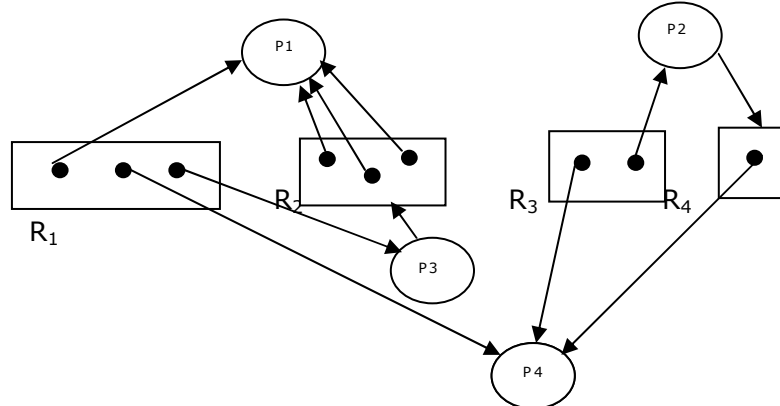## Q. No. 1 – 25 Carry One Mark Each

1. P1 and P2 are the two players rolling the same die on the condition that one who gets number 6 first wins the game. If p1 starts the game what are the winning chances of P1 and P2 respectively?

   (A) $\dfrac{6}{11}, \dfrac{5}{11}$ (B) $\dfrac{6}{11}, \dfrac{7}{11}$ (C) $\dfrac{5}{11}, \dfrac{6}{11}$ (D) $\dfrac{7}{11}, \dfrac{4}{11}$

2. The equivalent propositional function of $\left(\neg P \wedge \left(\neg Q \wedge R\right)\right) \vee \left(Q \wedge R\right) \vee \left(P \wedge R\right)$ is.

   (A) P   (B) $P \wedge Q \vee R$ (C) $R \wedge P \vee Q$ (D) R

3. Find the number of non-isomorphic graphs possible with 4 vertices?

   (A) 11   (B) 13   (C) 9   (D) 10

4. On a system with two processes P_1 and P_2, we are using round robin scheduling. Let the time needed for context switch is 9 micro sec, round robin time quantum is 2 millisec, and average time a process runs before blocking on I/O is 5 millisec. What will be the CPU efficiency (Do not count context switches at time zero and at the end)?

   (A) 99.55%   (B) 99.82%   (C) 99.73%   (D) 99.36%

5. Consider the resource allocation graph:

   Which of the following option will be the correct safe sequence?

   (A) P1 P3 P4 P2   (B) P4 P2 P1 P3
   (C) P4 P1 P3 P2   (D) All of the above

6. Assume that track size is 's' bytes and rotation rate in rpm is 'r'. Then data transfer rate is _____.

   (A) $\dfrac{r * s}{60}$ bytes/sec   (B) $\dfrac{60 * r}{s}$ bytes/sec

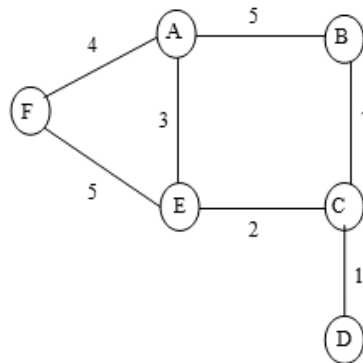   (C) $\dfrac{60 * s}{r}$ bytes/sec   (D) $\dfrac{60}{r * s}$ bytes/sec

7. Consider the following table structures:
    CREATE TABLE DEPT(dno int PRIMARY KEY,
                       dname varchar (30));

    CREATE TABLE EMP(eno int PRIMARY KEY,
                     ename varchar (30),
                     dno int <u>references</u> DEPT(dno));
    Which of the following operations may cause violation of referential integrity constraint?
    (A) Delete on EMP   (B) Insert into DEPT
    (C) Update on DEPT   (D) Both (A) & (C)

