyword? (CS2311 MAY/JUNE-2014)

12. What is the use of super keyword in Java? (CS1361 NOV/DEC-2014)

13. Define String. (CS1361 NOV/DEC-2014)

14. How interface is used in Java? Give an example. (CS1361 NOV/DEC-2014)

15. Compare String and StringBuffer. (CS1361 NOV/DEC-2014)

16. What is the need of interface? (CS1361 NOV/DEC-2014)

PART-B

1. Explain overriding methods and final methods in Java.(8) (CS1261 MAY /JUNE 2016)

2. Create a Java class Shape with constructor to initialize the one parameter "dimension". Now create three sub classes of Shape with following methods: (16)

(IT2301 APR/MAY-2015)

a. "Circle" with methods to calculate the area and circumference of the circle with dimension as radius

b. "Square" with methods to calculate the area and length of diagonal of the square with dimension as length of one side.

c. "Sphere" with methods to calculate the volume and surface area of the sphere with dimension as radius of the sphere. Write appropriate main method to create object of each class and test every method.

3. Explain with example how multiple inheritance is achieved in Java. (16)

(IT2301 APR/MAY-2015)

4. What are interfaces? Explain with an example how multiple inheritance is implemented using interfaces. (16) (CS2311 NOV/DEC-2014)

5. Develop a Library interface which has drawbook(), returnbook() (with fine), checkstatus() and reservebook() methods. All the methods are tagged with public in the following ways: (16) (IT2301 APR/MAY-2015)

a. Using draw book() - get the required book based on title

b. Using checkstatus – user book returned date details

c. Using with fine() – whether failed to return the book within a time period charge – Rs.5/day

d. Using reserve book() – block or reserve particular book for their account.

6. Explain about inheritance in Java. (16) (IT2301 NOV/DEC-2012) (CS1361 NOV/DEC-2014)

7. Explain the interfaces in detail with suitable example. (CS2311 MAY/JUNE-2014)

UNIT III EXCEPTION HANDLING AND I/O

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files.

TWO MARKS QUESTION & ANSWER

1. What is exception?

An exception is an event, which occurs during the execution of a program, that disrupts the normal flow of the program's instructions.

2. What is error?

An Error indicates that a non-recoverable condition has occurred that should not be caught. Error, a subclass of Throwable, is intended for drastic problems, such as OutOf-MemoryError, which would be reported by the JVM itself.

3. Which is superclass of Exception?

"Throwable", the parent class of all exception related classes.

4. What are the advantages of using exception handling?

Exception handling provides the following advantages over "traditional" error management techniques:

Separating Error Handling Code from “Regular” Code. Propagating Errors Up the Call Stack.

Grouping Error Types and Error Differentiation.

5. What are the types of Exceptions in Java

There are two types of exceptions in Java, unchecked exceptions and checked exceptions.

Checked exceptions: A checked exception is some subclass of Exception (or Exception itself), excluding class RuntimeException and its subclasses. Each method must either handle all checked exceptions by supplying a catch clause or list each unhandled checked exception as a thrown exception.

Unchecked exceptions: All Exceptions that extend the RuntimeException class are unchecked exceptions. Class Error and its subclasses also are unchecked.

6. Why Errors are Not Checked?

An unchecked exception classes which are the error classes (Error and its subclasses) are exempted from compile-time checking because they can occur at many points in the program and recovery from them is difficult or impossible. A program declaring such exceptions would be pointlessly.

7. How does a try statement determine which catch clause should be used to handle an exception?

When an exception is thrown within the body of a try statement, the catch clauses of the try statement are examined in the order in which they appear. The first catch clause that is capable of handling the exception is executed. The remaining catch clauses are ignored.

8. What is the purpose of the finally clause of a try-catch-finally statement?

The finally clause is used to provide the capability to execute code no matter whether or not an exception is thrown or caught.

9. What is the difference between checked and Unchecked Exceptions in Java?

All predefined exceptions in Java are either a checked exception or an unchecked excep-tion. Checked exceptions must be caught using try catch () block or we should throw the exception using throws clause. If you don’t, compilation of program will fail.

10. What is the difference between exception and error?

The exception class defines mild error conditions that your program encounters. Exceptions can occur when trying to open the file, which does not exist, the network

connection is disrupted, operands being manipulated are out of prescribed ranges, the class file you are interested in loading is missing. The error class defines serious error conditions that you should not attempt to recover from. In most cases it is advisable to let the program terminate when such an error is encountered.

11. What is the catch or declare rule for method declarations?

If a checked exception may be thrown within the body of a method, the method must either catch the exception or declare it in its throws clause.

12. When is the finally clause of a try-catch-finally statement executed?

The finally clause of the try-catch-finally statement is always executed unless the thread of execution terminates or an exception occurs within the execution of the finally clause.

13. What if there is a break or return statement in try block followed by finally block?

If there is a return statement in the try block, the finally block executes right after the return statement encountered, and before the return executes.

14. Write short notes on Throwable class.

The Throwable class is the superclass of all errors and exceptions in the Java language. It contains a snapshot of the execution stack of its thread at the time it was created. It can also contain a message string that gives more information about the error. The Exception class inherits all the methods from the class Throwable.

15. Write short notes on Exception class.

Java allows the user to create their own exception class which is derived from built-in class Exception. The Exception class inherits all the methods from the class Throwable.

Two commonly used constructors of Exception class are:

- Exception() - Constructs a new exception with null as its detail message.
- Exception(String message) - Constructs a new exception with the specified detail message.

Syntax:

```
class User_defined_name extends Exception{
……..
}
```

16. How is custom exception created?

The user defined exception is created by extending the Exception class or one of its sub-classes.

Example:

```
class MyException extends Exception {
public MyException(){super();} Public
MyException(String s){super(s);}

}
```

17. What are the different ways to handle exceptions?

There are two ways to handle Exceptions

- Wrapping the desire code in a try block followed by a catch block to catch the exception
- List the desired exception in the throws clause of the method and let the caller of the method handle those exceptions.

18. What do you mean by chained exceptions?

Chained Exceptions allows to relate one exception with another exception, i.e one excep-tion describes cause of another exception.

Throwable methods that supports chained exceptions are:

getCause() method :- This method returns actual cause of an exception.

initCause(Throwable cause) method :- This method sets the cause for the calling exception.

19. Write short notes on StackTraceElement.

The StackTraceElement class element represents a single stack frame which is a stack trace when an exception occurs. Extracting stack trace from an exception could provide useful information such as class name, method name, file name, and the source-code line number. This creates a stack trace element representing the specified execution point.

getStackTrace( ) - returns an array of StackTraceElements

20. List any three common run time errors.

Exception	Description
ArithmeticException	Arithmetic error, such as divide-by-zero
ArrayIndexOutOfBoundsException	Array index is out-of-bounds
IllegalThreadStateException	Requested operation not compatible with current thread state

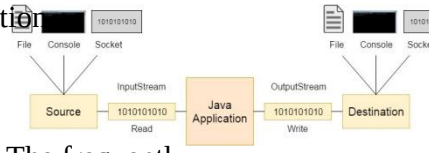
21. Differentiate throw and throws in Java.

Throw	throws
Java throw keyword is used to explicitly throw an exception.	Java throws keyword is used to declare an exception.
Checked exception cannot be propagated using throw only.	Checked exception can be propagated with throws.
Throw is followed by an instance.	Throws is followed by class.
Throw is used within the method.	Throws is used with the method signature.
You cannot throw multiple exceptions.	You can declare multiple exceptions e.g. public void method()throws IO Exception, SQL Exception.

void m(){
throw new IOException("Error");
}
	void m() throws IOException{
	//code
	}

22. Define Stream.

A stream can be defined as a sequence of data. The InputStream is used to read data from a source and the OutputStream is used for writing data to a destination.



23. List the type of streams supported in Java.

1. ***Byte Stream :*** It is used for handling input and output of 8 bit bytes. The frequently used classes are FileInputStream and FileOutputStream.

2. ***Character Stream :*** It is used for handling input and output of characters. Character stream uses 16 bit Unicode. The frequently used classes are FileReader and File Writer.

24. List out the predefined streams available in Java.

Java provides the following three standard streams −

- Standard Input − refers to the standard InputStream which is the keyboard by default. This is used to feed the data to user's program and represented as **System.in**.

- Standard Output − refers to the standard OutputStream by default,this is console and represented as **System.out**.

- Standard Error − This is used to output the error data produced by the user's program and usually a computer screen is used for standard error stream and represented as **System.err**.

25. What is Byte Stream in Java? List some of the ByteStream classes.

The byte stream classes provide a rich environment for handling byte-oriented I/O. List of Byte Stream classes

- Byte Array Input Stream

- Byte Array Output Stream

- Filtered Byte Streams
- Buffered Byte Streams

26. What is Character Stream in Java? List some of the CharacterStream classes.

The Character Stream classes provide a rich environment for handling character-oriented I/O.

List of Character Stream classes

- File Reader
- File Writer
- Char Array Reader
- Char Array Writer

27. What are the steps involved in Stream I/O operations?

1. Open an input/output stream associated with a physical device (e.g., file, network, console/keyboard), by constructing an appropriate I/O stream instance.

2. Read from the opened input stream until "end-of-stream" encountered, or *write* to the opened output stream (and optionally flush the buffered output).

3. Close the input/output stream.

28. Write about read() method.

- returns the input byte read as an int in the range of 0 to 255, or
- returns -1 if "end of stream" condition is detected, or
- throws an IOException if it encounters an I/O error.
- The read() method returns an int instead of a byte, because it uses -1 to indicate end-of-stream.
- The read() method blocks until a byte is available, an I/O error occurs, or the "end-of-stream" is detected.

29. What are the two variations of read() method?

public int read(byte[] bytes, int offset, int length) throws IOException
public int read(byte[] bytes) throws IOException

30. What are the two variations of write() method?

public void write(byte[] bytes, int offset, int length) throws IOException public void write(byte[] bytes) throws IOException

31. What's the difference between println(), print() and printf()?

print() - prints string inside the quotes
println() - prints string inside the quotes similar like print() method. Then the cursor moves to the beginning of the next line.
printf() - it provides string formatting (similar to printf in C/C++ programming).

