Mock Test 1

Number of Questions: 65 **Total Marks: 100**

Wrong answer for MCQ will result in negative marks, (–1/3) for 1 Mark Questions and (–2/3) for 2 Marks Question.

General Aptitude

Number of Questions: 10 **Section Marks: 15**

Direction for question 1: Fill in the blank with the suitable word/phrase:

1. There are _____candidates opting for Home Science today as a course of study at the college level.
(A) smaller (B) less
(C) fewer (D) lesser

Directions for questions 2 and 3: Select the correct alternative from the given choices.

2. The average weight of a class increases by 1 kg, when *A* joins the class. Later when *B* also joins, the average weight further increases by 1/2 kg. If the number of students now in the class is 14, the difference in the weights of *A* and *B* _____.

3. Every Saturday evening from 6 pm to 7 pm a game known as "FAMILY FORTUNES" is telecast on '*XTV*' channel. The mode of the game is as follows.
A table containing prices of different articles is present on the monitor. The anchor asks questions regarding the prices of different articles. If you are able to answer these questions correctly, the corresponding article is yours.
Be the lucky winner by answering the questions that follow the table given below:

2500	3000	1500	3500
2750	1750	3200	2800
2400	3600	4000	2200
1800	1200	1600	2250
3800	3400	3100	2000

A discount of 10% is offered on 'Ultra Microwave Oven' and in the above price table, the list price and the sale price of the above said article are adjacent to each other, not necessarily in the same order. What is its sale price?
(A) ₹4000 (B) ₹3600
(C) ₹1800 (D) ₹2000

Direction for question 4: Select the statement in which the underlined word is used correctly:

4. (A) These insects **adapted** themselves very easily to new environments.
(B) That woman has **adapted** a child from an orphanage.
(C) That Telugu family **immigrated** to Australia last year.
(D) People who have **emigrated** to the U.S. have had to deal with tougher labour laws.

Directions for question 5: Select the correct alternative from the given choices.

5. In a certain code language, if REPTILE is coded as 49 and CROCODILE is coded as 81, then how is ALLIGATOR coded in that language?
(A) 95 (B) 100
(C) 49 (D) 81

Direction for question 6: Out of the following four sentences, select the most suitable sentence with respect to grammar and usage:

6. (A) We took a month and a few days to get acclimated to our new teacher, who is from Baroda.
(B) We will take month and few days to get acclimated to our new teacher, who is from Baroda.
(C) We have taken month and a fewer days to get acclimated to our new teacher, who is from Baroda.
(D) We took a month few days to get acclimated to our new teacher, who is from Baroda.

Directions for question 7: Select the correct alternative from the given choices.

7. If $0 < x < 1$ and $1 + 3x + 5x^2 + 7x^3 + 9x^4 + \ldots \infty = 3$, then the value of x is ____.
(A) 1/2 (B) 1/3
(C) 1/4 (D) 1/5

Direction for question 8: In the following question, the first and the last sentences of a passage are in order and numbered 1 and 6. The rest of the passage is split into 4 parts and numbered as 2, 3, 4 and 5. These 4 parts are not arranged in the proper order. Read the sentences and arrange them in a logical sequence to make a passage and choose the correct sequence from the given order:

8. (1) A classic example of how the "get what you want by helping others get what they want" approach works is the result that a major automaker got when it came out with a new design.
(2) After all, the person turning the wrench knows more about the way it really works on the assembly line than the engineers who designed the wrench.
(3) Before making these changes, the management asked the employees who would actually be

building the new vehicles whether they had any ideas for making the assembly lines more effective.
(4) The workers had dozens of marvelous ideas.
(5) This design necessitated the construction of new plants and the retooling of existing ones.
(6) First, the employees explained that when they had to go down the steps into the pit to work on the underside of a car, they sometimes slipped and fell, injuring themselves.