8. Let R be a relationship between the entity sets E_1 and E_2 with primary keys X and Y respectively. If R is a one-to-one relationship between entities E_1 and E_2 then which of the following FDs hold?
    (A) Y → X only   (B) X → Y only
    (C) Both Y → X and X → Y   (D) neither of them

9. Consider a network with 6 nodes A to F as shown below.

    The net work uses a Distance Vector Routing protocol. All links are symmetric and the cost is identical in both directions. Once the routes have stabilized, the cost of link A – E is increased to 12 (in both directions). Find the new distance vector at nodes A and E after the next round of updates.
    (A) A: (0, 5, 5, 6, 3, 4) & E: (3, 8, 2, 3, 0, 5)
    (B) A: (0, 5, 5, 6, 12, 4) & E: (12, 8, 2, 3, 0, 5)
    (C) A: (0, 5, 14, 13, 12, 4) & E: (12, 8, 2, 3, 0, 5)
    (D) A: (0, 5, 12, 13, 12, 4) & E: (12, 9, 2, 3, 0, 5)

10. Consider the following bit stream.
    "01111010011111101110"
    Using bit stuffing framing method in Data Link layer, how many 0's present in the bit stream after performing bit stuffing using the flag "0111"?
    (A) 6   (B) 10   (C) 12   (D) 14

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11. Consider expression $2 + 7 \wedge 2 - 9 * 4 + 6 \div 2$ (where $\wedge$ is exponential operator).

What will be the contents of stack starting from 'top' pointer when evaluating the postfix expression of the given expression after scanning the 8th symbol?
(A) 16   (B) 19   (C) 16, 3   (D) 36, 51

12. The minimum number of nodes in an AVL tree of height 5 is _____?

13. Which of the following statements are TRUE?
   I. Linked allocation technique to allocate disk space removes the external fragmentation and size declaration problems of contiguous allocation technique.

   II. Second chance algorithm can be easily implemented by circular queue.

   III. Demand paging increases degree of multiprogramming.

   (A) I only   (B) I and II   (C) II and III   (D) All three

14. Using the following table.

Factor	Weight		
	Simple	**Average**	**Complex**
Number of user inputs	5	6	7
Number of user outputs	1	5	7
Number of user inquiries	10	12	5
Number of files	2	3	4
Number of external interfaces	2	5	7

A system has following characteristics

Number of user inputs	10 (simple)
Number of user outputs	3 (simple)
Number of user inquiries	7 (complex)
Number of files	4 (average)
Number of external interfaces	2 (complex)

The function point count for the system is:
(A) 105   (B) 125   (C) 114   (D) 100

