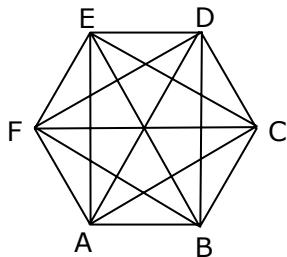


**Q. No. 1 – 25 Carry One Mark Each**

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  $x_{n+1} = \frac{2}{3} \left[ x_n + \frac{a}{2x_n^2} \right]$  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<sub>1</sub>;

fork  $L_1$ ;

S<sub>2</sub>i

S<sub>3,i</sub>

S<sub>4,i</sub>

goto L<sub>3</sub>

$L_1 : S_E \vdash$

$$S_{\epsilon,i}$$

fork L<sub>3</sub>

S<sub>7</sub>i

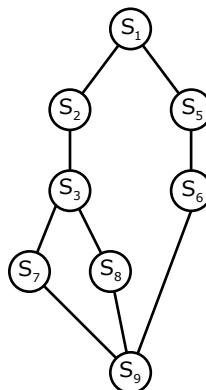
goto L<sub>2</sub>

L<sub>a</sub>; S<sub>a</sub>

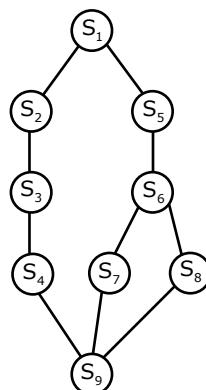
$L_3$  : join

S<sub>o,i</sub>

(A)



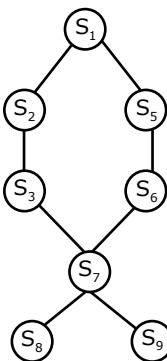
(B)



(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

9. Match the following protocols:

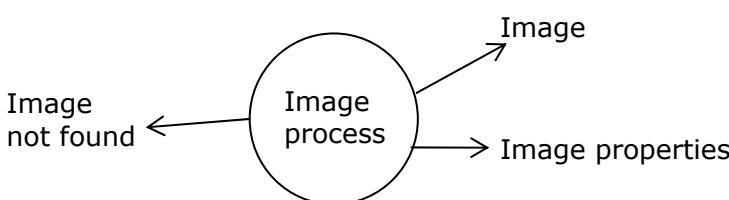
List-I	List-II
A. FTP	I TCP
B. SMTP	II UDP
C. RIP	
D. SNMP	
E. HTTP	

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

19. Which of the following are functionally equivalent to  $b\bar{c} + \bar{c}\bar{d}$  ?
- (A)  $\bar{a}b\bar{c} + a\bar{b}\bar{c} + a\bar{c}d + a\bar{c}\bar{d}$       (B)  $a\bar{b}\bar{c} + \bar{a}b\bar{c} + a\bar{b}\bar{c} + \bar{b}c$   
 (C)  $b\bar{c} + \bar{c}d + b\bar{d}$       (D)  $\bar{a}b\bar{c} + a\bar{b}\bar{c} + \bar{a}\bar{c}d + a\bar{c}d$
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)  $\frac{T_x}{T_x + T_y} \times 100$       (B)  $\frac{T_x + T_y}{T_x} \times 100$       (C)  $\frac{T_x + T_y}{T_y} \times 100$       (D)  $\frac{T_x + T_y}{T_x \cdot T_y} \times 100$
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  $(\sqrt{2}, -\sqrt{2})$  has
- (A) Maximum value -8      (B) Minimum value -8  
 (C) Maximum value 8      (D) Minimum value 8

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?

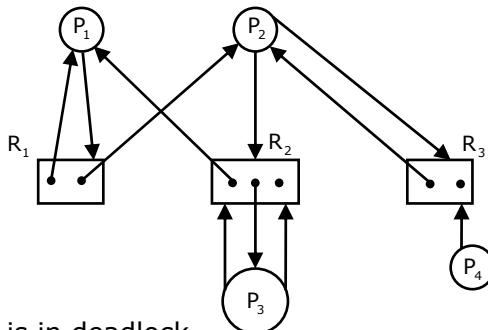
- (A) 4098                    (B) 5124                    (C) 1022                    (D) 6144