32. Write about FileInputStream.

- This stream is used for reading data from the files.
- Objects can be created using the keyword new and there are several types of constructors available.
- The two constructors which can be used to create a FileInputStream object:

Following constructor takes a file name as a string to create an input stream object to read the file:

```
OutputStream f = new FileOutputStream("filename ");
```

Following constructor takes a file object to create an input stream object to read the file. First we create a file object using File() method as follows:

```
File f = new File("filename ");

InputStream f = new FileInputStream(f);
```

33. Write about FileOutputStream.

- FileOutputStream is used to create a file and write data into it.
- The stream would create a file, if it doesn't already exist, before opening it for output.
- The two constructors which can be used to create a FileOutputStream object:
  - Following constructor takes a file name as a string to create an input stream object to write the file:
  - OutputStream f = new FileOutputStream("filename ");
  - Following constructor takes a file object to create an output stream object to write the file. First, we create a file object using File() method as follows:

```
File f = new File("filename ");

OutputStream f = new FileOutputStream(f);
```

UNIT III - ANNA UNIVERSITY PREVIOUS YEAR QUESTIONS

PART-A

1. Write down the fundamentals of exception handling? (IT2301 NOV/DEC-2012)

2. Give on a example on streams. (CS2311 NOV/DEC-2014)

3. What are the two types of exceptions? (CS2311 NOV/DEC-2014)

4. What is an exception? (CS1361 NOV/DEC-2014)

PART-B

1. Explain exception handling in Java with an example. (8)(CS1261 MAY /JUNE 2016)

2. Explain with an example the exception handling feature in Java.(8)

(CS1261 NOV /DEC 2016) (CS2311 APR/MAY-2015)

3. Explain I/O streams with suitable examples. (8) (IT2301 APR/MAY-2015)

4. Discuss about the Java error handling mechanism? What is the difference between “un-checked exceptions” and “checked exceptions”? What is the implication of catching all the exceptions with the type “Exception”? (8) (IT2301 APR/MAY-2015)

5. How are exceptions handled in Java? Elaborate with suitable examples. (8)

(IT2301 MAY/JUNE-2014)

6. Describe about different input and output streams and their classes. (16)

(IT2301 NOV/DEC-2012)

7. Discuss about throwing and catching exceptions. (16) (IT2301 NOV/DEC-2012)

8. Explain the concept of streams and its byte stream classes in detail.

(CS2311 MAY/JUNE-2014)

9. Explain the use of File stream classes and file modes. Write an example program for file manipulation. (16) (CS1361 NOV/DEC-2014)

10. Describe different types of exceptions. Write a program for handling Array out of bounds Exception. (16) (CS1361 NOV/DEC-2014)

11. Write a Java program that asks the user for a number and displays ten times the number. Also the program must throw an exception when the user enters a value greater than 10. (16) (CS1361 MAY/JUNE-2013)

UNIT IV MULTITHREADING AND GENERIC PROGRAMMING

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

TWO MARKS QUESTION & ANSWER

What are the benefits of Multithreading?

Multithreading increases the **responsiveness** of system as, if one thread of the application is not responding, the other would respond in that sense the user would not have to sit idle.

Multithreading allows **resource sharing** as threads belonging to the same process can share code and data of the process and it allows a process to have multiple threads at the same time active in **same address space**.

Creating a different process is costlier as the system has to allocate different memory and resources to each process, but creating threads is easy as it does not require allocating separate memory and resources for threads of the same process.

What are the differences between Multithreading and Multitasking?

Parameter	Multithreading	Multitasking
Definition	Multithreading is to execute multiple threads in a process concurrently.	Multitasking is to run multiple processes on a computer concurrently.
Execution	In Multithreading, the CPU switches between multiple threads in the same process.	In Multitasking, the CPU switches between multiple processes to complete the execution.
Resource Sharing	In Multithreading, resources are shared among multiple threads in a process.	In Multitasking, resources are shared among multiple processes.
Complexity	Multithreading is light-weight and easy to create.	Multitasking is heavy-weight and harder to create.

3. Define thread.

A thread is a basic execution unit which has its own program counter, set of the register and stack. But it shares the code, data, and file of the process to which it belongs.

4. List the states of thread life cycle.

A thread at any point of time exists in any one of the following states.

New

Runnable

Blocked

Waiting

Timed Waiting

Terminated

5. **List some methods supported by Threads.**
    - ***join():*** It makes to wait for this thread to die. We can wait for a thread to finish by calling its join() method.
    - ***sleep():*** It makes current executing thread to sleep for a specified interval of time. Time is in milli seconds.
    - ***yield():*** It makes current executing thread object to pause temporarily and gives control to other thread to execute.
    - ***notify():*** This method is inherited from Object class. This method wakes up a single thread that is waiting on this object's monitor to acquire lock.
    - ***notifyAll():*** This method is inherited from Object class. This method wakes up all threads that are waiting on this object's monitor to acquire lock.
    - ***wait():*** This method is inherited from Object class. This method makes current thread to wait until another thread invokes the notify() or the notifyAll() for this object.

6. **Can we start a thread twice?**

No. After starting a thread, it can never be started again. If we do so, an Illegal Thread-State Exception is thrown. In such case, thread will run once but for second time, it will throw exception.

Sample Program:

```
public class TestThreadTwice1 extends Thread
{
   public void run()
   {
      System.out.println("running...");
   }
   public static void main(String args[])
   {
      TestThreadTwice1 t1=new TestThreadTwice1();
      t1.start();
      t1.start();
   }
}
```

Output:

running...

Exception in thread “main” java.lang.IllegalThreadStateException at

java.base/java.lang.Thread.start(Thread.java:804)

at TestThreadTwice1.main(TestThreadTwice1.java:8)

Command exited with non-zero status 1

7. What is the use of join() method?

The join() method waits for a thread to die. In other words, it causes the currently running threads to stop executing until the thread it joins with completes its task.

Syntax:

public void join()throws InterruptedException
public void join (long milliseconds) throws Interrupted Exception

14. Why do we need Synchronization? The synchronization is mainly used to

- To prevent thread interference.
- To prevent consistency problem.

20. What are the types of Synchronization?

There are two types of synchronization:

- Process Synchronization
- Thread Synchronization

21. Write about Java synchronized method.

- If we declare any method as synchronized, it is known as synchronized method.
- Synchronized method is used to lock an object for any shared resource.
- When a thread invokes a synchronized method, it automatically acquires the lock for that object and releases it when the thread completes its task.

22. What do you mean by Synchronized block in java?

- Synchronized block can be used to perform synchronization on any specific resource of the method.
- Suppose we have 50 lines of code in your method, but we want to synchronize only 5 lines, we can use synchronized block.
- If we put all the codes of the method in the synchronized block, it will work same as the synchronized method.

18. Synchronized block is used to lock an object for any shared resource.
19. Scope of synchronized block is smaller than the method.

Syntax

synchronized (object reference expression)

```
{
  //code block
}
```

30. What is synchronization? Briefly explain.

Two or more threads accessing the same data simultaneously may lead to loss of data integrity. For example, when two people access a savings account, it is possible that one person may overdraw and the cheque may bounce. The importance of updating of the pass book can be well understood in this case.

31. Why would you use a synchronized block vs. synchronized method?

Synchronized blocks place locks for shorter periods than synchronized methods.

23. What's the difference between the methods sleep() and wait()

The code sleep(1000); puts thread aside for exactly one second. The code wait(1000), causes a wait of up to one second. A thread could stop waiting earlier if it receives the no-tify() or notifyAll() call. The method wait() is defined in the class Object and the method sleep() is defined in the class Thread.

24. What is synchronization and why is it important?

With respect to multithreading, synchronization is the capability to control the access of multiple threads to shared resources. Without synchronization, it is possible for one thread to modify a shared object while another thread is in the process of using or updat-ing that object's value. This often leads to significant errors.

25. What are three ways in which a thread can enter the waiting state?

A thread can enter the waiting state by invoking its sleep() method, by blocking on I/O, by unsuccessfully attempting to acquire an object's lock, or by invoking an object's wait() method. It can also enter the waiting state by invoking its (deprecated) suspend() meth-od.

26. When you will synchronize a piece of your code?

When you expect your code will be accessed by different threads and these threads may change a particular data causing data corruption.

27. What is daemon thread and which method is used to create the daemon thread?

Daemon thread is a low priority thread which runs intermittently in the back ground doing the garbage collection operation for the java runtime system. setDaemon method is used to create a daemon thread.

28. What is the difference between yielding and sleeping?

When a task invokes its yield() method, it returns to the ready state. When a task invokes its sleep() method, it returns to the waiting state.

34. Can I implement my own start() method?

The Thread start() method is not marked final, but should not be overridden. This meth-od contains the code that creates a new executable thread and is very specialised. Your threaded application should either pass a Runnable type to a new Thread, or extend Thread and override the run() method.

35. Do I need to use synchronized on setValue(int)?

It depends whether the method affects method local variables, class static or instance variables. If only method local variables are changed, the value is said to be *confined* by the method and is not prone to threading issues.

7. What is thread priority?

Thread Priority is an integer value that identifies the relative order in which it should be executed with respect to others. The thread priority values ranging from 1- 10 and the default value is 5. But if a thread have higher priority doesn't means that it will execute first. The thread scheduling depends on the OS.

8. What are the different ways in which a thread can enter into waiting state?

There are three ways for a thread to enter into waiting state. By invoking its sleep() method, by blocking on I/O, by unsuccessfully attempting to acquire an object's lock, or by invoking an object's wait() method.

9. How would you implement a thread pool?

The Thread Pool class is a generic implementation of a thread pool, which takes the following input Size of the pool to be constructed and name of the class which implements Runnable (which has a visible default constructor) and constructs a thread pool with active threads that are waiting for ctivation. once the threads have finished processing they come back and wait once again in the pool.

