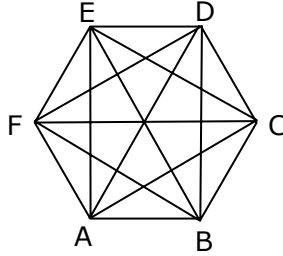**Q. No. 1 – 25 Carry One Mark Each**

1. Consider the following graph $G(V, E)$:

    The number of spanning trees for the above graph is _____

2. Let

    $N(x, y)$: x and y are neighbors

    $H(x, y)$: x should help y.

    $P(x, y)$: x will help y.

    Write the negation of the following statements in symbolic form.
    "Everyone should help his neighbours, or his neighbours will not help him".

    (A) $(\forall x)(\forall y)(N(x, y) \rightarrow (H(x, y) \vee \neg P(y, x)))$

    (B) $(\exists x)(\exists y)(N(x, y) \rightarrow (H(x, y) \vee \neg P(y, x)))$

    (C) $(\exists x)(\exists y)(N(x, y) \wedge (\neg H(x, y) \wedge \neg P(y, x)))$

    (D) $(\exists x)(\exists y)(N(x, y) \wedge \neg H(x, y) \wedge P(y, x))$

3. The N-R iteration $x_{n+1} = \dfrac{2}{3}\left[x_n + \dfrac{a}{2x_n^2}\right]$ can be used to compute the

    (A) Square of 'a'   (B) Square root of 'a'
    (C) Reciprocal of 'a'   (D) Cube root of 'a'

4. Consider the following statements:

    I.   OSPF is an implementation of Link State protocol.

    II. In Distance Vector Routing the flooding technique is used to exchange routing table with other nodes in a network.

    III. Choke Packet is a congestion control technique where the packet is sent from any node to its upstream node to inform it of congestion.
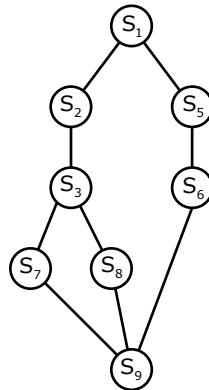
    Which of the above statements is/are correct?

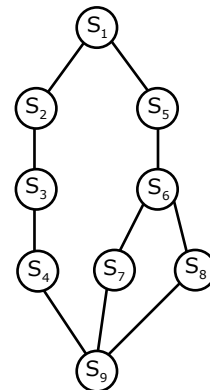   (A) I only   (B) I and II only   (C) I and III only   (D) I, II and III

---

5. What is the equivalent precedence graph for the following fork & join construct?

$S_1;$
fork $L_1;$
  $S_2;$
  $S_3;$
  $S_4;$
goto L_3
$L_1 : S_5;$
  $S_6;$
fork L_2
  $S_7;$
goto L_3
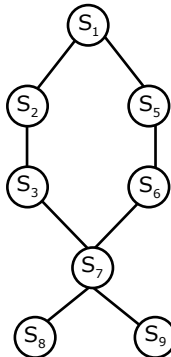$L_2 : S_8;$
$L_3 :$ join
$S_9;$

(A)

(B)

(C)

(D)   None of these

6. Which of the following main memory will be capable of supporting 80386 processor which has 32 bit address (32 pins) capacity?
    (A) 8 GB   (B) 16 GB   (C) 4 GB   (D) 2 GB

7. The number of partial dependencies in a relation R(X,Y,Z,U,V) with FD set
    $F = \{X \rightarrow YZ, Z \rightarrow V, V \rightarrow XY\}$ is

    (A) 1   (B) 3   (C) 5   (D) 2

8. Given a relation R(A,B,C) and set of F.D. $F = \{A \rightarrow BC, B \rightarrow C, C \rightarrow B\}$ the highest normal form of R is

    (A) 1 NF   (B) 2 NF   (C) 3 NF   (D) BCNF

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9.   Match the following protocols:

List-I	List-II
A. FTP	I TCP
B. SMTP	II UDP
C. RIP	
D. SNMP	
E. HTTP	

(A) A-I, B-II, C-II, D-I, E-I   (B) A-I, B-I, C-II, D-II, E-I

(C) A-II, B-I, C-II, D-II, E-II   (D) A-I, B-II, C-I, D-II, E-I

10.   Two hosts A and B connected via a communication link. Host B has a buffer for receiving data of total size 6000 Byte, the 2000 Bytes of received data (unprocessed data) is present in the receiver buffer at host B. The size of congestion window at host A is 3500 Byte, what will be the maximum sending window size at host A?

