Q. No. 1 – 25 Carry One Mark Each

1. In a tennis tournament 12 players, say $P_1, P_2, P_3, ..., P_{12}$ are divided into 6 pairs at random. From each pair, a winner is decided on the basis of a game played between the two players. Assume that all the players are of same strength. Find the probability that the player P_5 is among the six winning players.

   (A) $\frac{1}{4}$ (B) $\frac{8}{15}$ (C) $\frac{1}{2}$ (D) $\frac{15}{8}$

2. If A and B are two events such that $P\ A^C = 0.4$, $P\ B = 0.3$ and $P\ A \cap B^C = 0.5$, then find $P\ B / A \cup B^C$.

   (A) $\frac{1}{4}$ (B) $\frac{1}{8}$ (C) $\frac{3}{8}$ (D) None of these

3. The number of location(s) of the local maxima of the function $f\ x = \cos x$ in the interval $\left[\frac{\pi}{5}, \frac{11\pi}{5}\right]$ is

   (A) one at π (B) two at π and 2π (C) one at 2π (D) none of these

4. Assume that a certain process executes the following code segment.

   for $i = 0, i <= 8, i++$

   fork ;

   The number of new processes created is _____

5. Which of the following statements is/are true?

   S1. If there is a cycle in RAG then there will be deadlock.

   S2. If there is a cycle in RAG where all the resource types are of single instance then there is a dead lock.

   S3. Unsafe state results in dead lock.

   S4. Deadlock state is subset of unsafe state.

   (A) S4 only (B) S2 & S4 only

   (C) S1 & S4 only (D) S1, S3 and S4 only

6. Consider an operating system containing 'n' processes each requiring 4 resources. The maximum number of processes that can be executed without any deadlock if there are 18 resources is _____

7. The record pointer, key field and block pointer of a 'B' tree are 8B, 10B, & 6B respectively. If the block size is 1kB, then the order of the tree is _____

8. The canonical cover for set of FD's {A → B, C → B, BC → A, A → E, AC → D, CD →E} on relation R(ABCD) is

a) A → B, C→ A, A → E, CD →E

b) A → B, C→ A, C → E, A → E, C →D

c) A → B, C→ A, A → E, C →D

d) A → B, C→ B, A → E, C →D, CD → E

9. A class-C address has the following subnet mask of 255.255.255.192. Which of the following are valid IP-addresses under this network?

i) 194.25.64.68 ii)194.43.75.128

iii)194.65.73.64 iv)194.75.74.131

(A) i & ii only (B) i, ii & iv only (C) i & iv only (D) ii & iv only

10. Which of the following statements are true about TCP?

(i) It is a byte oriented port to port communication
(ii) It uses flow control mechanism protocol
(iii) Its connections are link to link and full duplex
(iv) It uses piggybacking whenever possible

(A) (i), (iii) and (iv) only (B) (i), (ii) and (iv) only
(C) (ii), (iii) and (iv) only (D) All of the given

11. Let $T(n)$ be the function defined by

$T(1) = 1$ for $n<1$; $T(n) = 2T(n/2) + \sqrt{n}$ for $n \geq 2$;

Which of the following is true?

(A) $T(n) = \Theta(\sqrt{n})$ (B) $T(n) = \Theta(n)$ (C) $T(n) = \Theta(\log n)$ (D) None of these

12. Consider the following pseudo code for post order traversal of binary tree:

```
Postorder strct node*node
{
if node == NULL
return;
X : _____________
Y: _____________
Z: _____________
}
```

Then X,Y and Z are

(A) X : Postorder node $\rightarrow$ left Y : Postorder node $\rightarrow$ right Z : print node

(B) X : Postorder node $\rightarrow$ left Y : print node Z : Postorder node $\rightarrow$ right

(C) X : Postorder node $\rightarrow$ left Y : Postorder node Z : print node

(D) X : print node Y : Postorder node $\rightarrow$ right Z : Postorder node $\rightarrow$ left