17. What is Generics? List its advantages.

Generics are similar to templates in C++. Using Generics, the programmer can create a single class, interface or method that automatically works with all types of data (Integer, String, Float etc) i.e. the code can be reused for object of many different types.

Advantages of Generics:

Generics make the code safer and easier to read.

Type casting is not needed.

It is checked at compile time. So problem will not be generated at run time.

3. How to implement generic method in Java?

Generic methods are methods that can accept any type of argument.

Syntax:

```
<type-parameter> return_type method_name (parameters) {...}
```

Example:

```
public void display(T data) {
    System.out.println(data);
}
```

d. What is the question mark in Java Generics used for?

The wildcard element is represented by ? and it specifies an unknown type i.e. it means any type. For example,

```
<? extends Number>
```

specifies any child classes of class Number e.g. Integer, Float, double etc.

e. What do you mean by bounded type parameters?

In Generics, bounded type parameter set restriction on the type that will be allowed to pass to a type-parameter.

Syntax: <T extends superclass>

For example, <T extends Number>

In this example, the type parameter is restricted to any child classes of class Number e.g. Integer, Float, double etc.

8. What is Erasure?

The Java compiler applies type erasure to implement generic programming. It replaces all type parameters in generic types with their bounds or Object if the type parameters are unbounded.

Example: Java class with Generics

```
class Gen<T>{
        T get(){
        …}
}
```

Example: T replaced by java.lang.Object

```
class Gen extends java.lang.Object{
        java.lang.Object get(){
        …}
}
```

30. List out the restrictions to be considered in generic programming.

- Cannot Instantiate Generic Types with Primitive Types
- Cannot Create Instances of Type Parameters
- Cannot Declare Static Fields Whose Types are Type Parameters
- Cannot Use Casts or instanceof With Parameterized Types
- Cannot Create Arrays of Parameterized Types
- Cannot Create, Catch, or Throw Objects of Parameterized Types

UNIT IV - ANNA UNIVERSITY PREVIOUS YEAR QUESTIONS

PART-A

1. What are the advantages of Generic Programming? (IT2301 APR/MAY-2015)
2. When a thread is created and started, what is its initial state? (IT2301 APR/MAY-2015)
3. Define multithreaded programming. (IT2301 NOV/DEC-2012)
4. What are the two ways for creating a thread? (IT2301 NOV/DEC-2012)
5. Write the methods of threads? (CS2311 MAY/JUNE-2014)
6. What is meant by thread? (CS1261 MAY /JUNE 2016)

PART-B

5. With a simple program explain the multithreading concept in Java.(16)

(CS1261 NOV /DEC 2016) (CS2311 APR/MAY-2015)

3. Write a complex program to illustrate about thread priorities. Imagine that the first thread has just begun to run, even before it has a chance to do anything. Now the higher priority thread that wants to run as well. Now the higher priority thread has to do its work before the first thread starts. (16). (IT2301 APR/MAY-2015)
4. Explain life cycle of a thread with help of a diagram. How do the wait and notify all/notify methods enable cooperation between thread? (8) (IT2301 APR/MAY-2015)
5. Explain in detail about generic method with a suitable example. (8)

(IT2301 APR/MAY-2015)

6. With illustrations explain multithreading, interrupting threads, thread states and thread priorities. (16) (IT2301 MAY/JUNE-2014)
7. What is a Thread? What are the different states of Thread? Explain the creation of Thread with an example program. (16) (CS1361 NOV/DEC-2014)
8. Using generic classes, write a program to perform the following operations on an array. (IT2301 MAY/JUNE-2014)

   Add an element in the beginning/middle/end. (8)

   Delete an element from a given position. (8)
9. What are interrupting threads? Explain thread states and synchronization. (16)

(IT2301 NOV/DEC-2012)

7. What is multithreading? Explain the two methods of implementing threads with an example. (16)(CS2311 NOV/DEC-2014)
8. Explain the lifecycle of a thread in detail with example program.

(CS2311 MAY/JUNE-2014)

UNIT V EVENT DRIVEN PROGRAMMING

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Com-ponents – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices-Scrollbars – Windows –Menus – Dialog Boxes.

TWO MARKS QUESTION & ANSWER

1. What is the difference between the 'Font' and 'FontMetrics' class?

Font class is used to set or retrieve the screen fonts.The Font class maps the characters of the language to their respective glyphs.

The FontMetrics class defines a font metrics object, which encapsulates information about the rendering of a particular font on a particular screen.i.e they provide access to the attributes of the font object.

2. What is the difference between the paint() and repaint() methods?

paint()	repaint()
The paint() method is called when some action is performed on the window.	Whenever a repaint method is called, the update method is also called along with paint() method.
This method supports painting via graphics object.	This method is used to cause paint() to be invoked by the AWT painting thread.

3. What is the difference between applications and applets?

Java Application	Applet
Java application on contains a main Method	An applet does not contain a main method
Does not require internet connection to execute	Requires internet connection to execute
Is stand alone application	Is a part of web page
Can be run without a browser	Requires a Java compatible browser
Users stream I/O classes	Use GUI interface provided by AWT or Swings
Entry point is main method	Entry point is init method
Generally used for console programs	Generally used for GUI interfaces

What is a layout manager and what are different types of layout managers available in java AWT?

A layout manager is an object that is used to organize components in a container. The different layouts are available are FlowLayout, BorderLayout, CardLayout, GridLayout and GridBagLayout.

5. What is an event and what are the models available for event handling?

An event is an event object that describes a state of change in a source. In other words, event occurs when an action is generated, like pressing button, clicking mouse, select-

ing a list, etc. There are two types of models for handling events and they are: a) event-inheritance model and b) event-delegation model

6. What is the lifecycle of an applet?

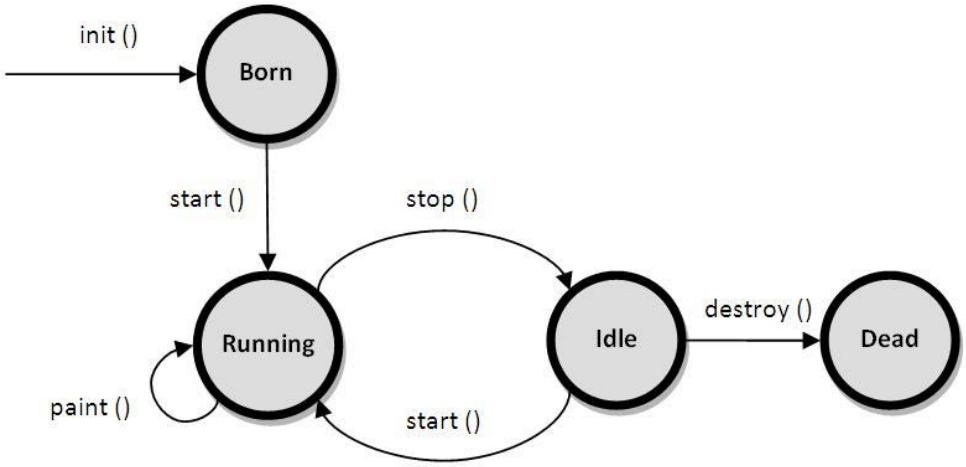
init() method - Can be called when an applet is first loaded

start() method - Can be called each time an applet is started.

paint() method - Can be called when the applet is minimized or maximized.

stop() method - Can be used when the browser moves off the applet's page.

destroy() method - Can be called when the browser is finished with the applet.



7. What class is the top of the AWT event hierarchy?

The java.awt.AWTEvent class is the highest-level class in the AWT event-class hierarchy.

8. Write a note on Borderlayout?

The BorderLayout class implements a common layout style for top-level windows. It has four narrow, fixed-width components at the edges and one large area in the center. The four sides are referred to as north, south, east, and west. The middles area is called the center. Here are the constructors defined by BorderLayout

BorderLayout( )

BorderLayout(int horz, int vert)

9. Distinguish between component and container

Java's Component class represents visual elements of a Graphical User Interface. Its sub-classes include Button, Checkbox, TextField, Choice, and Canvas. The Container class is another subclass of Component. A Container is a component that can contain other components (including other containers). This is the essential difference between con-tainers and other types of component. Subclasses of Container include Frame, Panel, and Applet.

Component	Container
component is an independent visual control, such as a push button or slider.	A container holds a group of components. Thus, a container is a special type of component that is designed to hold other Components

8. What is the difference between jcheckbox and jradiobutton?

In a checkbox group, a user can select more than one option. Each checkbox operates individually, so a user can toggle each response “on” and “off.”

Radio buttons, however, operate as a group and provide mutually exclusive selection values. A user can select only one option in a radio button group.

9. What is the difference between a MenuItem and a CheckboxMenuItem?

The CheckboxMenuItem class extends the MenuItem class to support a menu item that may be checked or unchecked.

10. What is the purpose of the enableEvents() method?

The enableEvents() method is used to enable an event for a particular object. Normally, an event is enabled when a listener is added to an object for a particular event. The enableEvents() method is used by objects that handle events by overriding their eventdispatch methods.

11. What is the difference between a Choice and a List?

A Choice is displayed in a compact form that requires you to pull it down to see the list of available choices. Only one item may be selected from a Choice. A List may be displayed in such a way that several List items are visible. A List supports the selection of one or more List items

12. What is the use of JList?

JList is a Swing component with which we can display a list of elements. This component also allows the user to select one or more elements visually.

7. What is meant by controls and what are different types of controls in AWT?

Controls are components that allow a user to interact with your application and the AWT supports the following types of controls: Labels, Push Buttons, Check Boxes, Choice Lists, Lists, Scrollbars, and Text Components. These controls are subclasses of Compo-nent.

8. What is the difference between scrollbar and scrollpane?

A Scrollbar is a Component, but not a Container whereas Scrollpane is a Conatiner and handles its own events and perform its own scrolling.

9. What is an event and what are the models available for event handling?

An event is an event object that describes a state of change in a source. In other words, event occurs when an action is generated, like pressing button, clicking mouse, selecting a list, etc. There are two types of models for handling events and they are: a) event-inheritance model and b) event-delegation model

10. Which containers use a border Layout as their default layout?

The window, Frame and Dialog classes use a border layout as their default layout.