(A) 6000 B   (B) 4000 B   (C) 3500 B   (D) 3000 B

11.   Output of the following program will be

int main( )
{
        char *p1="Graduate";
        char *p2=p1;
        printf("%c, %d", *(++p2), sizeof(p2));
}

(A) G, 8   (B) r, 7   (C) r, 4   (D) r, 8

12.   Which of the following sorting algorithms has best worst-time complexity?

(A) Quick sort   (B) Heap sort

(C) Insertion sort   (D) Selection sort

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13. Consider a computer system having n resources of the same type and these resources are shared by 4 processes which have maximum demands of 5, 4, 3, 6 respectively. Then for what values of n, the system will be in dead lock?

(a) 13　　　　(b) 14　　　　(c) 15　　　　(d) 16　　　　(e) 12

(A) (a) & (e) only　　　　　　　　(B) (b) & (c) only

(C) (a) only　　　　　　　　　　(D) (a), (b) & (e) only

14. The mean and variance of binomial distribution are 2.50 and 1.25 respectively. Find P(x<2).

(A) $\dfrac{5}{16}$　　　　(B) $\dfrac{1}{32}$　　　　(C) $\dfrac{16}{3}$　　　　(D) $\dfrac{3}{16}$

15. A host is using leaky bucket strategy for traffic shaping. The host sends a burst of data at a rate of 12 Mbps for first 4 seconds and remains silent for next 3 seconds. Then again a burst of data at a rate of 8 Mbps is sent for next 3 seconds and then the host remains silent for next 2 seconds. Now for last 3 seconds at what rate should the host send data so that the output data rate of the leaky bucket becomes 5 Mbps?

(A) 1 Mbps　　　　(B) 2 Mbps　　　　(C) 3Mbps　　　　(D) 4 Mbps

16. If the language L_1 is polynomially reduced to the language L_2 and L_2 is polynomially reduced to L_1, then which of the following cannot be true always?

(A) L_1 is decidable and L_2 is undecidable

(B) L_1 is regular and L_2 is CFL

(C) L_1 is recursive and L_2 is recursively enumerable

(D) None of these

17. The minimal finite automata that accepts all strings of a's and b's, where the number of a's is at least 'n' contains

(A) n states　　(B) (n+1) states　　(C) (n+2) states　　(D) (n+3) states

18. What would be the number of rows returned by SQL query on the given EMP table?

```
SELECT *
FROM   EMP;
WHERE  manager  IN  (NULL,  NULL,
       NULL);
```

eno	ename	manager
1	A	Null
2	B	Null
3	C	Null
4	D	Null

(A) Error　　　　(B) 3 rows　　　　(C) No Rows　　　　(D) 1 row

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19. Which of the following are functionally equivalent to $b\bar{c} + \bar{c}d$?

(A) $\bar{a}b\bar{c} + ab\bar{c} + acd + a\bar{c}\bar{d}$

(B) $a\bar{b}\bar{c} + \bar{a}bc + ab\bar{c} + \bar{b}c$

(C) $b\bar{c} + \bar{c}d + bd$

(D) $\bar{a}b\bar{c} + ab\bar{c} + \bar{a}cd + a\bar{c}d$

20. Consider the following k-map, P,Q,R are don't cares. What should be the values of P,Q,R in order to get the minimized SOP expression?