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

- |   |  |
|---|--|
| <p>(A) <math>\begin{bmatrix} 1 &amp; 2 &amp; 3 \\ 0 &amp; 1 &amp; 1 \\ 0 &amp; 2 &amp; 1 \end{bmatrix}, \begin{bmatrix} 1 &amp; 2 &amp; 3 \\ 0 &amp; 1 &amp; 1 \\ 0 &amp; 0 &amp; -1 \end{bmatrix}</math></p> <p>(C) <math>\begin{bmatrix} 1 &amp; 0 &amp; 0 \\ -2 &amp; 1 &amp; 0 \\ -3 &amp; -2 &amp; 1 \end{bmatrix}, \begin{bmatrix} 1 &amp; 2 &amp; 3 \\ 0 &amp; 1 &amp; 1 \\ 0 &amp; 0 &amp; 1 \end{bmatrix}</math></p> | <p>(B) <math>\begin{bmatrix} 1 &amp; 0 &amp; 0 \\ 2 &amp; 1 &amp; 0 \\ 3 &amp; 2 &amp; 1 \end{bmatrix}, \begin{bmatrix} 1 &amp; 2 &amp; 3 \\ 0 &amp; 1 &amp; 1 \\ 0 &amp; 0 &amp; -1 \end{bmatrix}</math></p> <p>(D) <math>\begin{bmatrix} 1 &amp; 0 &amp; 0 \\ 2 &amp; 1 &amp; 0 \\ 3 &amp; 2 &amp; 1 \end{bmatrix}, \begin{bmatrix} 1 &amp; 2 &amp; 3 \\ 0 &amp; 1 &amp; 1 \\ 0 &amp; 0 &amp; 1 \end{bmatrix}</math></p> |
|---|--|

28. What can you conclude from the resource allocation graph given below?



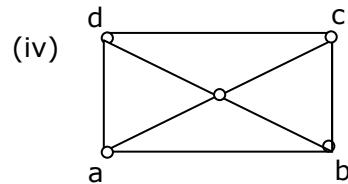
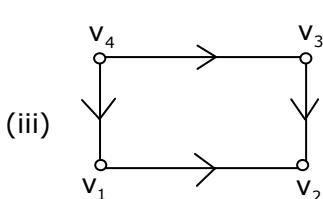
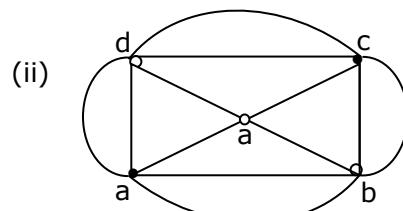
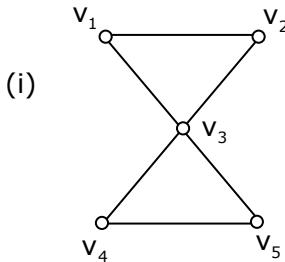
- (A) The system is in deadlock
- (B) It is free from deadlock as there is a safe sequence  $\langle P_1, P_2, P_3, P_4 \rangle$
- (C) It is free from deadlock as there is a safe sequence  $\langle P_2, P_1, P_3, P_4 \rangle$
- (D) It is free from deadlock as there is a safe sequence  $\langle P_2, P_3, P_1, P_4 \rangle$

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

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

EMP(eno, ename)

DEPT(dno, dname)

WORKS\_IN(eno,dno)

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

The above Relational Algebra 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 4<sup>th</sup> CPU burst ( $\tau_4$ ) 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

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)  $a_n = \frac{3^n}{2}(2C_1 + n^2 + 5n)$

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

(C)  $a_n = \frac{3^n}{2}(C_1 + n^2 + n)$

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

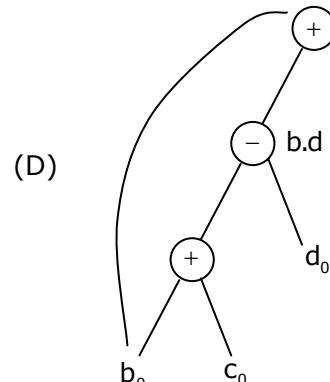
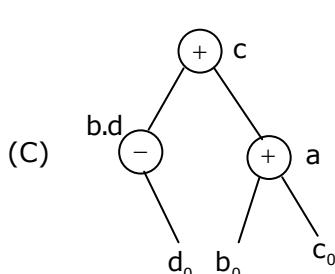
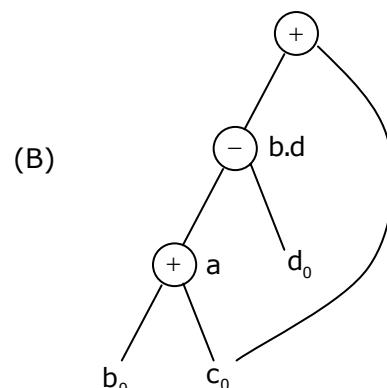
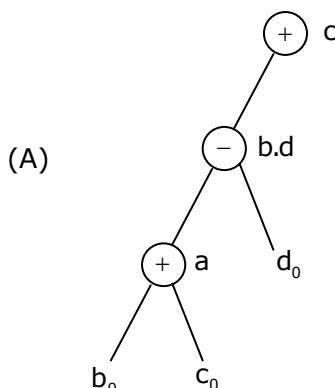
39. Draw a DAG for the block.