11. What are the differences between AWT and Swing?

SWING	AWT
Swing components are light weight.	AWT components are heavy

	weight.
Swing components are drawn by java itself that's why it'splatform independent.	AWT components are platform dependent.
Look and Feel of swing can be changed.	There is no such feature in AWT.
All of the buttons, entry fields, etc. are drawn by the Swing package on the drawing surface provided by the window object. This is the reason that Swing has more code.	AWT is a thin layer of code on top of OS.
Swing components are generally slower than AWT.	Use of native peers speeds component performance.
Swing supports a wider range of features like icons and pop-up tool-tips for components.	AWT components do not support features like icons and tool-tips.
Swing has many advanced features like JTabel, Jtabbed pane which is not available in AWT.	These feature is not available in AWT.

15. What is the use of WindowListener?

WindowListener interface is implemented in class to handle following activi-ties

Opening a window - Showing a window for the first time

Closing a window - Removing the window from the screen

Iconifying a window - Reducing the window to an icon on the desktop.

Deiconifying a window - Restoring the window to its original size.

Focused window - The window which contains the "focus owner".

Activated window (frame or dialog) - This window is either the focused window, or owns the focused window.

Deactivated window - This window has lost the focus. For more information about focus, see the AWT Focus Subsystem specifica-tion.

Maximizing the window - Increasing a window's size to the maximum allowable size, either in the vertical direction, the horizontal direc-tion, or both directions.

21. Difference between AWT and Swing

There are many differences between java awt and swing that are given below.

Java AWT	Java Swing
AWT components are platform-dependent.	Java swing components are platform-independent.
AWT components are heavyweight.	Swing components are lightweight.
AWT doesn't support pluggable look and feel.	Swing supports pluggable look and feel.
AWT provides less components than Swing.	Swing provides more powerful componentssuch as tables, lists, scrollpanes, colorchooser, tabbedpane etc.
AWT doesn't follow MVC (Model View Controller) where model represents data, view represents presentation and controller acts as an interface between model and view.	Swing follows MVC.

23. What is a container class?

Container classes are classes that can have other components on it. So for creating a GUI, we need at least one container object. There are 3 types of containers.

Panel: It is a pure container and is not a window in itself. The sole purpose of a Panel is to organize the components on to a window.

Frame: It is a fully functioning window with its title and icons.

Dialog: It can be thought of like a pop-up window that pops out when a message has to be displayed. It is not a fully functioning window like the Frame.

20. What is a layout manager and what are different types of layout managers available in java AWT?

A layout manager is an object that is used to organize components in a container. The different layouts are available are FlowLayout, BorderLayout, CardLayout, GridLayout and GridBagLayout.

24. How are the elements of different layouts organized?

FlowLayout - The elements of a FlowLayout are organized in a top to bottom, left to right fashion

BorderLayout - The elements of a BorderLayout are organized at the borders (North, South, East and West) and the center of a container.

CardLayout - The elements of a CardLayout are stacked, on top of the other, like a deck of cards.

GridLayout - The elements of a GridLayout are of equal size and are laid out using the square of a grid

GridBagLayout - The elements of a GridBagLayout are organized according to a grid. However, the elements are of different size and may occupy more than one row or column of the grid. In addition, the rows and columns may have dif-

ferent sizes. The default Layout Manager of Panel and Panel sub classes is FlowLayout.

32. Why would you use Swing Utilities.invoke And Wait or Swing Utilities. invoke Later?

To make update in a Swing component but not in a callback. And If the update to be hap-pened

immediately (perhaps for a progress bar component) then use invokeAndWait. When the update response is not need immediately, then use invokeLater.

29. What is an event and what are the models available for event handling?

An event is an event object that describes a state of change in a source. In other words, event occurs when an action is generated, like pressing button, clicking mouse, select-ing a list, etc. There are two types of models for handling events and they are: a) event-inheritance model and b) event-delegation model.

30. What is the difference between scrollbar and scrollpane?

A Scrollbar is a Component, but not a Container whereas Scrollpane is a Conatiner and handles its own events and perform its own scrolling.

36. Why won't the JVM terminate when I close all the application windows?

The AWT event dispatcher thread is not a daemon thread. You must explicitly call Sys-tem.exit to terminate the JVM.

37. What is meant by controls and what are different types of controls in AWT?

Controls are components that allow a user to interact with your application and the AWT supports the following types of controls: Labels, Push Buttons, Check Boxes, Choice Lists, Lists, Scrollbars, and Text Components. These controls are subclasses of Compo-nent.

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10. What is the purpose of the enableEvents() method?

The enableEvents() method is used to enable an event for a particular object. Normally,an event is enabled when a listener is added to an object for a particular event. The en-ableEvents() method is used by objects that handle events by overriding their eventdis-patch methods.

11. What class is the top of the AWT event hierarchy?

The java.awt.AWTEvent class is the highest-level class in the AWT event-class hierar-chy.

12. What is the difference between a MenuItem and a CheckboxMenuItem?

The CheckboxMenuItem class extends the MenuItem class to support a menu item that may be checked or unchecked.

34. What is source and listener?

source : A source is an object that generates an event. This occurs when the internal state of that object changes in some way.

listener : A listener is an object that is notified when an event occurs. It has two major requirements. First, it must have been registered with one or more sources to receive notifications about specific types of events. Second, it must implement methods to receive and process these notifications.

35. How can I create my own GUI components?

Custom graphical components can be created by producing a class that inherits from java.awt.Canvas. Your component should override the paint method, just like an applet does, to provide the graphical features of the component.

UNIT V - ANNA UNIVERSITY PREVIOUS YEAR QUESTIONS

PART-A

1. What is meant by event driven programming?

(CS1261 NOV /DEC 2016) (CS2311 APR/MAY-2015)

18. What is an event delegation model? (IT2301 APR/MAY-2015)

19. Draw the inheritance hierarchy for the Frame and Component classes in AWT and Swing. (IT2301 APR/MAY-2015)

20. Mention the subclass of AWT event class. (IT2301 MAY/JUNE-2014)

21. With an example describe in detail about how to work with 2D shapes in Java. (8)

(IT2301 APR/MAY-2015)

22. What is AWT? (IT2301 NOV/DEC-2012)

23. List different phases of Applet life cycle. (CS1261 MAY /JUNE 2016)

PART-B

4. Create a simple menu application that enables a user to select one of the following items: (16) (IT2301 APR/MAY-2015)

   a. Radio1 b. Radio2 c. Radio3 d. Radio4 e. Radio5 i. From the menu bar of the application

   From a pop-up menu

   From a toolbar

9. Add tooltips to each menu item that indicates some information about the Radio station such as type of music and its broadcast frequency.

10. Write a program to create a frame with the following menus, such that the corresponding geometric object is created when a menu is clicked. (IT2301 MAY/JUNE-2014)

    a. Circle. (4)

    b. Rectangle. (4)

    c. Line. (4)

    d. Diagonal for the rectangle. (4)

11. Write a program to stimulate the layout and working of a calculator. (16) (IT2301 MAY/ JUNE-2014)

12. Explain in detail about AWT event hierarchy. (16) (IT2301 MAY/JUNE-2014)

EC8394-ANALOG AND DIGITAL COMMUNICATION

UNIT I: ANALOG COMMUNICATION

PART-A TWO MARKS QUESTIONS WITH ANSWERS

1. Define noise and noise figure.

Noise is defined as any unwanted form of energy, which tends to interfere with proper reception and reproduction of wanted signal.

Noise figure is defined as the ratio between Signal to Noise ratio at the output to the Signal to Noise ratio at the input

2. What are the types of external noise and internal noise?

External noise can be classified into Atmospheric noise, Extraterrestrial noises,Man –made noises or industrial noises.Internal noise can be classified into Thermal noise, Shot noise, Transit time noise, Miscellaneous internal noise.

3. What are the types of extraterrestrial noise and write their origin.

The two type of extraterrestrial noise are solar noise and cosmic noise Solar noise is the electrical noise emanating from the sun. Cosmic noise is the noise received from the center part of our galaxy, other distant galaxies and other virtual point sources.

4. Explain thermal noise.

Thermal noise is the name given to the electrical noise arising from the random motion of electrons in a conductor.

5. Give the expression for noise voltage in a resistor.

The mean square value of thermal noise voltage is given by $Vn^2 = 4\ K\ T\ B\ R$ where K – Boltz man constant, R – resistance, T – Absolute temperature, B - Bandwidth

6. Explain White Noise.

Many types of noise sources are Gaussian and have flat spectral density over a wide frequency range. Such spectrum has all frequency components in equal portion, and is therefore called white noise. The power spectral density of white noise is independent of the operating frequency.

7. What is the need for modulation?

It is extremely difficult to radiate low frequency signals through earth's atmosphere in the form of electromagnetic energy.

At low frequency, the antenna size required becomes impractical.

Information signals often occupy the same frequency band. Signals from two or more sources would interfere if they are not modulated and translated to a different frequency band.

8. With reference to AM ,define modulation index (or) depth of modulation.

It is defined as the ratio of peak amplitude of the message to the carrier signal.

$m = \frac{E_m}{E_c}$ E_m = peak amplitude of modulating signal voltage

E_c = peak amplitude of the unmodulated carrier voltage

9. A broadcast radio transmitter radiates 5 kW power when the modulation percentage is 60%. How much is the carrier power?

$Pt = Pc(1+m^2/2) = 5000/(1+0.6^2/2) = 4237.28w$

10. What is the relationship between total current in AM wave and unmodulated carrier current?

It $=Ic(1+m^2/2)$

Ic= carrier current

It=total current

m=modulation index

11. An unmodulated carrier is modulated simultaneously by three modulating signals with coefficients of modulation m1 = 0.2, m2 = 0.4, m3 = 0.5. Determine the total coefficient of modulation.