(A) $0,0,1$

(B) $0,0,0$

(C) $1,1,1$

(D) $0,1,1$

xy\wz	00	01	11	10
00	0	P	0	0
01	0	0	1	1
11	1	1	1	1
10	Q	R	0	0

21. A variable A has been assigned fresh value in statement numbered 5, 9 and 13 in 20 statement program which does not have any jump instruction. This variable is used in statement number 6, 7, 10, 15 and 17. The statement range where the register used by variable A could be assigned to some other variable is.

(A) 8, 11-12, 18-20

(B) 18-20

(C) 6-8, 10-12, 14-20

(D) 8, 11-12, 14, 16, 18-19

22. If T_x is transfer time, T_y is word preparation time then percentage of time processor blocked due to DMA in cycle stealing mode is_____

(A) $\dfrac{T_x}{T_x + T_y} \times 100$

(B) $\dfrac{T_x + T_y}{T_x} \times 100$

(C) $\dfrac{T_x + T_y}{T_y} \times 100$

(D) $\dfrac{T_x + T_y}{T_x . T_y} \times 100$

23. The following portion of a DFD is not correct because
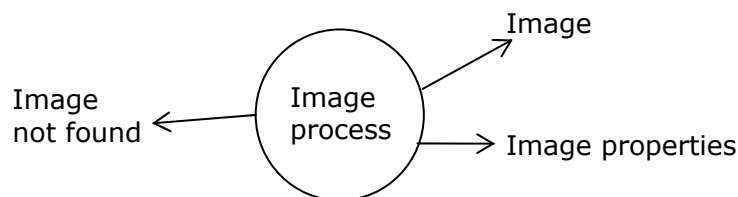
(A) It has no input data

(B) It has no data store

(C) The output does not go to an external entity

(D) There are many data flows

24. The function $f(x,y) = x^4 + y^4 + 4xy - 2y^2$ at $\left(\sqrt{2}, -\sqrt{2}\right)$ has

(A) Maximum value -8

(B) Minimum value -8

(C) Maximum value 8

(D) Minimum value 8

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25. The cyclomatic complexity of the following code is _____

```
int j;
for (j = 0; j < 10; j++)
{
        if (j% 4)
            printf("divisible by 4");
        else
            printf("not divisible by 4");
}
```

Q. No. 26 – 51 Carry Two Marks Each

26. A virtual memory has a page size 1k words. There are 8 pages and 4 frames. The associative memory page table contain following entries

Page	Frame
6	0
1	1
4	2
0	3

Which of the following virtual address (in decimal) will cause page fault?

(A) 4098   (B) 5124   (C) 1022   (D) 6144

27. If $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 5 & 7 \\ 3 & 8 & 10 \end{bmatrix}$ and $A = LU$ where $L = \begin{bmatrix} 1 & 0 & 0 \\ l_{21} & 1 & 0 \\ l_{31} & l_{32} & 1 \end{bmatrix}$ and $U = \begin{bmatrix} u_{11} & u_{12} & u_{13} \\ 0 & u_{22} & u_{23} \\ 0 & 0 & u_{33} \end{bmatrix}$ then

L and U are respectively

(A) $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 1 \\ 0 & 2 & 1 \end{bmatrix}, \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 1 \\ 0 & 0 & -1 \end{bmatrix}$

(B) $\begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix}, \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 1 \\ 0 & 0 & -1 \end{bmatrix}$

(C) $\begin{bmatrix} 1 & 0 & 0 \\ -2 & 1 & 0 \\ -3 & -2 & 1 \end{bmatrix}, \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

(D) $\begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix}, \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

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28. What can you conclude from the resource allocation graph given below?
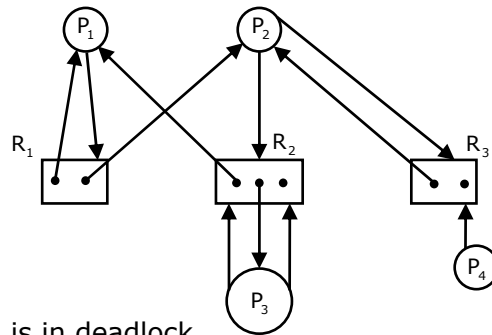
(A) The system is in deadlock

(B) It is free from deadlock as there is a safe sequence $\langle P_1, P_2, P_3, P_4 \rangle$

(C) It is free from deadlock as there is a safe sequence $\langle P_2, P_1, P_3, P_4 \rangle$

(D) It is free from deadlock as there is a safe sequence $\langle P_2, P_3, P_1, P_4 \rangle$

29. Consider a system with 16 bit physical address. Assume that whole physical address space is divided into 8 equal sized partitions.