15. Consider the following grammar.

$S \rightarrow ACB|CbB|Ba$

$A \rightarrow da|BC$

$B \rightarrow g| \in$
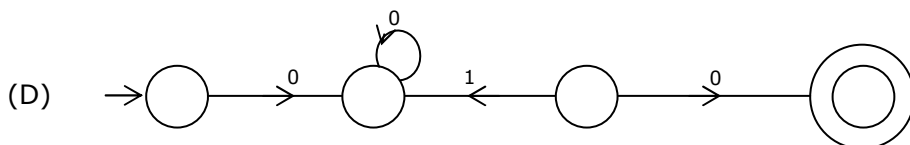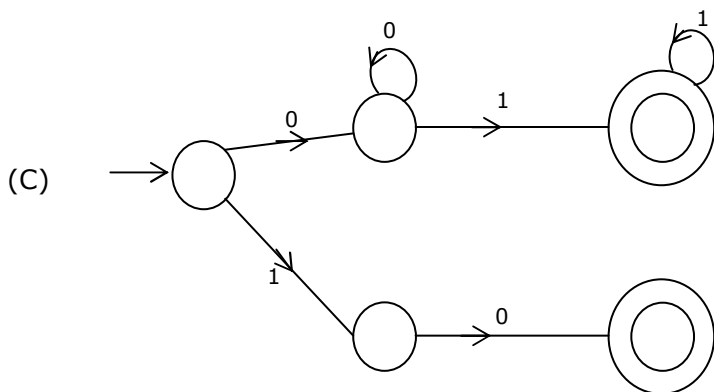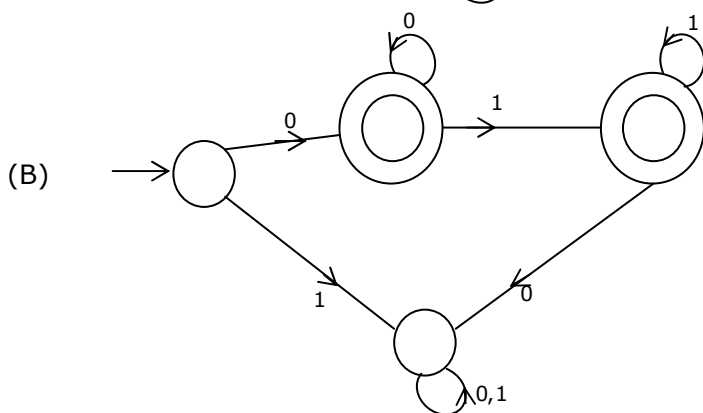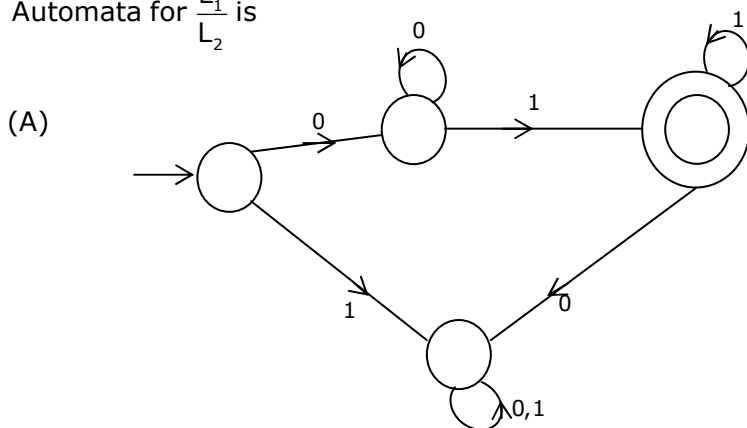
$C \rightarrow h| \in$

First of starting symbol S is?

(A) $\{d, g, h, \in\}$ (B) $\{a, g, h, \in\}$ (C) $\{d, g, h, b, a\}$ (D) $\{d, g, h, \in, b, a\}$

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16. $L_1 = \left(0^+1^* + 10\right)$, $L_2 = \left(1^+\right)$

Automata for $\dfrac{L_1}{L_2}$ is

(A)

(B)

(C)

(D)

17. How many accepting state will remain in the minimization of the DFA corresponding to the following grammar.

    $S \rightarrow 0S / 1A$

    $A \rightarrow 1A / 0B$

    $B \rightarrow 0B / 1C / \epsilon$

    $C \rightarrow 1C / 0A / \epsilon$

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

18. The number of rows returned by the following relational algebra expression is _____.

    $$\sigma_{A=B \text{ and } B=C \text{ and } C=A} \left(\Pi_A(R) \times \Pi_B(R) \times \Pi_C(R) \right)$$

Relation = R		
A	B	C
1	1	1
1	1	1
2	2	1

19. The minimized value of the function $w^1y^1 + xw + xy^1z = $ ____?

    (A) $w^1y^1 + xy^1z$

    (B) $w^1y^1 + xw$

    (C) $xw + xy^1z$

    (D) $w^1y^1 + xy^1z + xw$

20. The value of $F = A \oplus A \oplus A \oplus A \ldots\ldots \oplus A \oplus A \ldots..n$ terms. is ____ .

    (A) A   (B) 0   (C) A (or) 0   (D) $A^{'}$

21. Consider a direct mapping cache of 32 KB with block size of 128 byte. Suppose size of main memory is 2 MB. If there is no additional bits required then the size of tag array in bits is _____.