$mt = \sqrt{m_1^2 + m_2^2 + m_3^2} = \sqrt{0.2^2+0.4^2+0.5^2} = 0.67$

12. Define amplitude Modulation.(Dec'13)

Amplitude Modulation is the process of changing the amplitude of a relatively high frequency carrier signal in proportion with the instantaneous value of the modulating signal.

13. Define Modulation index and percent modulation for an AM wave.

Modulation index is a term used to describe the amount of amplitude change present in an AM waveform .It is also called as coefficient of modulation. Mathematically modulation index is

$$m = Em/Ec$$

Where m = Modulation coefficient, Em = Peak change in the amplitude of the output waveform voltage, Ec = Peak amplitude of the unmodulated carrier voltage, Percent modulation gives the percentage change in the amplitude of the output, wave when the carrier is acted on by a modulating signal.

14. What is meant by Frequency modulation and Phase modulation?

Frequency of carrier is varied in accordance with amplitude of modulating signal.

Phase of carrier is varied in accordance with the amplitude of modulating signal.

15. What is Bandwidth of AM wave?

Band width is difference between highest upper side frequency and lowest lower side frequency. B.W = 2fm(max).

16. What is over,under,critical modulation?

If m >1, has severe distortion.This condition is Over modulation. If m=1, has greatest output and condition is Critical modulation. If m< 1 ,has no distortion and condition is Under modulation**.**

17. Define deviation ratio.

It is the worst-case modulation index which is the ratio of maximum permitted frequency deviation and maximum modulating signal frequency.

Deviation ratio = $\Delta f_{(max)} / f_{m(max)}$

18.State Carson's rule for determining approximate Band Width of FM signal.

Carson rule states that the bandwidth required to transmit an angle modulated wave as twice the sum of the peak frequency deviation and the highest modulating signal frequency**.**

Band Width = $2 [\Delta f + f_{m(max)}]$ Hz

Δf = frequency deviation in Hz $f_{m(max)}$ = highest modulating signal frequency in Hz

19.A carrier is frequency is frequency modulated with a sinusoidal signal of 2 KHz resulting in a maximum frequency deviation of 5 KHz. Find the approximate band width of the modulated signal.

Δf = frequency deviation in Hz = 5 KHz

$f_{m(max)}$ = highest modulating signal frequency in Hz = 2 KHz

Band Width = $2 [\Delta f + f_{m(max)}]$ Hz = 14 KHz

20. Distinguish between narrow band FM and wide band FM.(Dec'13)

Narrow band FM	**Wide band FM**
Frequency deviation in carrier frequency is very small	Frequency deviation in carrier frequency is large
Band width is twice the highest modulating frequency	Band width is calculated as per Carson's rule

21. What are the advantages of FM over AM?

i)The amplitude of FM is constant. Hence transmitter power remains constant in FM where as it varies in AM. ii)Since amplitude of FM is constant, the noise interference is minimum in FM. iii)Any noise superimposing on modulated carrier can be removed with the help of amplitude limiter. iv)The depth of modulation have limitation in AM. But in FM, the depth of modulation can be increased to any value. v)Since guard bands are provided in FM, there is less possibility of adjacent channel interference.vi)Since space waves are used for FM, the radius of propagation is limited to line of sight(LOS) . Hence it is possible to operate several independent transmitters on same frequency with minimum interference. vii)Since FM uses UHF and VHF ranges, the noise interference is minimum compared to AM which uses MF and HF ranges.

23. What is the advantage and disadvantage of Angle modulation?

Advantages: 1. Noise Reduction 2. Improved system fidelity 3. More effective use of power

Disadvantage: 1. Require more Bandwidth 2. Use more complex circuits in both transmitter and receiver

23. Draw the FM waveform? (June'13)

24. Determine the modulation depth of FM system with a maximum frequency deviation of 75 KHz and the maximum modulating frequency of 10 KHz

$m_f = \Delta f / f_m = 75 \times 10^3 / 10 \times 10^3 = 7.5$

25.Define instantaneous frequency deviation.

The instantaneous frequency deviation is the instantaneous change in the frequency of the carrier and is defined as the first derivative of the instantaneous phase deviation.

PART –B 16 MARKS QUESTIONS

1. Obtain AM wave equation and explain each term with the help of frequency spectrum and also obtain an expression for its power?
2. i)What is the need for modulation? ii) Explain with necessary diagram any one method for generation of AM waves. **(June' 13).**
3. Explain with block diagram of a Fm transmitter using direct modulation. ii) Discuss about spectral characteristics of FM signal. **(June' 13).**
4. Draw the block diagram of AM superhetrodyne receiver and explain function of each block. **(Dec'13)**
5. An AM modulator has a carrier of 400 KHz with amplitude of 20v; modulating signal of 8 KHz with amplitude of 8.5v is applied. Determine
   21. Upper and lower side frequencies.
   22. Modulation coefficient and percent modulation
   23. Peak amplitude of the modulated carrier and upper and lower side frequency voltages.
   24. Maximum and minimum amplitude of the envelope.
   25. Expression of modulated wave.
   26. Sketch the output spectrum and envelope.
6. Write down the expression for FM and PM waves and draw their frequency spectrum and explain. **(Nov'14)**
7. Obtain the mathematical expressions for AM & FM modulated waves & draw the necessary waveforms in both cases.
8. Compare AM, FM and PM systems.
9. Expalin the phase deviation and Modulation index of angle modulated wave
10. Write short notes on (i)Shot noise (ii) Thermal noise. (iii) Internal Noise **(Nov'14)**

UNIT III : DIGITAL COMMUNICATION
PART-A TWO MARKS QUESTIONS WITH ANSWERS

1. Define ASK and FSK. (Dec'13)

ASK: A binary information signal directly modulates the amplitude of an analog carrier.

FSK: The frequency of a sinusoidal carrier is shifted between two discrete values**.**

2. Define bit time and baud rate.

Bit time: It is the reciprocal of the bit rate

Baud rate: The rate of change of a signal on the transmission medium after encoding and modulation have occurred. Baud = 1/ts

3. Define DPSK and QPSK.

DPSK is an alternative form of digital modulation where the binary input information is contained in the difference between two successive signaling elements rather than absolute phase .It combines two basic operations namely ,differential encoding and phase shift keying. .

QPSK: The two successive bits in a bit stream ar combined together to form a message and each message is represented by a distinct value of phase shift of the carrier. Each symbol or message contains two bits so the symbol duration Ts =2Tb.

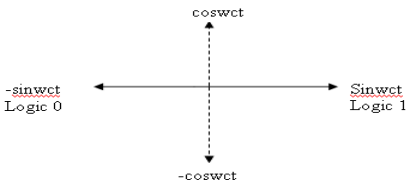
These symbols are transmitted by the same carrier at four different phase shifts as shown below.

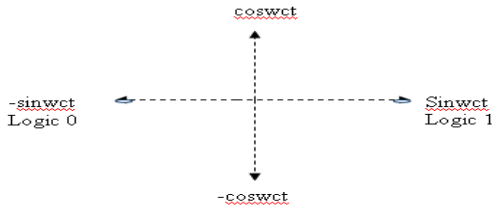
Symbol	Phase
00	-135
01	-45
10	135
11	45

4.What is a constellation diagram? Draw the constellation diagram and phasor diagram for BPSK.

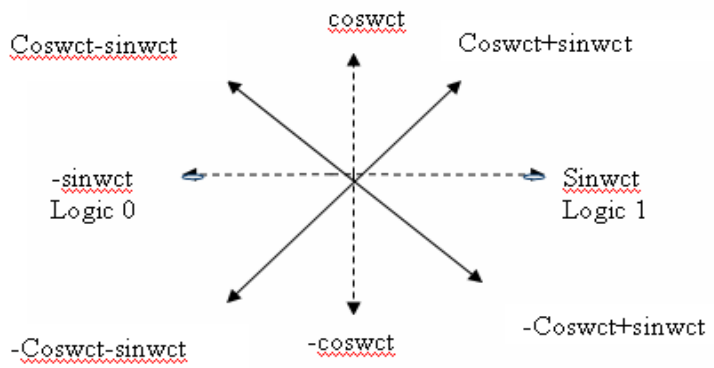
Constellation diagram is used to show the relative positions of the peaks of the phasors.

Phasor diagram: constellation diagram





5.Draw the phasor diagram of QPSK signal.(June'13)



6. What is the primary advantage of DBPSK and what is its disadvantage?

Advantage: simple implementation. No carrier recovery circuit needed for detection.

Disadvantage: It requires between 1 dB and 3 dB more signal to noise ratio to achieve the same BER as that of standard absolute PSK

7. What are the advantages of M-ary signaling schemes?

M-ary signaling schemes transmit multiple bits at a time.

Bandwidth requirement of M-ary signaling schemes is reduced.

8. Compare binary PSK with QPSK.

BPSK Binary Phase Shift Keying	**QPSK** Quadrature Phase Shift Keying
One bit form a symbol	Two bits form a symbol
Two possible symbols	Four possible symbols
Minimum bandwidth required = f_b where f_b is bit rate	Minimum bandwidth required = $f_b / 2$ where f_b is bit rate

9. What are the advantages of QPSK as compared to BPSK?

For the same bit rate, the bandwidth required by QPSK is reduced to half as compared to BPSK.

Because of reduced bandwidth, the information transmission rate of QPSK is higher.

10.What happens to the probability of error in M-ary PSK as the value of M increases?

As the value of M increases, the Euclidean distance between the symbols reduces. Hence the symbols are closer to each other. This increases the probability of error in M-ary systems.

11.What is the minimum bandwidth required for BPSK, QPSK, 8-PSK, 8-QAM and16-QAM systems if the bit rate is 10 MBPS?