13. Map the following statements to true(T)/false(F) respectively.
S1:Suppose Y $\leq_p$ X(Y is polynomially reduced to X). If Y cannot be solved in polynomial time, then X also cannot be solved in polynomial time.
S2: To prove a problem to be NP – complete one needs to reduce that problem to another known NP –Complete problem.
(A) FF (B) FT (C) TF (D) TT

14. Which among the following is a pre-processor directive?

i) File Inclusion	ii) Type Coercion
iii) Conditional Compilation	iv) Macro Expansion
(A) i, ii, iii but not iv	(B) i, ii, iv but not iii
(C) i, iii, iv but not ii	(D) ii, iii, iv but not i

15. Which of the following specifies a way in which the attribute of grammar symbols are related to each other?

(A) Syntactic Rule (B) Semantic Rule
(C) Lexical Rule (D) None of these

16. Given that a language $L_A = L_1 \cup L_2$, where L_1 & L_2 are two other languages. If L_A is known to be a regular language, then which of the following statements is necessarily TRUE?

(A) If L_1 is regular, then L_2 will also be regular

(B) If L_1 is regular & finite, then L_2 will be regular

(C) If L_1 is regular & finite, then L_2 will be regular & finite

(D) None of these

17. Which among the following is a characteristic of Peephole Optimization?

(A) Algebraic Simplification
(B) Use of Machine Idioms
(C) Redundant Instruction Elimination
(D) All of these

18. What is the number of instructions needed to add 'n' numbers in one-address mode and store the result in the memory?
(A) n (B) n+1 (C) n-1 (D) 2n

19. The number of self-dual functions possible with 4-boolean variables is _____

20. To implement A + BC, minimum number of NAND & NOR gates used respectively is
(A) 3, 3 (B) 3, 4 (C) 4, 3 (D) 3, 5

21. If the MTBF of a magnetic disc is 10000 hrs and MTTR is 100 hrs then the percentage of availability is _____

22. Which of the following cache designs helps in removing 'conflict' misses?

(A) Direct-mapped (B) Associative (C) Set-associative (D) None of these

23. The rank of matrix $\begin{bmatrix} K & -1 & 0 \\ 0 & K & -1 \\ -1 & 0 & K \end{bmatrix}$ is 2. Then the value of K is ___

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

24. $\int_2^4 \frac{\sqrt{x}}{\sqrt{x} + \sqrt{6-x}}\, dx =$ _____

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

25. If $A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$ then $A^6 - 4A^5 + 8A^4 - 12A^3 + 14A^2 =$ _____

(A) 0 (B) 4A (C) 4A + 5I (D) -4A + 5I

Q. No. 26 – 55 Carry Two Marks Each

26. Consider a computer system that has a cache with 512 blocks, each of which can store 32 bytes of data. All addresses are byte addresses. Then to which cache line will the memory address O×FBFC map to if the cache is direct mapped and 8 way set – associative, respectively?
(A) DBA, 3C (B) 1DA, 1D (C) 1DF, 1F (D) 1CF, 3E

27. Suppose that a direct-mapped cache has 2^{10} cache lines, with 2^4 bytes of data per cache line. If the cache is used to store blocks for a byte addressable memory of size 2^{30} bytes, the space required for storing the tags in bytes is _____

28. Consider a combinational block which takes 4-bits input (say ABCD) and results two times circular right shifted version of input as output. The minimum number of gates required to implement this logic is _____

29. Given memory partition of 100K, 500K, 200K, 300K and 600K in order, if we have processes needing memory of 212K, 417K, 112K and 405K respectively, which of the following memory allocation technique(s) will be suitable to allocate memory for all the processes?
I. First Fit
II. Best Fit
III. Worst Fit
a. II only
b. I and II
c. II and III
d. All three

30. Consider the page reference string given as follows:-
1 2 4 2 3 5 3 4 3 1 6 3 2 1 2 1 2 3 5 4
The number of page faults caused by optimal page replacement policy using pure demand paging for a memory with 4 frames is _____