(A) 5, 3, 4, 2 (B) 3, 4, 2, 5
(C) 2, 5, 4, 3 (D) 4, 3, 2, 5

Directions for questions 9 and 10: Select the correct alternative from the given choices.

9. In a parking lot six buses are parked in front of bus number 25 and fifteen buses are parked behind bus number 45. If six buses are parked between bus numbers 25 and 45, then how many buses are there in the parking lot?

(A) 29 (B) 26
(C) 15 (D) Cannot be determined

10. Jane Davis, founder of Get Into Reading, which has helped Clare Ross so much, discovered the healing power of books by accident. An English lecturer at Liverpool University, England, she also taught literature courses in her community. In the process she discovered that people derived consolation from great writers and the support network the group provided. So she set up Get Into Reading, which now has more than 135 groups.
Which of the statement(s) below is/are logically valid and can be inferred from the above statements?
(i) Reading gives multiple benefits, both unexpected and wholesome.
(ii) Reading helps everyone to set up an association like Get Into Reading.
(iii) Reading is just a waste of time which makes one hope for an unattainable goal.
(iv) Reading gives not only help from great writers but also support from other sources.

(A) (i) and (iii) (B) (i) and (iv)
(C) (ii) and (iii) (D) (ii) and (iv)

COMPUTER SCIENCE ENGINEERING

Number of Questions: 55 **Section Marks: 85**

Directions for questions 11 to 65: Select the correct alternative form the given choices

11. One of the eigenvectors of the matrix

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix} \text{ is } \_\_\_\_\_$$

(A) $\begin{bmatrix} 4 \\ 3 \\ -2 \end{bmatrix}$ (B) $\begin{bmatrix} 2 \\ 2 \\ -2 \end{bmatrix}$

(C) $\begin{bmatrix} 3 \\ 4 \\ -2 \end{bmatrix}$ (D) $\begin{bmatrix} -3 \\ -3 \\ -3 \end{bmatrix}$

12. The number of edges in a bipartite graph with 11 vertices should be at most ____

(A) 11 (B) 20
(C) 30 (D) 44

13. Which of the following is NOT a valid identity for any three arbitrary events A, B and C of a sample space?

(A) $P\left(\frac{\bar{A}}{B}\right) = 1 - P(A/B)$
(B) $P(A \cap B) = P(A)\, P(B/A)$
(C) $P((A \cup B)/C) = P(A/C) + P(B/C) - P((A \cap B)/C)$
(D) None of these

14. If the number of telephone calls coming to a telephone exchange follows Poisson distribution with an average of 3 calls per hour, then the probability that the number of telephone calls coming to the telephone exchange in one hour exceeding 3 is _____

(A) 0.3528 (B) 0.6472
(C) 0.2341 (D) 0.7659

15. If $f(x) = 2x$, $g(x) = 3x^2$ and $h(x) = 3$ and (fogoh) (x) exists, then the value of (fogoh) (3) is ____

16. Which of the following algorithm can be used to sort the numbers 1, 2, 3, ..., 99, in $O(n)$ time?
(A) Merge sort
(B) Quick sort
(C) Heap sort
(D) Radix sort

17. Consider the following statements:
I. The minimum number of edges in a connected graph which is not cyclic on 'n' vertices is $(n - 1)$.
II. A simple connected graph with 'n' nodes has maximum edges.
Which of the following is TRUE?
(A) Only I
(B) Only II
(C) Both I and II
(D) Neither I nor II

$$n\frac{(n-1)}{2}$$

18. A disk has the following parameters:
Number of tracks = 360
Number of blocks per track = 360
Disk rotates 600 RPM
What is the Latency?
(A) 5 seconds (B) 0.5 seconds
(C) 0.05 seconds (D) 0.005 seconds

19. Which of the following is TRUE?
I. A B-tree of order 3, constructed with *n*-elements which are in ascending order leads to maximum number of Node splits.
II. A B^+-tree of order 3, constructed with *n*-elements which are in descending order leads to maximum number of Node Splits.
(Assume value of '*n*' upto 10 elements)
(A) I only (B) II only
(C) Both I and II (D) Neither I nor II