System	**Minimum band width required** if f_b = bit rate	**Minimum band width required** if f_b = 10 Mbps
BPSK	f_b	10 MHz
QPSK	$f_b / 2$	5 MHz
8 – PSK	$f_b / 3$	3.33 MHz
8- QAM	$f_b / 3$	3.33 MHz
16 – QAM	$f_b / 4$	2.5 MHz

12. What is difference between coherent and non coherent detection?

Coherent detection	**Non- Coherent detection**
Carrier which is in perfect coherence with that used in transmitter is used for demodulation. Carrier recovery circuit is needed for detection	No carrier recovery circuit needed for detection.
Relatively complex	Simple implementation

13. Define Bandwidth efficiency. What is the bandwidth efficiency of BPSK and 8-PSK system?

It is the ratio of the transmission bit rate to the minimum bandwidth required for a particular modulation scheme.

For BPSK, transmission rate = f_b and minimum bandwidth = f_b, Band width efficiency = 1

For 8-PSK, transmission rate = f_b and minimum bandwidth = $f_b/3$ Band width efficiency = 3

14. What is the difference between probability of error P(e) and bit error rate BER?

P(e) Probability of error is a theoretical (mathematical) expectation of the bit error rate for a given system.BER is an empirical record of a system's actual bit error performance. For Example, if a system has a P(e) of 10^{-5} , this mean that, you can expect one

bit error in every 100,000 bits transmitted. If a system has a BER of 10^{-5}, this mean that, there was one bit error for every 100,000 bits transmitted. BER is measured and then compared to the expected probability of error to evaluate the system's performance.

15. Define (E_b / N_0) Energy per bit to Noise power density ratio.

Energy per bit to noise power ratio is used to compare two or more digital modulation systems that uses different bit rates and modulation schemes.

It is the product of carrier to noise power ratio and the noise band width to bit rate ratio. This is equivalent to signal to noise ratio.

16. List out the advantages and disadvantages of QPSK.

Advantages: low error probability, good noise immunity, baud rate is half of the bit rate

Disadvantages: very complex to generate and detect the signal

17. Define carrier recovery.

It is the process of extracting a phase coherent reference carrier from a received signal.

18. Draw the block diagram of BFSK transmitter. (Dec'12)

19. Compare QAM and QPSK.

Parameter	QPSK	QAM
Type of modulation	Quadrature phase modulation	Quadrature amplitude and phase modulation
Noise immunity	Better than QASK	Poorer than QPSK
Probabilty of error	Less than QASK	More than QPSK
Type of demodulation	Synchronous	Synchronous
Complexity	Less complex than QASK	More complex than QPSK

20. Why QAM is preferred when compared to other digital to analog modulation technique ?

In all PSK methods, one symbol is distinguished from the other in phase. But all the symbols transmitted are of same amplitude. Noise immunity will improve if the signal vectors differ not only in phase, but also in amplitude. Here, the direct modulation of carriers in quadrature is involved therefore the system is called QAM.

21. List out merits and demerits of ASK.

Merits: Simple technique ,Easy to generate and detect.

Demerits: very sensitive to noise, Used at very low bit rates upto 100 bits/sec.

22. Define frequency deviation.

It is the half difference between mark and space frequencies.

$$\Delta f = \frac{fm-fs}{2}$$

Where Δf—frequency deviation (hz), fm-fs—absolute difference between mark and space frequencies.

PART –B 16 MARKS QUESTIONS

f. Explain BPSK Transmitter and receiver with a neat diagram.**(Dec'13)**

g. Explain BFSK Transmitter and receiver with a neat diagram.

h. Explain QPSK Transmitter and receiver with a neat diagram.**(Nov'14)**

i. Explain DPSK Transmitter and receiver with a neat diagram. What are the advantages of DPSK over PSK **(June'13)**.

j. With relevant diagram explain the method of synchronous detection of FSK signal. What should be the relationship between bit rate and frequency shift for better performance. **(June'13)**

k. Explain 8 QAM transmitter and receiver diagrams.**(Dec'13)**

l. Write short notes on the Carrier Recovery of the following (i)Costas loop, (ii) Squaring loop.

m. For an QPSK modulator with an input data rate (Fb)equal to 20mbps and a carrier freq of 70Mhz determine the minimum double sided Nyquist bandwidth (fn) and baud.

9. Compare and contrast the various Digital Communication Systems **(Nov'14)**

10. Explain the operation of the following (a) 8-PSK (b)QAM.

UNIT II : PULSE AND DATA COMMUNICATION
PART-A TWO MARKS QUESTIONS WITH ANSWERS

1. What are the error detection techniques?

Redundancy checking ----- VRC, LRC, CRC, Checksum

Parity coding, Exact count encoding, Echoplex

2. What is redundancy checking?

Redundancy checking is defined as the process of adding extra bits for detecting errors at the destination.

3. What is meant by CRC?

CRC is a systematic code, where instead of adding bits together to achieve a desired parity ,a sequence of redundant bits called CRC or CRC remainder is added to the end of the data to be transmitted. It can be written as (n,k) cyclic codes.

4. Define FCS.

The group of characters forming a message is called as block or frame of data. Hence, the bit sequence for the LRC is called as block check sequence or frame check sequence(FCS).

5. Name the two error correction method. (Nov'14)

Retransmission and forward error correction.

6. What is Forward Error Correction?

It is the type of error correction scheme, where the errors are detected and corrected without retransmission but by adding the redundant bit to the message before transmission.

7. Define DTE and DCE.

DTE is a binary digital device where the information originates or terminates. It contains the hardware and software necessary to establish and control communications between end points within a data communication systems. DCE is used to interfaces data terminal equipment to a transmission channel.

8. Define parallel interface.

Parallel interface allows the user to transfer data between two devices with eight or more bits at a same time or simultaneously. It is also called as serial by word transmission.

9. Define UART and USRT.

UART:Universal asyncronous receiver/transmitter is used for asynchronous transmission of data between DTE and DCE. Asyncronous transmission means that an asynchronous data format is used and there is no clocking information transferred between DTE and DCE.

USRT:Universal synchronous receiver/transmitter is used for synchronous data transmission between DTE and DCE .It means that there is clocking information transferred between USRT and modem .

10. What is meant by RS 232 interface?

RS 232 interface specifies a 25 wire cable with DB25P compatible connector .It is simply a cable and two connectors, the standard also specifies limitations on the voltage levels that the DTE and DCE can output onto or receive from the cable.

11.What is meant by centronics parallel interface?

Centronics parallel interface was originally designed to be used for transferring data between a microcomputer and a printer. Centronics was one of the original companies to design printers especially for desktop computers.

12.Give the primary functions of UART.

*To perform serial to parallel and parallel to serial conversion of data.

* To perform error detection by inserting and checking parity bits.

*To insert and detect start and stop bits.

13.State sampling Theorem.

If a finite energy signal g(t) contains no frequency component higher than W Hz, it is completely determined by specifying its ordinates at a separation of points spaced 1/ 2W seconds apart.

14.What is Aliasing or Foldover?

When the continuous time signal g(t) is sampled at the rate less than Nyquist rate, frequencies higher than W takes on the identity of the low frequencies in sampled signal spectrum . This is called aliasing. The use of a low pass reconstruction filter, with its pass band extending from –W to W will not yield an undistorted version of the original signal. Aliasing can be reduced by sampling at a rate higher than Nyquist rate.In other words, Aliasing occurs when the signal is sampled at a rate less than Nyguist rate(2W samples/ sec). It is prevented by using Guard Bands Pre-alias Filter

15. Define Nyquist rate and Nyquist interval.

According to sampling theorem, a continuous time signal can be completely represented in its samples and recovered back if the sampling frequency is $f_S \geq 2W$. Here f_S is sampling frequency and W is the highest frequency component of the signal.

Nyquist rate: The minimum sampling rate of 2W samples per second is called Nyquist rate.

i.e., $f_S = 2W \rightarrow$ Nyquist rate

Nyquist interval: Reciprocal of 2W is called the Nyquist interval.

Nyquist interval = 1/2W

16. Define aliasing error. Give the upper bound for the aliasing error.

Let $\{g(n/f_S)\}$ denote the sequence obtained by sampling an arbitrary signal g(t) at the rate f_S samples per second. Let $g_i(t)$ denote the signal reconstructed from this sequence by interpolation;

That is, $g_i(t)=\sum g(\ ) \text{ sinc } (f_S t - n)$

The absolute error $\varepsilon = | g(t) – gi(t) |$ is called the aliasing error.

The aliasing error is bounded as

$$\varepsilon \leq 2 \quad | G(f) | df$$

17. What is Inter symbol Interference (ISI) ?

ISI arises because of imperfections in the overall frequency response of the system.

When a short pulse of duration $\mathbf{T_b}$ seconds is transmitted through a band limited system, the frequency components constituting the input pulse are differentially attenuated and, more significantly, differentially delayed by the system. Consequently the pulse appearing at the output of the system is dispersed over an interval longer than T_b seconds.Thus when a sequence of short pulses are transmitted through the system, one pulse every T_b seconds, the dispersed responses originating from different symbol intervals will interfere with each other, there by resulting in ISI.

18. What are the types of pulse modulation systems and define them?

PAM is a process in which amplitudes of regularly spaced pulses are varied in proportion to the corresponding sample values of continuous message signal.

PPM is the process in which the position of a pulse relative to its unmodulated time of occurrence is varied in accordance with message signals.

PWM is the process in which the samples of message signal are used to vary the duration of individual pulses in the carrier.

19. What do you mean by Aperture Effect?

It is nothing but amplitude distortion occurring at PAM due to the sinc function. It is overcome by using a Equalizer whose transfer function is

$$| H(f)| = T^{-1} \text{sinc}(fT)$$

20. What is Quantization and sampling?

Quantization :It is the process in which the analog sample of the original signal is converted into a digital form.

Sampling :It is the process in which the original analog signal is converted into a discrete time and continuous amplitude signal

21. What is Quantization Noise?

The difference between the output analog sample and the discrete output quantized signal gives raise to an error called Quantization Noise.

22. What are the advantages of digital transmission?

The advantage of digital transmission over analog transmission is noise immunity. Digital pulses are less susceptible than analog signals to variations caused by noise.

Digital signals are better suited to processing and multiplexing than analog signals.

Digital transmission systems are more noise resistant than the analog transmission systems.

Digital systems are better suited to evaluate error performance.