31. Let us initialize counting semaphore X to 5. Assume that processes P_i $i = 1$ to 15 are coded as follows.

```
while –1
{
  P x
  {
    critical section
  }
  V x
}
```

and suppose that P_{16} is coded as follows:

```
while 1
{
  V x
  {
    critical section
  }
  P x
}
```

The number of processes can be in the critical section atmost at any point of time is _____

32. Consider a simple graph G with k components. If each component has n_1, n_2,….n_k vertices, then maximum number of edges in G is

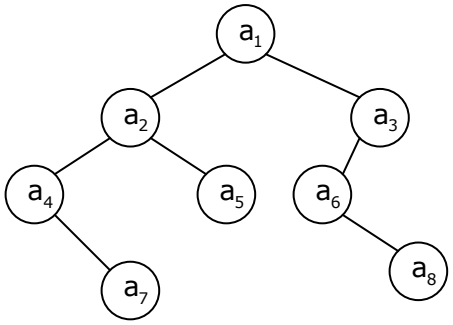
(A) $\left(\frac{n}{2}\right)$ where $n \le \sum_{i=1}^{k} n_i$

(B) $\left(\frac{n}{2}\right)$-k where $n = \sum_{i=1}^{k} n_i$

(C) $\sum_{i=1}^{k} {}^{n_i}c_2$

(D) $\left(\frac{n}{2}\right)$+k where $n = \sum_{i=1}^{k} n_i$

33. An operation swap tree takes a binary tree and swaps the left and right children of each node starting from root node. Consider the following binary tree given below.



What is post order traversal of the tree after applying swap operation?

(A) $a_7\ a_4\ a_5\ a_2\ a_8\ a_6\ a_3\ a_1$ (B) $a_8\ a_6\ a_3\ a_5\ a_7\ a_4\ a_2\ a_1$

(C) $a_7\ a_4\ a_5\ a_3\ a_8\ a_6\ a_2\ a_1$ (D) $a_7\ a_5\ a_4\ a_3\ a_8\ a_6\ a_2\ a_1$

34. The asymptotic behavior of polynomial in 'n' of the form $f\ n = \sum_{i=0}^{m} a_i n^i$ where $a_m > 0$ is

(A) $O\ \log m$ (B) $O\ n^m$ (C) $O\ n \log m$ (D) None of these

35. What will be the output of following program?

```
int main()
    {
    enum colorcode {red, yellow=10, green, blue=5, indigo=9, violet};
    print f ("%d %d %d %d %d %d", red, yellow, green, blue, indigo, violet);
    return 0;
    }
```

(A) 10 10 11 5 9 10 (B) 0 1 2 3 4 5

(C) 0 10 1 5 9 2 (D) 0 10 11 5 9 10

36. Match the following:-

1. Insertion in the middle of an array	A. O(1)
2. Deletion of a node in middle of a linked list	B. O (logn)
3. Deletion of head of linked list	C. O(n)
4. Search of the ith element of a linked list	D. $O(n^2)$

(A) 1-C, 2-C, 3-A, 4-A
(B) 1-C, 2-C, 3-A, 4-C
(C) 1-A, 2-C, 3-A, 4-C
(D) 1-A, 2-C, 3-C, 4-A

37. In an IPv4 packet, the value of HLEN is 15, and the value of the total length field is 0X0064. The total number of data being carried by this packet in bytes is _____

38. Which of the following multiplier pattern of booth's algorithm gives the better performance?
(A) 01111111110
(B) 1111100011111
(B) 011111011111
(D) 111111111000

39. Consider the grammar $G\ V, T, P, S$ where
$V = S, A, B$, $T = a, b$, $S = S$
$P \Rightarrow S \rightarrow A|bb$
$A \rightarrow B|b$
$B \rightarrow S|a$
The total number of productions in the above grammar after the removal of unit productions from it is _____

40. The transitions of a pushdown automata accepting L are given below:

$\delta\ q_0, 0, Z_0 = q_0, 0Z_0$

$\delta\ q_0, 0, 0 = q_0, 00$

$\delta\ q_0, 1, 1 = q_0, 11$

$\delta\ q_0, 1, 0 = q_0, 10$

$\delta\ q_0, 2, 1 = q_1, \varepsilon$

$\delta\ q_1, 2, 0 = q_1, \varepsilon$

$\delta\ q_1, 2, 1 = q_1, \varepsilon$

$\delta\ q_1, \varepsilon, Z_0 = q_f, \varepsilon$

Find the language L that the above PDA accepts by final state q_f where Z_0 is start symbol?