20. Which of the following is always TRUE?
I. If a program runs on a processor with a higher frequency, then it implies that the processor always executes more number of instructions per second than a low frequency processor.
II. If a processor executes more number of instructions per second then it implies that the processor always finishes a program faster than a processor which executes fewer instructions per second.
(A) I only (B) II only
(C) Both I and II (D) Neither I nor II

21. A machine has 5-stage pipeline, which uses delay slots to handle control dependencies. If the dependencies are resolved in the 3rd stage then the number of delay slots needed to ensure correct operation is _____.

22. A language L consists of all binary strings beginning with a '1' such that when its value is converted to decimal, is divisible by '3'. Then which of the following is TRUE?
(A) L can be recognized by a Deterministic Finite Automata.
(B) L can be recognized by a Non-deterministic finite automata but not by deterministic finite automata.
(C) L can be recognized by a deterministic push-down automata but not by a finite automata.
(D) The language L cannot recognized by any push down automata.

23. Which of the following problem is decidable?
(A) A Context free language L is regular or not.
(B) Complement of a CFL is CFL or not.
(C) Finding whether a given CFL is empty or not.
(D) Finding whether the intersection of two CFLs is empty or not.

24. Which of the following is TRUE about socket programming?
I. The accept( ) socket call returns the non-negative file descriptor of the accepted socket (if there is no error).
II. The return value of receive( ) specifies the number of bytes read from or if the socket was closed or an error was encountered.
III. In socket programming close( ) and shut down( ) functions operate in same way.
(A) I only (B) I, II only
(C) I, II, III (D) II only

25. Which of the following is FALSE about the connecting device 'Repeater'?
(A) A Repeater is used to connect segments of a LAN.
(B) A Repeater can connect two LANs of different protocols.
(C) A Repeater forwards every frame as it has no filtering capability.
(D) A Repeater is a generator not an amplifier.

26. Using Caesar Cipher with key = 10, what is the encrypted message of "GATECS"?
(A) SCETAG (B) AGETSC
(C) WQJUSI (D) QKDOMC

27. The binding takes place at, which of the following?
(I) language design time
(II) compile time
(III) load time
(IV) link time (or) run time
(V) language implementation time
(A) (II), (III), (IV) (B) (II), (III), (IV), (V)
(C) (I), (II), (III), (IV) (D) All the above

28. Consider the following program:

```
var x;
function fun1( )
{
    var x1 = 20;
    document.write (∀x = ∀ + x);
}
function fun2( )
{
    var x ;
    x = 10;
    fun1( );
}
x = 5
fun2( );
```

Using static scoping what is the value of *x* printed when fun 2( ) is called?
(A) 5 (B) 10
(C) 20 (D) shows error

29. Number of binary trees that can be formed with 3 elements is _____

30. The root directory of the file system should be placed at
(A) Anywhere on the disk
(B) Fixed location on the disk

(C) Fixed location on the primary memory.
(D) None of the above

31. In a Round-Robin scheduling, if time Quantum and Process switch takes equal amount of time, then the CPU efficiency will be
(A) 75%
(B) 50%
(C) 65.5%
(D) Depending on the number of processes in the system

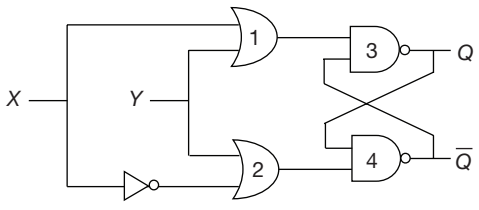
32. Which of the following statements is FALSE?
(A) Type incompatibilities between actual and formal parameters are detected at compile time.
(B) Array subscript out of range is detected at run time.
(C) Multiple declarations of a variable leads to compile time error.
(D) None of the above