23. What are the disadvantages of digital transmission?

The transmission of digitally encoded analog signals requires significantly more bandwidth than simply transmitting the original analog signal. Analog signal must be converted to digital codes prior to transmission and converted back to analog form at the receiver, thus necessitating additional encoding and decoding circuitry.

24. Define pulse code modulation.

In pulse code modulation, analog signal is sampled and converted to fixed length, serial binary number for transmission. The binary number varies according to the amplitude of the analog signal.

25. Define companding Nyquist sampling rate

Companding is the process of compressing, then expanding. With companded systems, the higher amplitude analog signals are compressed prior to transmission, then expanded at the receiver.

Nyquist sampling rate: Nyquist sampling rate states that, the minimum sampling rate is equal to twice the highest audio input frequency.

PART –B 16 MARKS QUESTIONS

1.Explain about centronics parallel interface

2.Explain in detail about line control unit in data communication hardware.

3.Write in detail about Pulse Amplitude Modulation.

4.Define and explain ASCII code and Bar codes.

5.Explain the operation of PPM & PWM.

6.State and explain the various Error Detection methods and Error correction Methods

7. Explain the procedure of PCM generation and detection with its block diagram.**(June'13), (Nov'14)**

8.Explain in detail about DCE and DTE. **(Nov'14)**

9.Give a detailed note on (i)Retransmission (ii) Forward error control

10.Explain about the standards organizations for data communications in detail. **(Nov'14)**

UNIT IV SOURCE AND ERROR CONTROL CODING
PART-A TWO MARKS QUESTIONS WITH ANSWERS

1. Give the factors which influence reliable transmission?

Transmitted signal power. channel bandwidth.

2. List out the advantages of error control coding.

Reduces the required transmitted power, Reduces the size of antennas, Reduces the hardware cost.

3. What are the disadvantages of error control coding?

Increases the transmission bandwidth, Increases the complexity of decoder.

4. Give the types of error control codes. (June'13)

Block codes , Convolutional codes.

5. List the types of block codes.

Linear block codes, Cyclic codes.

6. Define block codes.

The codes which consists of (n-k) parity bits for every k bit message block are known as block codes

7. Define linear block codes.

Block code is the code in which every 'k-bit' message block (n-k) parity bits are appended to produce 'n' bit codeword. If the parity bits are the linear combination of 'k' message bits then the code is referred as linear block codes.

8. What are the systematic codes?

Block codes in which the message bits are transmitted in unaltered form are called systematic codes.

9. Define generator matrix.

Generator matrix Gkxn is used in the encoding operation and its k rows are linearly independent the encoding operation and its k rows are linearly independent

$G_{kxn}=[P_{kx(n-k)} \mid I\ kxk]$;

Where, P-parity matrix, I-identity matrix

10. Explain Shannon-Fano coding. (June'13)

An efficient code can be obtained by the following simple procedure, known as Shannon- Fano algorithm. List the source symbols in order of decreasing probability. Partition the set into two sets that are as close to equiprobable as possible, and sign 0 to the upper set and 1 to the lower set. Continue this process, each time partitioning the sets with as nearly equal probabilities as possible until further partitioning is not possible.

11. Define information rate.

If the time rate at which source X emits symbols is r symbols per second. The information rate R of the source is given by R=r H(X) bits/second, H(X)- entropy of the source

12. What is data compaction?

For efficient signal transmission the redundant information must be removed from the signal prior to transmission .This information with no loss of information is ordinarily performed on a signal in digital form and is referred to as data compaction or lossless data compression.

13. Define mutual information and channel capacity.

Mutual information I(X,Y) of a channel is defined by I(X,Y)=H(X)-H(X/Y) bits/symbol

H(X)- entropy of the source, H(X/Y)- conditional entropy of Y.

14. Define entropy.

Entropy is the measure of the average information content per second.

$$\text{Entropy} = -\sum_{i=1}^{n} p_i \log_b(p_i)$$

n = number of different outcomes.

15. Define syndrome.

Syndrome contains information about the error pattern ‘e ‘ and may therefore be used for error detection . S is a x (n-k0 vector and is used to decode the vector C from the received vector ‘r ‘ $S = r H^T$ where r = C + e .

16. Give the properties of syndrome.

The syndrome depends only on the error pattern and not on the transmitted code word.

All error patterns that differ by a codeword have the same syndrome.

17. Define: Cyclic codes

Cyclic codes are a sub-class of linear block codes .It posses a well defined mathematical structure and which provides efficient decoding.

18.Give any two properties of cyclic codes?

Linearity, Cyclic property

19. State cyclic porperty.

Cyclic property states that any cyclic shift of a code word in the code is also a codeword.

20. State linearity property.

Linearity property states that the sum of any 2 code words in the code is also a code.

21. Give the graphical representation of convolutional encoder?

Code tree, Trellis, State diagram

22. What is the need for convolution coding?

Convolution coding may be the preferred method in applications where the message bits come in serially rather in large blocks in which case the use of buffer may be undesirable.

23. What is trellis?

Trellis is a tree like structure with remerging branches. The code branch with an input 'o' is drawn by a solid line and a branch by an input '1' is drawn as a dashed line. each input sequence corresponds to a specific path through the trellis. trellis contains (l+k) levels where l - length the message and

k-constraint length level, j- is the depth of the trellis

24. What is code tree ?

Each branch of the tree responds an input symbol with the corresponding pair of input binary symbols indicated on the branch the input 'o' specifies the upper branch of the tree and the input '1' specifies the lower branch of the tree. a specific path is traced from left to right in accordance with the input sequence .the corresponding coded symbols on the branches of that path constitute the output sequence.

25. Distinguish block codes and convolution codes?

Block codes	**Convolution codes**
1) code the block of k Msg bits.	1) code each msg bit individually.
2) needs the buffer to store msg block.	2) does not need the buffer since the bits are arriving in serial fashion.

PART –B 16 MARKS QUESTIONS

1. Five symbols of the alphabet of DMS and their probabilities are given below. S={So,S1,S2,S3,S4}

P(S) = {0.1, 0.1, 0.2, 0.2, 0.4}.Code the symbols using Huffman coding. Find the efficiency of the code. **(Nov'14)**

2. Find the Shannon –fanno code for the following seven messages with probabilities indicated. S={S1,S2,S3,S4,S5, S6,S7},P(S)= {0.05,0.15,0.2,0.05,0.15,0.3,0.1}.

3. Construct a convolution encoder whose constraint length is 3 and has 3 modulo- 2 adders and an output multiplexer. The generator sequences of the encoder are $g^{(1)}$=(1,0,1),$g^{(2)}$=(1,1,0),$g^{(3)}$=(1,1,1). Draw the block diagram of the encoder. Find the encoder output produced by the message sequence 10111.

4. Explain coding and decoding process of block codes.

5. Write in detail the procedure of Shannon-fanno coding scheme

6. (i)Derive the channel capacity of Binary symmetric channel. (ii)Derive the channel capacity of Binary erasure channel.

8. Define entropy. Explain the properties of entropy.

9. Give brief notes on error detection. **(June'13)**

10.Write short notes on (1)Linear Block Codes(2)Viterbi Algorithm **(Nov'14)**

UNIT V MULTI - USER RADIO COMMUNICATION

PART-A TWO MARKS QUESTIONS WITH ANSWERS

1. What are the different multiple access techniques used in wire less communication?

TDMA – Time Division Multiple Access, FDMA- Frequency Division Multiple Access,
CDMA – Code Division Multiple Access.

2. Compare FDMA and TDMA.(June'13)

FDMA - Frequency Division Multiple Access	TDMA - Time Division Multiple Access
All users access the channel by transmitting simultaneously but using disjoint frequency bands	All users occupy the same RF band width of the channel, but they transmit sequentially in time
Fixed assignment multiple access technique	Fixed assignment multiple access technique
Well suited for analog communication	Well suited for digital communication

3. List the merits of CDMA over TDMA.

CDMA does not require an external synchronization network which is an essential feature of TDMA. CDMA offers a gradual degradation in performance as the number of user is increased. It is there fore relatively easy to add new users to the system. CDMA offers an external interference rejection capability.

4. What is CDMA?

CDMA – Code Division Multiple Access. In CDMA , all users transmit simultaneously and occupy the same RF bandwidth. Each user is assigned a **code** which perform the DSSS or FHSS modulation

5.List out any four features of TDMA.

TDMA shares a single carrier frequency with several users where each user makes use of non overlapping time slots.Data transmission for users is not continuous,but occurs in burst. Because of discontinuous transmission,handoff process is much simpler for a suscriber unit . TDMA uses different time slots for transmission and reception ,thus duplexers are not required.

6. What is Satellite?

An artificial body that is projected from earth to orbit either earth (or) another body of solar systems.Types: Information satellites and Communication Satellites

7. Define Satellite Communication.

It is defined as the use of orbiting satellites to receive, amplify andretransmit data to earth stations.

8. State Kepler's first law.

It states that the path followed by the satellite around the primary will bean ellipse.An ellipse has two focal points F1 and F2. The center of mass of the twobody system, termed the barycenter is always centered on one of the foci.e = [square root of (a^2-b^2)]/a

9. State Kepler's second law.

It states that for equal time intervals, the satellite will sweep out equalareas in its orbital plane, focused at the barycenter.

10. State Kepler's third law.

It states that the square of the periodic time of orbit is perpendicular to thecube of the mean distance between the two bodiesa^3= 3 / n^2 Where, n = Mean motion of the satellite in rad/sec.3 = Earth's geocentric gravitational constant.With the n in radians per sec. the orbital period in second is given by, P = 27 / n

11. Define apogee and perigee

The point farthest from the earth is apogee, The point closest from the earth is perigee.

12. What is line of apsides?

The line joining the perigee and apogee through the center of the earth.

13. Define ascending node and descending node.

The point where the orbit crosses the equatorial plane going from south to north.
The point where the orbit crosses the equatorial plane going from north to south.

14. Define Inclination.

The angle between the orbital plane and the earth's equatorial plane. It is measured at the ascending node from the equator to the orbit going from east to north.