(A) Language L= $0^n\ 1^m\ 2^{m+n} \mid m, n \geq 1$

(B) Language L= $0^n\ 1^n\ 2^{2n} \mid n \geq 1$

(C) Language L= $0^n\ 1^m\ 2^P \mid n, m, p \geq 0$

(D) Language L= $0^n\ 1^n\ 2^n \mid n \geq 0$

41. For the regular expression $0^*\ 10+110\ \ 0+1\ ^*$, the number of non-final states and number of states where for every input it loops back to same state, are respectively, in the minimized DFA possible ?

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

42. Consider the following regular languages given below:

L_1 : Languages that accepts strings over $\Sigma = a, b$,such that length of string is greater than 1, but multiple of 3.

L_2 : Languages that accepts strings over $\Sigma = a, b$,such that every string contains atmost 2 a's and atmost 2 b's.

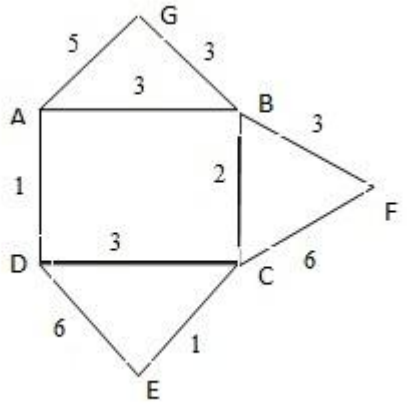
L_3 : Languages that corresponds to following regular expression R

$R = 10 + 0 + 11\ 0^*1$ over $\Sigma = [0, 1]$.

Let the number of states in the minimized DFA of each of it be n_1, n_2, n_3 respectively. Then which of the following is true?

(A) $n_1 = n_3 < n_2$ (B) $n_1 < n_3 < n_2$ (C) $n_3 < n_1 < n_2$ (D) None of these

43. Consider the following subnet. Distance vector routing is used, and the following vectors have just come in to router C: from B: (3, 0, 6, 5, 3, 8, 3); from D: (1, 5, 3, 0, 8, 6, 3); from E: (4, 3, 1, 1, 0, 4, 6); and from F: (3, 8, 3, 6, 4, 0, 9). The measured delays to B, D, E and F are 2, 3, 1 and 6, respectively. What is C's new routing table?



(A) (4, 2, 0, 2, 1, 5, 5) (B) (4, 4, 0, 3, 1, 6, 5)
(C) (5, 4, 0, 3, 5, 6, 6) (D) (5, 2, 0, 2, 5, 5, 5)

44. Consider a relation R(ABCD) with FD's { A → B, A → C, BC → D }. Answer the following:
(i)What is the highest normal form of this relation?
(ii)Does this relation have any redundancy in it?

a) 3NF, NO b) 2NF, NO c) 3NF, YES d) 2NF, YES

45. If A is a 4-rowed square matrix such that $|A| = 4$, then adj (adj A) is equal to

(A) 2A (B) 4A (C) 8A (D) 16A

46. Three identical dice are rolled. The probability that the same number will not appear on each of them is

(A) $\frac{1}{216}$ (B) $\frac{215}{216}$ (C) $\frac{1}{108}$ (D) $\frac{71}{72}$

47. If $\lim_{x\to 0}\left(\frac{\sin x - a\sin 2x}{\tan^3 x}\right)$ is finite, then value of a is

(A) 0 (B) 1 (C) ½ (D) -2

Common Data Questions: 48 & 49

Suppose it is given that births in a hospital 'A' occur randomly at an average rate of 1.8 births per hour.