If 8 processes request memory of sizes 6 KB, 4KB, 2KB, 10KB, 7 KB, 12KB, 3 KB and 5 KB. Calculate the total amount of internal fragmentation and number of processes for which no allocation possible respectively (with the assumption that one partition is allocated to one process).

(A) 21 KB, 2   (B) 16 KB, 2   (C) 22 KB, 2   (D) 37 KB, 2

30. Which of the following graphs have an Euler circuit?
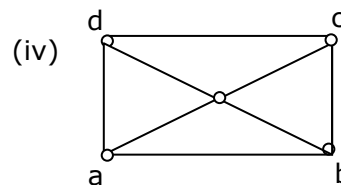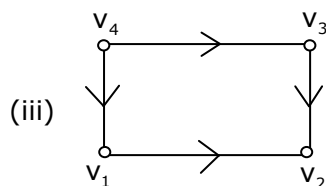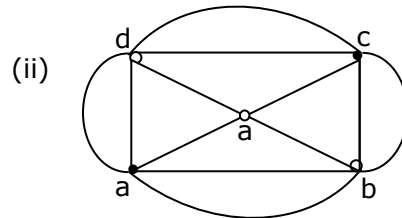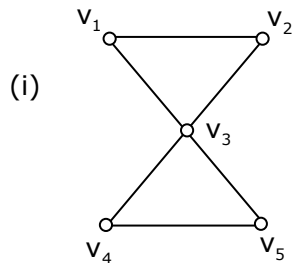
(A) (ii), (i), (iv) only   (B) (i) only

(C) (iii), (iv) only   (D) None of the given graphs

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31. Consider the set of relations for the given query:-

EMP(<u>eno</u>, ename)

DEPT(<u>dno</u>,dname)

WORKS_IN(<u>eno,dno</u>)

$\prod_{eno}(EMP) - \prod_{eno}((\prod_{eno}(EMP) \times \prod_{dno}(DEPT)) - \prod_{eno,dno}(WORKS\_IN))$

The above Relational Algbegra expression returns

(A) The eno's of employees working in at least one department

(B) The eno's of employees working in all departments

(C) The eno's of employees working in 2 (or) more departments

(D) The eno's of employees not working in any department

32. Consider the following C-Code what value will be returned by call(10)?
```
static int i =10;
int call(int n)
{
    static int i= 5;
    if(n < 100)
    {
        n=n+i;
        i= getl(i)+n;
        return call(n);
    }
    else return 2*n;
}

int getl(int x)
{
    x=x+i;
    i=x;
    return x;
}
```
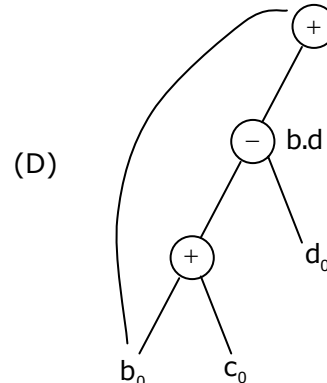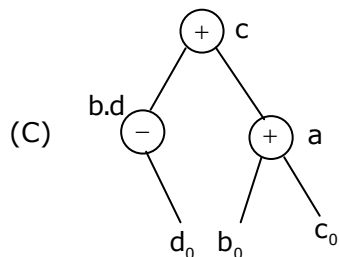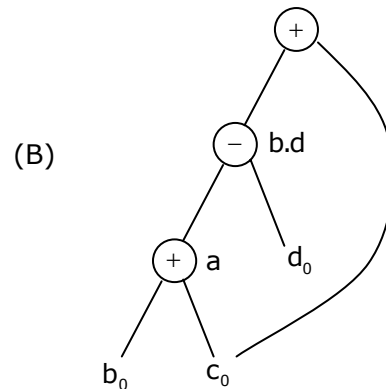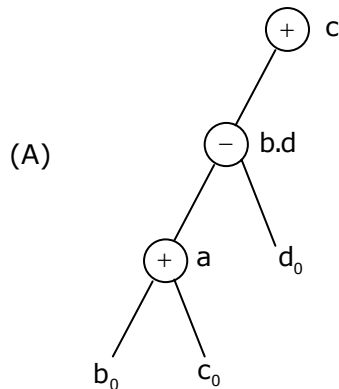(A) 135   (B) 470   (C) 270   (D) None of these