22. Using Booth's algorithm for multiplication the multiplier -37 will be recorded as.

    (A) -1 $+1$ 0 -1 $+1$ 0 -1

    (B) 0 $+1$ 0 -1 $+1$ 0 -1

    (C) -1 0 $+1$ -1 $+1$ 0 -1

    (D) $+1$ 0   0 -1 $+1$ 0 -1

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23. Match the following.

(P)	Ambiguity	(1)	Unique left most derivation
(Q)	Top-down parsing	(2)	Right most derivation in reverse order
(R)	Bottom-up parsing	(3)	Multiple right most derivations
(S)	Unambiguous grammar	(4)	Left most derivation
		(5)	Right most derivation
		(6)	Syntax trees

(A) $P-4, Q-2, R-3, S-1$
(B) $P-3, Q-4, R-2, S-1$
(C) $P-4, Q-3, R-6, S-2$
(D) $P-3, Q-4, R-5, S-1$

24. The characteristics equation of 3 x 3 matrixes is given as $A^3 - 6A^2 + 11A - 6I = 0$ then $A^{-1} = $ _____ .

(A) $\frac{1}{6}(A^2 + 6A - 11I)$
(B) $6(A^2 - 6A + 11I)$

(C) $\frac{1}{6}(A^2 - 6A + 11I)$
(D) $(A^2 - 6A + 11I)$

25. Consider a set Associative cache memory with 4 sets $(0-3)$ and total 8 cache blocks $(0-7)$ and main memory with 128 blocks. The following block request is map by the CPU (if LRU policy is used for cache block replacement in set Associative cache organization).

    0 5 3 9 7 0 16 55

If we use $2-$way set associative, then the cache set and cache block pair in which main memory block 7 is present is.

(A) 3,6
(B) 3,7
(C) 2,5
(D) 7 is recently replaced

Q. No. 26 – 51 Carry Two Marks Each

26. An instruction Pipeline is having 4 stages if there exists 20% branch instruction out of which 60% of them are conditional, 30% of which satisfy the condition. If penalty for branch is 3 cycle and penalty associated with a conditional branch instruction whose condition is not satisfied is 1 cycle. If clock time is 10 ns then the average access time for an instruction (in ns) is_____.

27.　The prefix form of $-a \uparrow b \uparrow c/d + e * f/g$ ($\uparrow$ is exponential operator) is.

(A) $+/ \uparrow -a \uparrow bcd / *efg$　　　　　　(B) $+/ \uparrow\uparrow -abcd / *efg$

(C) $+/ \uparrow -ab \uparrow cd / *efg$　　　　　　(D) $+/ \uparrow\uparrow -abcd * /efg$

28.　Assume that currently disk is pointing to cylinder number 90 and the sequence for the cylinder request is $98, 183, 37, 122, 14, 124, 65, 67$. What is the total number of seek for FCFS and Nearest track next (NTN) scheduling algorithm respectively?

(A) $603, 313$　　　(B) $580, 283$　　　(C) $600, 300$　　　　(D) $624, 323$

29.　Which of the following post-order traversal represents a valid BST?

(A) 10, 5, 25, 40, 35, 38, 20　　　　　(B) 5,25,10,35,38,40,20

(C) 5,10,25,38,40,35,20　　　　　　(D) 5,10,25,40,20,38,35

30.　$32-bit$ Shift register operated with $1\,MHz$ clock. How much time required to it, to load & Read the data in SIPO (Serial In Parallel Out).

(A) $32\,\mu s$　　　　(B) $1\,\mu s$　　　　(C) $33\,\mu s$　　　　(D) $63\,\mu s$

31.　Which of the following schedules are conflicts serializable?

$S1 : r_1(A), r_1(B), w_2(A), r_3(A), w_1(B), w_3(A), r_2(B), w_2(B)$

$S2 : r_1(A), r_2(A), r_3(B), w_1(A), r_2(C), r_2(B), w_2(B), w_1(C)$

$S3 : w_3(A), r_1(A), w_1(B), r_2(B), w_2(C), r_3(C)$

(A) S1, S3 only　　　(B) S2, S3 only　　　(C) S1, S2 only　　　(D) All of the above

32.　In a sorted set of n distinct elements we want to find the next higher element after some element y in the set using binary search. What is the runtime complexity of this operation?