48. The probability that we observe 5 births in a given interval of 2 hours is _____

Suppose it is given that births in a hospital 'A' occur randomly at an average rate of 1.8 births per hour.

49. Suppose there is another hospital B, where birth occur randomly at an average rate of 3.1 births per hour.

The probability that we observe 6 births in total from the two hospitals in a given 1 hour period is _____

Common Data Questions: 50 & 51

An Ethernet LAN has transmission delay of 10ms and propagation delay from one station to another is 2ms. The system is operating on a 5kbps bandwidth.

50. The channel efficiency in percentage is _____

An Ethernet LAN has transmission delay of 10ms and propagation delay from one station to another is 2ms. The system is operating on a 5kbps bandwidth.

51. What is the minimum frame length?

(A)20 bit (B) 30 bit (C) 40 bit (D) 50 bit

Statement for Linked Answer Questions: 52 & 53

Given below are some transaction schedules that involve three transactions $T_1 - T_2 - T_3$

Schedule 1

$T_2 : R_x,\ T_2 : R_y,\ T_1 : W_x,\ T_3 : W_y,\ T_3 : W_z,\ T_2 : W_z,$
$T_1 : R_z,\ T_2 : W_y$

Schedule 2

$T_2 : R_x,\ T_2 : W_y,\ T_3 : R_y,\ T_3 : W_x,\ T_1 : W_y,\ T_3 : R_x,$
$T_1 : R_y,\ T_2 : W_y$

Schedule 3

$T_1 : R_x,\ T_2 : R_y,\ T_3 : W_y,\ T_2 : R_z,\ T_3 : R_z,\ T_1 : W_z,$
$T_1 : W_y,\ T_2 : W_y$

Schedule 4

$T_1 : R_x,\ T_3 : W_y,\ T_2 : R_z,\ T_3 : R_z,\ T_1 : W_y,\ T_2 : W_x,$
$T_1 : R_y,\ T_2 : W_z$

52. Which of the above given schedules is conflict serializable?
(A) Schedule 1 (B) Schedule 2 (C) Schedule 3 (D) Schedule 4

Given below are some transaction schedules that involve three transactions $T_1 - T_2 - T_3$

Schedule 1

$T_2 : R_x,\ T_2 : R_y,\ T_1 : W_x,\ T_3 : W_y,\ T_3 : W_z,\ T_2 : W_z,$
$T_1 : R_z,\ T_2 : W_y$

Schedule 2

$T_2 : R_x,\ T_2 : W_y,\ T_3 : R_y,\ T_3 : W_x,\ T_1 : W_y,\ T_3 : R_x,$
$T_1 : R_y,\ T_2 : W_y$

Schedule 3

$T_1 : R_x,\ T_2 : R_y,\ T_3 : W_y,\ T_2 : R_z,\ T_3 : R_z,\ T_1 : W_z,$
$T_1 : W_y,\ T_2 : W_y$

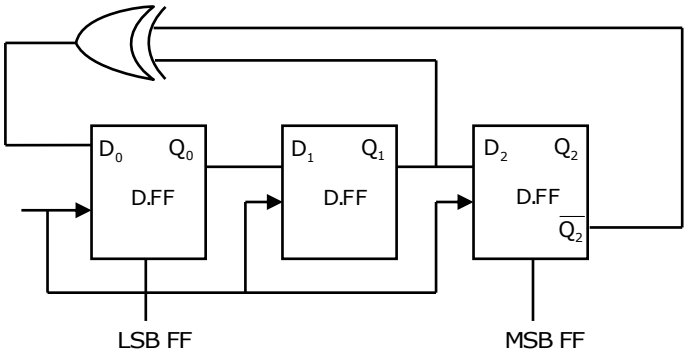
Schedule 4

$T_1 : R_x,\ T_3 : W_y,\ T_2 : R_z,\ T_3 : R_z,\ T_1 : W_y,\ T_2 : W_x,$
$T_1 : R_y,\ T_2 : W_z$