33. Consider the following program

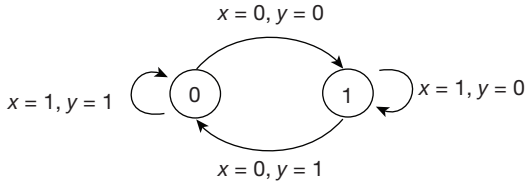
```
void fun( )
{
    int a, b, c, d;
:
:
:
          for ( ) – (I)
            {
              int b, c, d;
                  :
                  :
                     for ( ) – (II)
      {
         int c,d, x, y;
         ___ // line (I)
      }
            }
}
```

Which of the following variables are visible at line (I)?
(A) c, d, x, y of for (II); b, c, d of for (I); a, b, c, d of fun ( )
(B) c, d, x, y of for (II)
(C) c, d, x, y of for (II); b of for (I); a of fun ( )
(D) c, d, x, y of for (I); b of for (II); a, b, c, d of fun ( )

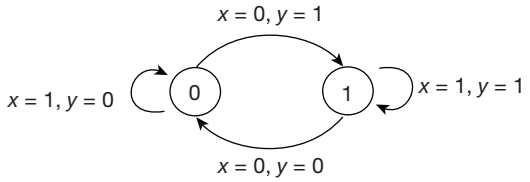
34. What is the state diagram of the following latch circuit?



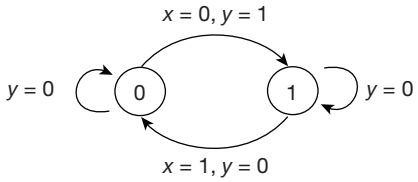
(A)



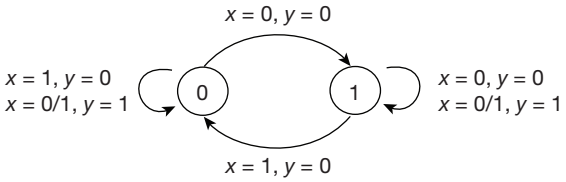
(B)



(C)



(D)



35. Consider the boolean function,
$F(a, b, c) = \pi M(2, 5)$
Then minimum SOP (Sum of Products) form of F is:
(A) $a^1 c + b^1 c^1 + ab$ (B) $a^1 b^1 + bc + ac^1$
(C) Both (A) and (B) (D) $a^1 b^1 + b^1 c^1 + bc + ab$

36. Consider the propositions:
S_1: If Ramu is in the classroom, then Lokesh will be in the playground
S_2: Ramu is in the classroom and S_3 : Lokesh is in the playground
Then which of the following is TRUE?
(A) S_2 logically follows from S_1 and S_3 but S_3 does not follow logically from S_1 and S_2
(B) S_2 does not follow logically from S_1 and S_3 but S_3 logically follows from S_1 and S_2
(C) S_2 does not follow logically from S_1 and S_3, and S_3 does not follow logically from S_1 and S_2
(D) S_2 logically follows from S_1 and S_3, and S_3 logically follows from S_1 and S_2

37. If $S_1 = \{0, 1, 2, 3, 4\}$, $S_2 = \{1, 2, 3, 4, 5\}$, $S_3 = \{0, 1, 2, 3, 4, 5\}$ and $S_4 = \{1, 2, 3, 4, 5, 6\}$ and $+_m$ and x_m denote the operations of addition modulo m and multiplication

modulo m respectively, then which of the following is NOT an abelian group?