(A) $O(n)$　　　　(B) $O(\log n)$　　　(C) $O(n\log n)$　　　(D) $O(n^2)$
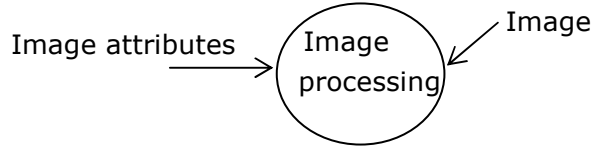
33.　Consider the following function.

$$f(m,n) = \begin{cases} n+1 : \text{if } m = 0 \,\& \, n > 0 \\ f(m-1, 1) : \text{if } m > 0 \,\& \, n = 0 \\ f(m-1, f(m, n-1)) : \text{if } m > 0 \,\& \, n > 0 \end{cases}$$

The value of f (1, 3) is _____

34. Let $M[1,n]$ be max heap then which of the following is again max heap?

    1. $M[1,.....\lfloor n/2 \rfloor]$

    2. $M[1,.....n-1]$

    3. $M[n,.....1]$

    (A) 1 only   (B) 1, 3 only   (C) 1, 2 only   (D) 1, 2 & 3

35. If the availability of certain software with Mean Time between Failures (MTBF) 20 days is 95%, then what should be the Mean Time to Repair (MTTR)?

    (A) 12 hours   (B) 1 day   (C) 36 hours   (D) 2 days

36. A Sliding window protocol of 4Mbps point to point link has propagation delay of 0.5sec. Assume that each frame carries 2KB of data. What is the minimum number of bits used for sequence number field?

    (A) 10   (B) 9   (C) 12   (D) 8

37. The following is a dump of UDP header in hexadecimal format 5EFA00FD001C3297. What is the total length of user datagram? Is the packet from client to server or vice versa?

    (A) 30 bytes and packet is going from client to server

    (B) 28 bytes and packet is going from client to server

    (C) 30 bytes and packet is going from server to client

    (D) 28 bytes and packet is going from server to client

38. Which of the following RE is different from rest of three?

    (A) $100\left((00+10)^*100\right)^*$ (B) $100\left(((0+1)0)^*100\right)^*$

    (C) $100\left(\left((00)^*(10)^*\right)^*100\right)^*$ (D) $100\left(((0+1)^*0^*)^*100\right)^*$

39. A two-dimensional array int $a[32][32]$ where each element takes 2 byte, cache size 2^{12} bytes and line size is 2^6 bytes. The following program segment is stored in the direct mapped cache.

    $for(i=1; i \le 32; ++i)$

    $for(j=0; j \le 31; ++j)$

    $a[i][j]=0$

    If initially cache is empty then total number of compulsory cache miss for storing above array is ____.

40. How many transitions are possible with $\Sigma = \{0,1\}$ and $Q = \{q_0, q_1\}$ for a DFA?

    (A) $4^2 - 1$ (B) $2^4 - 1$ (C) 2^4 (D) $4^{2\times4}$

41. The following portion of DFD is not correct as

    (A) there is no external entity
    (B) there is no data store
    (C) there are two data flow inputs to the process
    (D) there is no output data

42. A random variable has the pdf $\left. \begin{array}{l} f(x) = 3x^2; \ \ 0 < x < 1 \\ \qquad = 0; \ \ \text{else where} \end{array} \right\}$. Then $P\left(x \le \dfrac{1}{2} \right) = $ ____