33. The following keys are inserted in an empty binary search tree and height of the root of tree is 1
Keys are: 11, 10, 1, 9, 7, 4, 3, 2, 6, 8, 5, 12;
The height of constructed BST is _____

34. Suppose a system uses shortest job first scheduling (SJF) and exponential average of the measured lengths of previous CPU bursts is $\alpha = 0.25$. If the initial value of the predicted CPU burst time, $\tau_1 = 4$ unit, what will be the predicted time for 4th CPU burst (τ_4) for a process with burst times of 4 unit, 12 unit and 8 unit respectively?

(A) 5   (B) 6.5   (C) 8.5   (D) 9.11

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35. The number of distinct operators and operands in a program are 16 and 8 respectively. Using Halstead complexity measures, the calculated program length is_____.

36. A computer on a 12 Mbps network is regulated by a token bucket which is filled at rate of 4 Mbps. Initially filled with capacity of 42 Mb. The maximum duration in seconds for which the computer can transmit at full 12 mbps speed is ____

37. If data of size 4 Mb is sent from Transport Layer where each segment size is 1000 Bytes, then what will be the overhead wastage in % is _____ . (Header size is 40 Bytes).

38. The solution of recurrence relation $a_n - 3.a_{n-1} = 3^n(n+2)$ is .....

(A) $a_n = \dfrac{3^n}{2}\left(2C_1 + n^2 + 5n\right)$

(B) $a_n = 3^n\left(2C_1 + n^2 + 5n\right)$

(C) $a_n = \dfrac{3^n}{2}\left(C_1 + n^2 + n\right)$

(D) $a_n = 3^n\left(C_1 + n^2 + 5n\right)$

39. Draw a DAG for the block.

$a := b + c$
$b := a - d$
$c := b + c$
$d := a - d.$

(A)

(B)

(C)

(D)

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40. Which of the following regular expression is equivalent to $(11*0+0)(0+1)*0*1*$?

(A) $1*0(0+1)*$ (B) $(1*0+0)(0*1*)*$

(C) Both (A) & (B)   (D) $(1*0+0)(0+1)$

41. Consider two level memory systems in which the average access time is 150 ns without level L_1. The level 1 access time is 20 ns. The average access time with L_1 is 40 ns. The hit ratio of L_1 in percentage is _____

42. If $f(x) = \begin{cases} 0 & \text{for } x \le 0 \\ 5x - 4 & \text{for } 0 < x \le 1 \\ 4x^2 - 3x & \text{for } 1 < x < 2 \\ 3x + 4 & \text{for } x \ge 2 \end{cases}$ then