(A) $(S_1, +_5)$ (B) (S_2, x_6)
(C) $(S_3, +_6)$ (D) (S_4, x_7)

38. A stationary value of a function $f(x)$ is a value of x, where $f^1(x) = 0$. The number of distinct stationary values of $f(x) = 8x^5 - 15x^4 + 10x^2$, where $f(x)$ has neither maximum nor minimum is ____

39. In a hostel, there are 5 triple rooms (each room can accommodate 3 students), 6 double rooms (each room can accommodate 2 students) and 3 single rooms (each room can accommodate 1 student). The number of ways in which 30 students can be accommodated in these 14 rooms is ____

(A) $\frac{30!}{(3!)^5 \times (2!)^6 \times (1!)^3}$ (B) $\frac{30!}{(5!)^3 \times (2!)^6 \times (3!)^1}$

(C) $\frac{30!}{3! \times 2! \times 1!}$ (D) $\frac{30!}{5! \times 6! \times 3!}$

40. Which of the following statements is/are NOT TRUE?

(I) The product of two symmetric matrices A and B is symmetric if and only if $AB - BA = 0$

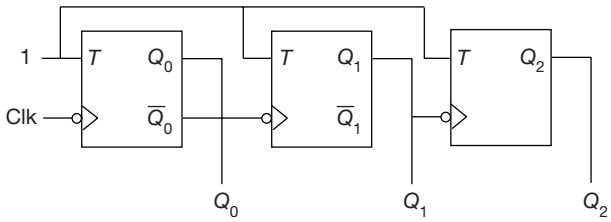
(II) The product of two skew-symmetric matrices A and B is skew-symmetric if and only if $AB + BA = 0$

(III) The eigenvectors corresponding to two distinct eigenvalues of a matrix are linearly independent

(IV) The eigenvectors corresponding to two distinct eigenvalues of a real symmetric matrix are orthogonal

(A) Only (I) (B) Only (II)
(C) Both (III) and (IV) (D) None of these

41. Analyze the following counter circuit, and find the Count sequence $Q_2Q_1Q_0$ (in decimal). Consider the initial condition of all flip flops at reset.



(A) 0, 7, 6, 5, 4, 3, 2, 1, 0….
(B) 0, 1, 2, 3, 4, 5, 6, 7, 0…..
(C) 0, 3, 2, 5, 4, 7, 6, 1, 0….
(D) 0, 6, 2, 5, 1, 7, 3, 4, 0….

42. Which of the following grammar is $LL(1)$, $LR(0)$ and SLR(1)?

(A) $S \to A\ B \mid B\ A$
$A \to b\ A^I$
$B \to a\ B^I$
$B^I \to a\ A\ B^I \mid \in$

(B) $E \to TE^I$
$E^I \to +\ TE^I \mid E$
$T \to E\ F \mid E\ a \mid b$
$F \to (E) \mid a$

(C) $E \to E\ F \mid e$
$F \to F + \mid f$
$T \to E\ T \mid g$

(D) $S \to a\ A\ B \mid B\ a \mid A\ b$
$A \to c$
$B \to c$

43. Consider the grammar:
$S \to i\ C\ t\ S\ S^1 \mid a$
$S^1 \to \text{e}\ S \mid \in$
$C \to b$
An $LL(1)$ Parsing table, M is constructed for this grammar and the grammar is not in $LL(1)$. Then which of the following entries in M, contains multiple entries?

(A) $M[S^1, t]$ (B) $M[S, i]$
(C) $M[S^1, e]$ (D) $M[S, a]$

44. Consider the following Syntax Directed Definition:

Production	Semantic Rule
(1) $L \to E_n$	L.val = E.val
(2) $E \to E_1 + T$	$E.val = E_1.$ val + T.val
(3) $E \to T$	E.val = T.val
(4) $T \to T_1 * F$	$T.val = T_1.val * F.val$
(5) $T \to F$	T.val = F.val
(6) $F \to (E)$	F.val = E.val
(7) $F \to$ digit	F.val = digit.lexval

It evaluates the expressions, which are terminated by an end marker 'n' with operators + and *.
Then which of the following statement(s) is/are FALSE?