    A) 0.875   (B) 0.6   (C) 0.5   (D) 0.125

43. Match the following:

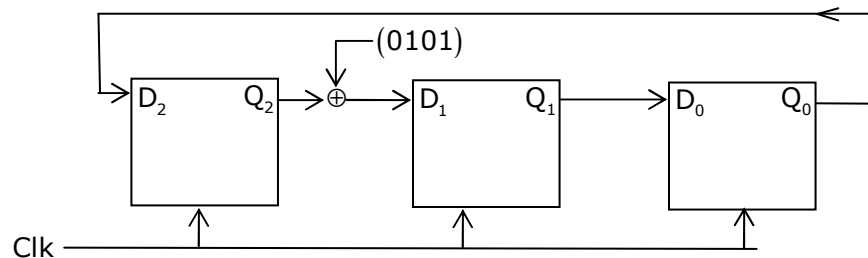 | P : | $\Sigma(1,2,4,7,8,11,13,14)$ | (1) | Full – adder sum function |
    |---|---|---|---|
    | Q : | $\Sigma(0,3,5,6,9,10,12,15)$ | (2) | Full – adder carry function |
    | R : | $\Sigma(1,2,4,7)$ | (3) | EX – OR |
    | S : | $\Sigma(3,5,6,7)$ | (4) | EX – NOR |

    (A) P – 1, Q – 2, R – 3, S – 4   (B) P – 2, Q – 1, R – 4, S – 3
    (C) P – 3, Q – 4, R – 1, S – 2   (D) P – 4, Q – 3, R – 2, S – 1

44. Consider the following relation schema:
    Student(RollNo,Sname,Scity)
    Packages(Pcode,Pname,Price)
    Registers(RollNo,Pcode,Date)
    What does the following SQL query return?
    Select distinct S.RollNo
    From Student S
    Where NOT EXISTS ((Select P.Pcode
                       From Packages P)
                      Minus
                      (Select R.Pcode
                        From Registers R
                        Where R.RollNo=S.RollNo))
    (A) RollNos of students who registered for all the packages
    (B) RollNos of students who didn't register for any of the packages
    (C) RollNos of students who registered for at least one package
    (D) None of these

45. Find the roots of $x^3-3x^2-16x+48=0$ such that sum of two roots being zero.
(A) 4, -4, 3   (B) 4, 4, 3   (C) 3, 3, 4   (D) 1, 2, 3

46. What is the regular expression corresponding to DFA.

(A) $\left(01+(00)^*1\right)^*$ (B) $\left(10+0(00)^*(1+01)\right)^*$

(C) $0(00)^*10^*$ (D) 0^*10^*

47. Consider the following shift register if the initial value is 101. what will be the value after $4 - $clock cycle?

(A) 110   (B) 001   (C) 100   (D) 000

Common Data Questions: 48 & 49

During lexical analysis, the following list of lexemes (keys) were recognized.

$123, Abm, 46, 145, Dyz, axy, goto, 134$

A hash function $F(key) = (key + 1) \mod 8$ with chaining is used to insert keys into hash-based symbol table, indexed from 0 to 7. Identifier's key value is determined by the ASCII value of its first character. (ASCII value of A is 65 and a is 97)

48. The number of vacant positions in symbol table is _____

During lexical analysis, the following list of lexemes (keys) were recognized.

$123, Abm, 46, 145, Dyz, axy, goto, 134$

A hash function $F(key) = (key + 1) \mod 8$ with chaining is used to insert keys into hash-based symbol table, indexed from 0 to 7. Identifier's key value is determined by the ASCII value of its first character. (ASCII value of A is 65 and a is 97)

49. The number of keys inserted into bucket with index number 2 is _____.

Common Data Questions: 50 & 51

Consider the following

$$S_n = \sum n; \quad S_{n^2} = \sum n^2; \quad S_{n^3} = \sum n^3$$

50. Evaluate $\lim\limits_{n\to\infty} \dfrac{1}{8} \cdot \dfrac{\left(8\,S_n + S_n \cdot S_{n^3}\right)}{\left(S_{n^2}\right)^2}$

   (A) 9/64   (B) 64/9   (C) 0   (D) 1

Consider the following

$$S_n = \sum n; \quad S_{n^2} = \sum n^2; \quad S_{n^3} = \sum n^3$$

51. Evaluate $\lim\limits_{n\to 0} \dfrac{8\,S_n + S_n \cdot S_{n^3}}{8S_n}$

   (A) 9/64   (B) 64/9   (C) 3   (D) 1

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

Statement for Linked Answer Questions: 52 & 53

An undirected graph G=(V, E) contains n (n=2k, for k>1) nodes named as V_1, V_2, …., V_n. Two nodes V_i and V_j are connected if and only if (i+j) mod 2=0. Each edge (V_i, V_j) is assigned a weight of (i+j). Further the graph has one edge from V_1 to V_2, which is always connected with weight 0.