$$a \cdot = b + c$$

$$b := a - d$$

$$c \cdot = b + c$$

$$d \cdot = a - d$$



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

- |  |  |
|--|--|
| (A) $1 * 0(0 + 1)^*$<br>(C) Both (A) & (B) | (B) $(1 * 0 + 0)(0 * 1^*)^*$<br>(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  $f(x) = \begin{cases} 0 & \text{for } x \leq 0 \\ 5x - 4 & \text{for } 0 < x \leq 1 \\ 4x^2 - 3x & \text{for } 1 < x < 2 \\ 3x + 4 & \text{for } x \geq 2 \end{cases}$  then

- |  |   |
|--|---|
| (A) $f(x)$ is discontinuous at $x = 0$<br>(C) $f(x)$ is left continuous at $x=2$ | (B) $f(x)$ is continuous at $x = 1$<br>(D) All of these |
|--|---|

43. The number of decoders of size  $3 \times 8$  needed to get the target decoder  $7 \times 128$  is \_\_\_\_\_

44. Consider the following pushdown automata:

- (1)  $\delta(q_0, \epsilon, z_0) = (q_0, \epsilon)$
- (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)  $\delta(q_1, 1, x) = (q_1, \epsilon)$
- (7)  $\delta(q_1, \epsilon, z_0) = (q_1, \epsilon)$

The language accepted by making stack empty is

- (A)  $0^n 1^{2n} / n \geq 0$     (B)  $0^n 1^{2n} / n > 0$     (C)  $0^{2n} 1^n / n \geq 0$     (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)  $\begin{bmatrix} -\frac{1}{\sqrt{2}} & \frac{1}{\sqrt{3}} & \frac{1}{\sqrt{6}} \\ 0 & -\frac{1}{\sqrt{3}} & \frac{2}{\sqrt{6}} \\ \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{3}} & \frac{1}{\sqrt{6}} \end{bmatrix}$

(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?

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

(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

## 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}



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
$\rightarrow$		
$q_0$	$q_1$	$q_0$
$q_1$	$q_0$	$q_2$
$q_2$	$q_3$	$q_1$
$+q_3$	$q_3$	$q_0$
$q_4$	$q_3$	$q_5$
$q_5$	$q_6$	$q_4$
$q_6$	$q_5$	$q_6$
$q_7$	$q_6$	$q_3$

52. Number of states required to represent the same language with minimum number of states automata.

(A) 4                    (B) 5                    (C) 6                    (D) 7

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

	a	b
$\rightarrow$		
$q_0$	$q_1$	$q_0$
$q_1$	$q_0$	$q_2$
$q_2$	$q_3$	$q_1$
$+q_3$	$q_3$	$q_0$
$q_4$	$q_3$	$q_5$
$q_5$	$q_6$	$q_4$
$q_6$	$q_5$	$q_6$
$q_7$	$q_6$	$q_3$

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.

```
P1 : wait(s); cs; signal(s);
P2 : wait(s); cs; signal(s);
P3 : wait(s); cs; signal(s);
P4 : signal(s); cs; wait(s);
P5 : signal(s); cs; wait(s);
```

54. What is maximum possible value of S?
- (A) 1      (B) 2      (C) 3      (D) 0

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

$P_1 : \quad \text{wait}(s); \quad cs; \quad \text{signal}(s);$

$P_3 : \quad \text{wait}(s); \quad \text{cs}; \quad \text{signal}(s);$

$P_3 : \quad \text{wait}(s); \quad \text{cs}; \quad \text{signal}(s);$

$P_4 : \text{signal}(s); \text{ cs}; \text{ wait}(s);$

$P_c$  : 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:**



### **Choose grammatically wrong sentences**

**Q. No. 61 – 65 Carry Two Marks Each**