I. Given SDD is S-attributed grammar.
II. Given SDD is not L-attributed grammar.
III. Given SDD is an attribute grammar.

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

45. Consider a system which is using Round-Robin Scheduling Technique with context switch overhead of 2 ms, what is the value of time quantum(q) for $n = 6$ processes, so that each process must be guaranteed to get its chance (or) turn at the CPU exactly after 36 ms of time (in ms) is _____.

46. Consider the page reference string:
1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 5
If the number of page faults are 9 using LRU page replacement policy then the number of page frames required would be?

(A) 3 (B) 4
(C) 5 (D) 6

47. Consider a system with processes P_1, P_2. X is a Binary semaphore variable with an initial value of 1 and count is a variable with initial value of 1.
The processes P_1, P_2 executes routines $P1()$, $P2()$ for accessing critical section.

```
P1 ( )                    P2 ( )
{                         {
   DOWN (X)                  UP (X);
   count    +                count - -;
+;
   UP (X);                   DOWN (X);
}                         }
```

Consider the following statements ($S1$, $S2$, $S3$)
$S1$: The maximum value of count can be infinite.
$S2$: The system cannot guarantee progress.
$S3$: The system doesnot provide Mutual Exclusion.
Which of the above statements is/are TRUE?
(A) $S1$only (B) $S1$ and $S3$
(C) $S2$ and $S3$ (D) $S1$, $S2$, $S3$

48. Consider the function fun() which deletes the duplicate elements on a non-empty sorted single linked list.

```
typedef struct SL
{
    int data;
    struct   SL * next;
}SLL;
void fun(SLL *first)
{
    SLL *curr = first, *temp;
    if (!curr)
    return ;
    while (___I___)
    {
        temp = curr → next;
        if (curr → data = = temp → data)
        curr → next = temp → next;
        free(temp);
            (____II____)
}}
```

If first node address is passed to fun( ), Fill in the blanks.

	I	II
(A)	curr	temp = temp → next
(B)	curr	curr = curr → next
(C)	! temp	curr = curr → next
(D)	temp	temp = temp → next

49. Consider the following Tree traversals of a binary Tree:
Pre-order: A B C D E F G H J K L M P Q N
In order: C D E B G H F K L P Q M N J A
Construct a binary tree T from above traversals. The number of nodes with one child in the tree are _____

50. Consider the following program:

```
int fun (int * x)
{
    *x+ = 5;
    return (3 * (* x) - 1) ;
}
void main( )
{
int a = 8, b = 12, s1, s2;
s1 = (a/2) + fun(&a);
s2 = fun(&b) * (b/2);
}
```

Which of the following statement(s) is/are TRUE?
(A) The value of $s1$ will be same, irrespective of evaluation order.
(B) The value of $s2$ is will be irrespective of evaluation order.
(C) Both (A) and (B)
(D) None of the above

51. The first 32-bits of an IPv4 header in Hexa-decimal notation has a value 4500139CH. Then which of the following cannot be concluded by these 32-bits?
I. The header length is 20 Bytes.
II. The total length of the packet (both header and data) is 5000 Bytes.
III. The datagram is Last Fragment.
IV. The fragmentation offset field is 628.
(A) III, IV (B) II, III, IV
(C) II only (D) I, II, III, IV

52. The stations on a wireless ALOHA network are maximum of 1200 km apart. Signals propagate with a speed of 3×10^8 m/s. The maximum number of retransmission attempts are 15 and for the attempt number 2, by using Binary exponential Back-off algorithm, which of the following are possible Back-off time values?
(A) 0 ms, 1 ms
(B) 0 ms, 1 ms, 2 ms, 3 ms
(C) 0 ms, 4 ms, 8 ms, 12 ms
(D) 4 ms, 8 ms

53. Consider the below transition table of a PDA M_1:

	ε	0	1
$\rightarrow q_0$	$(q_1, \varepsilon, \$)$	–	–
q_1	$(q_2, 1, \varepsilon)$	$(q_1, \$, 0\$)$ M_1 M_2	$(q_1, \$, 1\$)$ M_3 M_4
q_2	–	–	–