52. What will be the cost of minimum spanning tree of G?

(A) $7n - 18$ (B) $8n - 22$ (C) $9n - 30$ (D) $\frac{1}{2}\left(n^2 + 4n - 12\right)$

An undirected graph G=(V, E) contains n (n=2k, for k>1) nodes named as V_1, V_2, …., V_n. Two nodes V_i and V_j are connected if and only if (i+j) mod 2=0. Each edge (V_i, V_j) is assigned a weight of (i+j). Further the graph has one edge from V_1 to V_2, which is always connected with weight 0.

53. The length of a path from V_n to V_{n-1} in the minimum spanning tree is_____.
(A) $2n + 2$ (B) $2n + 3$ (C) $2n - 1$ (D) $2n + 5$

Statement for Linked Answer Questions: 54 & 55

54. What is the number of page faults by Least Recently Used page replacements for a memory with 4 frames for the page reference string 2,0, 1, 2, 3, 0, 5, 1, 3, 6, 3, 2 ,1 ,4 ,0?
(A) 7   (B) 8   (C) 9   (D) 10

55. If number of frames is 3, then how many more page faults will occur using the same page reference string?
(A) 0   (B) 1   (C) 2   (D) 3

Q. No. 56 – 60 Carry One Mark Each

Choose the appropriate synonym for the given word given below:

56. Valediction
(A) Prorogue   (B) adieu   (C) adroit   (D) worthy

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

57. Melt: Liquid
(A)Heat: Vapour   (B) Water: Liquid
(C) Freeze: Cold   (D) Liquid: Ice

Fill in the blanks:

58. Rehman _____ popular musician
    (A) is a most   (B) is an   (C) is the   (D) is the most

Choose grammatically wrong sentences:

59. (A) The young will support the nation
    (B) We like to clean the house in spring
    (C) He is a honest person
    (D) Each student was present in the hall

60. 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

Q. No. 61 – 65 Carry Two Marks Each

61. In one day cricket match, the total runs made by a team were 200, out of which 160 were made by spinners.
    Conclusions:
    (A) The team has 80% of the spinners
    (B) The team won the match with the help of spinners
    (C) The face bowlers has flopped in the match
    (D) Spinners can also bat well

62. Mr. Vikas buys some apples at 8 per rupee from one trader and a similar quantity at 5 per rupee from another trader. He mixes both the varieties and sell the whole at 9 per rupee. What is the profit or loss percentage that he makes?
    (A) 31.62 % Profit   (B) 31.62 % Loss   (C) 46.25 % Profit   (D) 46.25 % Loss

63. How many 3 digit number can be formed from 2, 3, 5, 6, 7 & 9 which are divisible by 5 & none of digit is repeated?
    (A) 30   (B) 10   (C) 15   (D) 20

64.

RESULT OF HALF YEARLY & ANNUAL EXAMINATION	NO. OF STUDENTS			
	A	B	C	D
Failed in Both Exams	28	23	17	27
Failed in Half-yearly But passed in Annual Exam	14	12	8	13
Passed in Half-yearly but failed in Annual Exam	6	17	9	15
Passed in Both Exams	64	55	46	76

Which section has maximum pass% in at least one of two examinations?
(A) D   (B) C   (C) A   (D) B

65. Two trains start from A and B at the same time and proceed towards B and A at 30 km/hr and 42 km/hr respectively. When they meet it is found that one train has moved 60 km than the other. What is the distance between A and B?

(A) 215   (B) 260   (C) 460   (D) 360