(A) $f(x)$ is discontinuous at $x = 0$ (B) $f(x)$ is continuous at $x = 1$

(C) $f(x)$ is left continuous at $x=2$ (D) All of these

43. The number of decoders of size 3×8 needed to get the target decoder 7×128 is _____

44. Consider the following pushdown automata:

(1) $\delta(q_0, \in, z_0) = (q_0, \in)$

(2) $\delta(q_0, 0, z_0) = (q_0, xz_0)$

(3) $\delta(q_0, 0, x) = (q_1, x)$

(4) $\delta(q_1, 0, x) = (q_2, xx)$

(5) $\delta(q_2, 0, x) = (q_1, x)$

(6) $\delta(q_1, 1, x) = (q_1, \in)$

(7) $\delta(q_1, \in, z_0) = (q_1, \in)$

The language accepted by making stack empty is

(A) $0^n 1^{2n} / n \ge 0$ (B) $0^n 1^{2n} / n > 0$ (C) $0^{2n} 1^n / n \ge 0$ (D) $0^{2n} 1^n / n > 0$

---

45. If the eigen values of a matrix are (-2, 3, 6) and the corresponding eigen vectors

are $\begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}, \begin{bmatrix} -1 \\ -1 \\ 1 \end{bmatrix} \& \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$ then the spectral matrix is

(A) $\begin{bmatrix} -1 & 1 & 1 \\ 0 & -1 & 2 \\ 1 & 1 & 1 \end{bmatrix}$

(B) $\begin{bmatrix} 4 & 0 & 0 \\ 0 & 9 & 0 \\ 0 & 0 & 36 \end{bmatrix}$

(C) $\begin{bmatrix} -\dfrac{1}{\sqrt{2}} & \dfrac{1}{\sqrt{3}} & \dfrac{1}{\sqrt{6}} \\ 0 & -\dfrac{1}{\sqrt{3}} & \dfrac{2}{\sqrt{6}} \\ \dfrac{1}{\sqrt{2}} & \dfrac{1}{\sqrt{3}} & \dfrac{1}{\sqrt{6}} \end{bmatrix}$

(D) $\begin{bmatrix} -2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 6 \end{bmatrix}$

46. How many non-negative integer solutions are possible to the inequality?

$(x_1 + x_2 + x_3 + x_4 + x_5 + x_6) \le 10$

(A) 3003   (B) $17_{C_{10}}$ (C) 10_{C_7} (D) 16_{C_6}

47. Which of the following is true for ripple counters?
(A) Clock is applied to only LSB flip flop
(B) Each flip flop toggles at a different time
(C) Propagation delay is additive
(D) All of these

Common Data Questions: 48 & 49

Two persons Ajit and Sujith throw with one die for a stake of Rs. 2200. Sujith has the first throw.

48. The expectation of Ajit is
(A) Rs.12000   (B) Rs.11000   (C) Rs.10000   (D) Rs.33000

Two persons Ajit and Sujith throw with one die for a stake of Rs. 2200. Sujith has the first throw.

49. The expectation of Sujith is
(A) Rs.12000   (B) Rs.11000   (C) Rs.33000   (D) Rs.10000

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Common Data Questions: 50 & 51

A binary max-heap is implemented using an array A. The contents of A is {90, 70, 75, 15, 45, 40, 60}

50. The contents of A after two delete operations is _____
    (A) {70, 45, 60, 15, 40}   (B) {70, 40, 60, 15, 45}
    (C) {70, 45, 60, 40, 15}   (D){70, 40, 60, 45, 15}

A binary max-heap is implemented using an array A. The contents of A is {90, 70, 75, 15, 45, 40, 60}

51. The content of A[3] is increased from 15 to 100. What will be the content of A after that change?
    (A) {90, 100, 75, 70, 45, 40, 60}   (B) {100, 90, 75, 70, 45, 40, 60}
    (C) {100, 90, 75, 45, 70, 40, 60}   (D){100, 90, 75, 70, 45, 60, 40}

Linked Answer Questions: Q.52 to Q.55 Carry Two Marks Each

Statement for Linked Answer Questions: 52 & 53

Consider the following transition table of DFA where q_3 is final state:

	a	b
→ q_0	q_1	q_0
q_1	q_0	q_2
q_2	q_3	q_1
+q_3	q_3	q_0
q_4	q_3	q_5
q_5	q_6	q_4
q_6	q_5	q_6
q_7	q_6	q_3

52. Number of states required to represent the same language with minimum number of states automata.
    (A) 4   (B) 5   (C) 6   (D) 7