53. For the conflict serializable schedule found in the previous question, the equivalent serial schedule possible is
(A) $T_3 - T_1 - T_2$ (B) $T_2 - T_1 - T_3$ (C) $T_3 - T_2 - T_1$ (D) None of these

Statement for Linked Answer Questions: 54 & 55

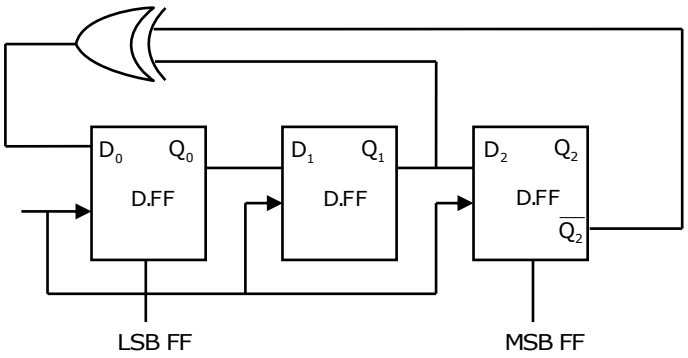
Consider the following circuit:



54. The above circuit is

(A) mod-7 counter (B) mod-8 counter (C) mod-5 counter (D) mod-6 counter

Consider the following circuit:



55. If the initial state of the counter is $Q_2Q_1Q_0 = 001$, the state after 76_{10} clocks is

(A) 001 (B) 000 (C) 011 (D) 110

Q. No. 56 – 60 Carry One Mark Each

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

56. Tawdry: Meretricious
(A) Rebuke: Reprove (B) Polish: Festive
(C) Secular: Obnoxious (D) Vital: Tenuous

Fill in the blanks:

57. He _____ until now.
(A) is with me (B) was with me
(C) has been with me (D) was been with me

Choose the appropriate synonym for the given words given below:

58. Copiousness
(A) profusion (B) consent (C) concent (D) enthusiasm

Choose the odd one out:

59. (A) quake (B) shudder (C) totter (D) titter

60. # means < , ^ means > and $ means =
If P#Q, R ^S and Q$R, then which of the following statement is definitely true ?
(A) P#R (B) P#S (C) P$Q (D) None of these

Q. No. 61 – 65 Carry Two Marks Each

61. A: It is economic to buy a car by loan
B: It is economic to buy a car by direct cash (single payment)
Which of the following argument if true, will weaken argument of B?
(A) Middle class people also have ability to buy a car
(B) Middle class people cannot buy a car in single instalment
(C) Middle class people have more money
(D) Car is a status symbol for middle class people

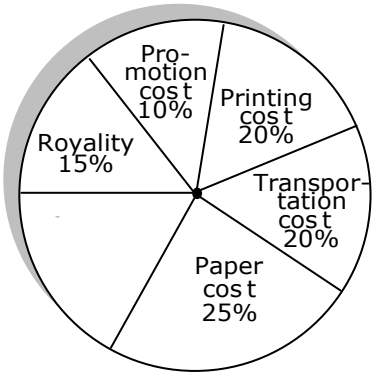
62. In a class of 40 students, 12 enrolled for both English & German. 22 enrolled for German. If students of class enrolled at least one of the subjects, then how many students enrolled for only English & not German?
(A) 30 (B) 12 (C) 18 (D) 40

63. The number $3^{57} + 13^{59}$ is divisible by
(A) 5 (B) 10 (C) Both (A) & (B) (D) None of these

64. Out of six coins, four coins are tossed simultaneously; in how many coins, there outcomes will almost three of the coins turn up as a head?

(A) 30 (B) 42 (C) 50 (D) can't be found

65. Consider the below data for various expenditures (in %) in publishing a book:



Price of book is marked 20% above CP. If marked price of book is Rs.180, then what is the cost of paper using in singly copy of book?

(A) 37.5 (B) 36 (C) 40 (D) 42.75