Here q_0 is the start state and q_2 is the final state. The transition entries has the form (Q, A, B) where Q is the Target state, A is the top of the stack and B is the symbols to be written in place of top of stack.
$L(M_1)$ accepts the strings of the form,
{w/w contains more 1s than 0s}

Based on this information identify the correct transitions for M_1, M_2, M_3, M_4:

(A) $M1$: $(q_1, 1, \varepsilon)$, $M2$: Not required
$M3$: $(q_1, 0, \varepsilon)$, $M4$: Not required

(B) $M1$: $(q_1, 1, \varepsilon)$, $M2$: $(q_1, 0, 00)$
$M3$: $(q_1, 0, \varepsilon)$, $M4$: $(q_1, 1, 11)$

(C) $M1$: $(q_1, 1, 10)$, $M2$: $(q_1, 0, \varepsilon)$
$M3$: $(q_1, 0, 01)$, $M4$: $(q_1, 1, \varepsilon)$

(D) $M1$: $(q_1, 0, \varepsilon)$, $M2$: $(q_1, 1, \varepsilon)$
$M3$: $(q_1, 1, \varepsilon)$, $M4$: $(q_1, 0, \varepsilon)$

54. Consider the following languages:
$L_1 = \{x^m y^n z^p \mid (m = n \vee n = p) \wedge m + n + p \geq 10\}$
$L_2 = \{x^m y^n z^p \mid (m = n \vee n = p) \wedge m + n + p \leq 10\}$
Which of these languages is/are Regular?

(A) L_1 only (B) L_2 only
(C) Both L_1 and L_2 (D) Neither L_1 nor L_2

55. Consider the following languages:
$L_1 = \{a^i b^{2i} \mid i \in \{1, 2, \ldots\}\}$
$L_2 = \{a^i b^{i^2} \mid i \in \{1, 2, \ldots\}\}$
Which of the following statement is correct about L_1 and L_2?

(A) Both L_1 and L_2 are CFLs.
(B) L_1 is CFL and L_2 is recursive but not CFL.
(C) Complement of L_2 is CFL.
(D) L_1 is regular and L_2 is CFL.

56. Consider a branch instruction which has below format:

6 bits	5 bits	5 bits	
opcode	R_S	R_T	#immediate

The instruction has 6-bit branch type of opcode, 5-bit registers R_S, R_T and 16-bit immediate value.
A Branch instruction performs a modification of (PC + 4) (address of next instruction) if the condition is true. If the maximum range of jump instruction is $PC + 4 - X$ to $(PC + 4) + Y$. $[(PC + 4) - X$ and $(PC + 4) + Y$ are memory address locations]. Then the respective values of X and Y would be:

(A) –32768 and 32767 (B) 32768 and 32767
(C) 131072 and 131068 (D) 131068 and 131072

57. Consider the following code fragment:

Loop:	LOAD R_1, $0(R_2)$	$R_1 \leftarrow M[0 + R_2]$
	ADD R_1, R_1, #1	$R_1 \leftarrow R_1 + 1$.
	STORE R_1, $0(R_2)$	$M[0 + R_2] \leftarrow R_1$
	ADD R_2, R_2, #4	$R_2 \leftarrow R_2 + 4$.
	SUB R_4, R_3, R_2	$R_4 \leftarrow R_3 - R_2$.