15.What is declination?

The angle of tilt is often referred to as the declination which must not be confused with the magnetic declination used in correcting compass readings.

16.Write short notes on station keeping.

It is the process of maintenance of satellite's attitude against different factors that can cause drift with time. Satellites need to have their orbits adjusted from time to time, because the satellite is initially placed in the correct orbit,natural forces induce a progressive drift.

17. What is meant by Pitch angle?

Movement of a spacecraft about an axis which is perpendicular to its longitudinal axis. It is the degree of elevation or depression.

18. What is an propellant?

A solid or liquid substance burnt in a rocket for the purpose of producing thrust.

19.What is meant by frequency reuse?

The satellite as a whole to be accessed by earth stations widely separated geographically but transmitting on the same frequency that is known as frequency reuse.

20.What are the limitations of FDMA-satellite access?

a. If the traffic in the downlink is much heavier than that in the uplink, then FDMA is relatively inefficient. b. Compared with TDMA, FDMA has less flexibility in reassigning channels. c. Carrier frequency assignments are hardware controlled.

21. Write about pre-assigned TDMA satellite access.

Example for pre-assigned TDMA is CSC for the SPADE network. CSC can accommodate upto 49 earth stations in the network and 1 reference station. All bursts are of equal length. Each burst contains 128 bits. The bit rate is 128 Kb/s.

22. Write about demand assigned TDMA satellite access.

The burst length may be kept constant and the number of bursts per frame used by the given station is varied when the demand is varied.

23.Define AMPS.

AMPS is a first-generation cellular technology that uses separate frequencies for each conversation and it uses the 800 MHz frequency band of the spectrum Utilizes FDMA (Frequency division multiple access) to separate users

24.What is meant by hand over?

The term handover or handoff is the process of transferring an ongoing call or data session from one channel connected to another channel. It can be classified into soft and hard hand over.

Is normally performed because the signal level from the current cell is becoming to low, but can also be done for different reasons, such as too much traffic in a cell

PART –B 16 MARKS QUESTIONS

1. Explain in detail about AMPS.
2. Describe the elements in GSM radio access network.
3. Explain the types of Multiple Access techniques.
4. Explain TDMA system with frame structure, frame efficiency and features.
5. Explain CDMA system with its features and list out various problems in CDMA systems.
6. Compare TDMA, FDMA and CDMA
7. State Kepler's three laws of planetary motion.Illustrate in each case their relevance to artificial satellites orbiting the earth.
8. Write short notes on Frequency reuse and Hand over**(Nov'14)**
9. Explain in detail about Bluetooth.
10. Explain about Error correction coding in GSM. **(Nov'14)**

V.S.B. ENGINEERING COLLEGE, KARUR
Department of Electronics and Communication Engineering
Academic Year: 2018-2019 (ODD Semester)

a. ASSIGNMENT QUESTIONS

Class : II IT (3rd sem)

S. No.	Reg. No.	Name of the Student	Assignment Questions
1	922517205001	ABITHA R	Obtain AM wave equation and explain each term with the help of frequency spectrum and also obtain an expression for its power?
2	922517205002	ARUNKUMAR S	What is the need for modulation? ii) Explain with necessary diagram any one method for generation of AM waves.
3	922517205003	AVINASH K	Explain with block diagram of a Fm transmitter using direct modulation. ii) Discuss about spectral characteristics of FM signal.
4	922517205004	BHARATH S	Draw the block diagram of AM superhetrodyne receiver and explain function of each block.
5	922517205005	BOOPATHI D	An AM modulator has a carrier of 400 KHz with amplitude of 20v; modulating signal of 8 KHz with amplitude of 8.5v is applied. Determine 27. Upper and lower side frequencies. 28. Modulation coefficient and percent modulation 29. Peak amplitude of the modulated carrier and upper and lower side frequency voltages. 30. Maximum and minimum amplitude of the envelope. 31. Expression of modulated wave. 32. Sketch the output spectrum and envelope.
6	922517205006	DEEPAK M	Write down the expression for FM and PM waves and draw their frequency spectrum and explain.
7	922517205007	DEVAMATHANIKA G	Obtain the mathematical expressions for AM & FM modulated waves & draw the necessary waveforms in both cases.
8	922517205008	DINAKAR B	Compare AM, FM and PM systems.
9	922517205009	GAYATHRI M	Expalin the phase deviation and Modulation index of angle modulated wave.
10	922517205011	HARIHARASUTHAN M	Write short notes on (i)Shot noise (ii) Thermal noise. (iii) Internal Noise.
11	922517205012	HARSHAVARDHINI A	Explain about centronics parallel interface.

S. No.	Reg. No.	Name of the Student	Assignment Questions
12	922517205013	HEMA R	Explain in detail about line control unit in data communication hardware.
13	922517205015	KALAIARASI D	Write in detail about Pulse Amplitude Modulation.
14	922517205016	KAMALNATH S	Define and explain ASCII code and Bar codes.
15	922517205017	KANITHA V	Explain the operation of PPM & PWM.
16	922517205018	KARTHIKA M	State and explain the various Error Detection methods and Error correction Methods.
17	922517205019	KARTHIKEYAN S	Explain the procedure of PCM generation and detection with its block diagram.
18	922517205021	KAUSALYA R	Explain in detail about DCE and DTE.
19	922517205022	KAVINKUMAR R	Give a detailed note on (i)Retransmission (ii) Forward error control.
20	922517205023	KAVIYA E	Explain about the standards organizations for data communications in detail.
21	922517205024	KAVIYA G	Explain BPSK Transmitter and receiver with a neat diagram.
22	922517205025	KAVYA T	Explain BFSK Transmitter and receiver with a neat diagram.
23	922517205026	KESAVAKUMAR K	Explain QPSK Transmitter and receiver with a neat diagram.
24	922517205027	KRISHNA S	Explain DPSK Transmitter and receiver with a neat diagram. What are the advantages of DPSK over PSK?
25	922517205028	LAKSHMANAN G	With relevant diagram explain the method of synchronous detection of FSK signal. What should be the relationship between bit rate and frequency shift for better performance.
26	922517205029	MANISHALINI K	Explain 8 QAM transmitter and receiver diagrams.
27	922517205030	MANOJ R	Write short notes on the Carrier Recovery of the following (i)Costas loop, (ii) Squaring loop.
28	922517205031	MOUNIKA K	For an QPSK modulator with an input data rate (Fb)equal to 20mbps and a carrier freq of 70Mhz determine the minimum double sided Nyquist bandwidth (fn) and baud.
29	922517205032	NAVEENA M	Compare and contrast the various Digital Communication Systems.
30	922517205033	NAVEENKUMAR S	Explain the operation of the following (a) 8-PSK (b)QAM.
31	922517205034	NITHYA P	Five symbols of the alphabet of DMS and their probabilities are given below. S={So,S1,S2,S3,S4} P(S) = {0.1, 0.1, 0.2, 0.2, 0.4}.Code the symbols using Huffman

S. No.	Reg. No.	Name of the Student	Assignment Questions
			coding. Find the efficiency of the code.
32	922517205035	PADMAPRIYA M	Find the Shannon –fanno code for the following even messages withprobabilities indicated. S={S1,S2,S3,S4,S5, S6,S7},P(S)= 0.05,0.15,0.2,0.05,0.15,0.3,0.1}.
33	922517205036	PRABHAKARAN T	Construct a convolution encoder whose constraint length is 3 and has 3 modulo- 2 adders and an output multiplexer. The generator sequences of the encoder are $g^{(1)}$=(1,0,1),$g^{(2)}$=(1,1,0),$g^{(3)}$=(1,1,1). Draw the block diagram of the encoder. Find the encoder output produced by the message sequence 10111.
34	922517205037	PRABU B	Explain coding and decoding process of block codes.
35	922517205038	PRAVEEN T	Write in detail the procedure of Shannon-fanno coding scheme.
36	922517205039	PRAVEEN KUMAR I	(i)Derive the channel capacity of Binary symmetric channel. (ii)Derive the channel capacity of Binary erasure channel.
37	922517205040	PRAVIN KUMAR M	Define entropy. Explain the properties of entropy.
38	922517205041	PRIYADHARSHINI K	Give brief notes on error detection.
39	922517205042	PRIYANGA D	Write short notes on (1)Linear Block Codes(2)Viterbi Algorithm.
40	922517205043	RAGAVI K	Explain in detail about AMPS.
41	922517205044	SABITHA R	Describe the elements in GSM radio access network.
42	922517205045	SABITHA V	Explain the types of Multiple Access techniques.
43	922517205046	SAMRIN S	Explain TDMA system with frame structure, frame efficiency and features.
44	922517205048	SANDHIYA D	Explain CDMA system with its features and list out various problems in CDMA systems.
45	922517205050	SHALINI G	Compare TDMA, FDMA and CDMA.
46	922517205051	SIVAGANESH S	State Kepler's three laws of planetary motion.Illustrate in each case their relevance to artificial satellites orbiting the earth.
47	922517205052	SNEHA S	Write short notes on Frequency reuse and Hand over.
48	922517205053	SOWNDHARYA K	Explain in detail about Bluetooth.
49	922517205054	SRINIVASAN S	Explain about Error correction coding in GSM.

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50	922517205055	SRIRAMYA S	Explain how viterbi decoding procedure is used for decoding convolutional codes using an example.
51	922517205056	SURIYAKALA S	Determine the BCS for the following data and CRC generating polynomial.
52	922517205057	SURUTHI S	For a BPSK modulator with a Carrier frequency of 70 MHz and an input bit rate of 10 Mbps, determine the maximum and minimum upper and lower side frequencies, draw the output spectrum, determine the minimum Nyquist bandwidth, and calculate the baud (Assume f= 5MHz).
53	922517205058	SWATHI V	Describe the processing steps to convert a k bit message word to n bit codeword (n>k). Introduce an error and demonstrate how an error can be corrected with an example.
54	922517205060	VALLI PREETHI G	Illustrate the operation of a satellite communication system with a block diagram.