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Consider the following transition table of DFA where q_3 is final state:

	a	b
→ q_0	q_1	q_0
q_1	q_0	q_2
q_2	q_3	q_1
+ q_3	q_3	q_0
q_4	q_3	q_5
q_5	q_6	q_4
q_6	q_5	q_6
q_7	q_6	q_3

53. In the process of minimization, q_0 and q_1 states are merged with which of the following states respectively?

(A) q_5, q_6 (B) q_6, q_4 (C) q_6, q_5 (D) q_4, q_5

Statement for Linked Answer Questions: 54 & 55

The following five concurrent processes operating on counting semaphore variable (S), which is initialized to 0.

P_1 : wait(s); cs; signal(s);
P_2 : wait(s); cs; signal(s);
P_3 : wait(s); cs; signal(s);
P_4 : signal(s); cs; wait(s);
P_5 : signal(s); cs; wait(s);

54. What is maximum possible value of S?

(A) 1   (B) 2   (C) 3   (D) 0

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The following five concurrent processes operating on counting semaphore variable(S), which is initialized to 0.

P_1 : wait(s); cs; signal(s);

P_2 : wait(s); cs; signal(s);

P_3 : wait(s); cs; signal(s);

P_4 : signal(s); cs; wait(s);

P_5 : signal(s); cs; wait(s);

55. If S is initialized to the answer of earlier part, then what is maximum number of processes that can be present in critical section (cs) simultaneously?
(A) 2   (B) 3   (C) 4   (D) 5

Q. No. 56 – 60 Carry One Mark Each

56. They panicked and........
(A) flew for their lives
(B) flowed for their lives
(C) fled for their lives
(D) fleeing for their lives

Choose the appropriate antonyms for the below given word:

57. Ameliorate
(A) make slow   (B) make sure   (C) make swift   (D) make worse

Choose a pair that has most similar relationship to the given pair:

58. Bird : Eagle
(A) Reptile : Creeper   (B) Disease : Plague
(C) Vitamin : Iodine   (D) Page : Break

Choose grammatically wrong sentences

59. (A) The girl likes her mother
(B) The girl told that she improved her hand writing
(C) You, he and I are partners
(D) I and You are responsible for the loss

60. Find the value of the expression 1 – 6 + 2 – 7 + 3-8 +……… to 100 terms.
(A) -250   (B) -500   (C) -450   (D) -300

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Q. No. 61 – 65 Carry Two Marks Each

61. A monkey, while climbing a stair case consisting of 21 steps, slips one step after climbing every 3 steps. If he takes one second to climb one step and one second to slip one step, how many seconds will he take to reach the 21st step of the staircase?
(A) 39   (B) 41   (C) 38   (D) 44

62. An integer is chosen at random from the first 100 integers. What is the probability that this number will not be divisible by 5 or 8 ?
(A) $\frac{3}{10}$ (B) $\frac{7}{10}$ (C) $\frac{9}{10}$ (D) $\frac{2}{5}$

63. A shopkeeper sells two items at the price of Rs.160. If one of them is sold at 10% profit and another sold at 10% loss, then find the profit/loss ?
(A) 3.23   (B) 5.75   (C) 2.5   (D) 6.9

64.

5 6			4 8			3 6	
4	7		3	8		?	9

(A) 2   (B) 3   (C) 4   (D) 6

65. In 1991, produce growers began using a new, inexpensive pesticide, provoking many objections that they would damage both the environment and the produce they were growing. However, the fears have proven unfounded as, though 1996, produce prices had dropped and no ill effects had been reported.
Which of the following, if true, would be the strongest objection to the argument above?
(A) Consumption of the produce declined from 1991 to 1993, but rose sharply from 1994 to 1996.
(B) Several areas in which use of the pesticide was forbidden have also experienced a drop in produce prices.
(C) The amount of produce grown in 1991 was larger than that of 1996.
(D) The time since the beginning of the use of the pesticide has been too short to allow some of the predicted effects to occur.