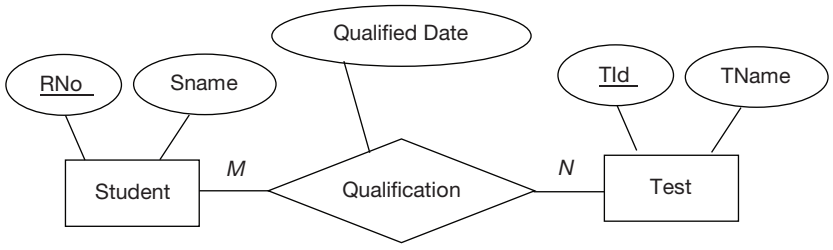
BNEZ R_4, loop Branch to loop if $R_1! = 0$
Let the initial value of R_3 is $R_2 + 400$.
The instruction sequence executed on a 5-stage RISC pipeline. (IF: Instruction Fetch, ID: Instruction decode and Register fetch, E.x., execute, MA: Memory Access, WB: Write Back) without any forwarding hardware, but register read and write can happen in the same clock cycle. Branch outcome is known in the EX stage and is handled by flushing the instructions which started execution before the EX stage of Branch instruction. If each stage takes 1 clock cycle, then the number of clock cycles required to execute the given loop will be _____.

58. A floating point number of 20-bit length has the following format:

1 bits	7 bits	
Sign	Excess – 64 Exponent	Mantissa

The decimal equivalent of the value $(5403E)_{16}$ is _____.

59. Consider the following Entity Relationship Diagram (ERD):



Which of the following possible relations will not hold if the above ERD is mapped into a relational model?

(A) Student (RNo, Sname)
(B) Qualification (RNo, TID, Qualified Date)
(C) Test (TID, RNo, TName)
(D) Test (TID, TName)

60. Consider the following relations:
Sailor (sid, SName, Rating, Age)
Reserves (sid, bid)
Boats (bid, bname, color)
Primary keys are shown with underline.
Query: Display the 'sids' of sailors who have reserved both black and white color boats.
Which of the following Relational algebra expression for the above query always gives correct result?

(A)

$$\pi_{\text{sid}}\left(\left(\left(\sigma^{(\text{Boats})}_{\text{color='black'}} \cap \sigma^{(\text{Boats})}_{\text{color='white'}}\right)\text{sailor}\right)\ \text{Reserves}\right)$$

(B) $\pi_{sid}\left(\sigma^{(Sailor\ Reserves\ Boats)}_{color='black'} \cap \sigma^{(Sailor\ Reserves\ Boats)}_{color='white'}\right)$

(C) $\pi_{sid}\left(\left(\left(\sigma^{(Boats)}_{color='black'}\right)\ Reserves\right)\ Sailor\right) \cap$
$\pi_{sid}\left(\left(\left(\sigma^{(Boats)}_{color='white'}\right)\ Reserves\right)\ Sailor\right)$

(D) All the above

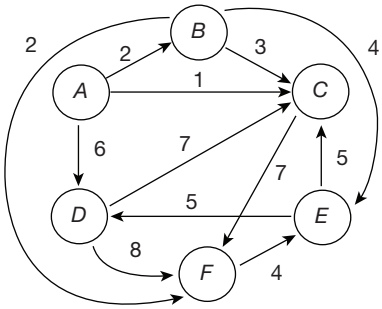
61. Consider the following sequence of elements:

I.	8	7	6	5	4	3	2	1
II.	8	1	2	7	3	6	4	5
III.	8	7	6	5	1	2	3	4

Which sequence(s) takes maximum number of swap operations if selection sort is implemented to arrange the elements in ascending order?

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

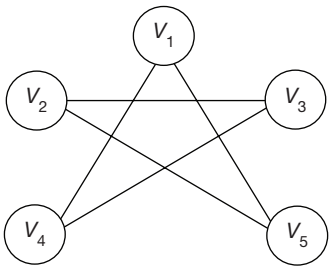
62. Let G be the Directed Weighted graph shown below:



What is the sequence of vertices identified by the Dijkstra's algorithm for single source shortest path, when the algorithm is started at vertex '*A*'?

(A) *ACBEDF*
(B) *ACFBED*
(C) *ACBFED*
(D) *ACBEFD*

63. A complete undirected, Weighted graph *G* is given on the vertex set $\{V_1, V_2, V_3, V_4, V_5\}$



Construct 2 minimum spanning trees, for the First spanning tree, the graph has weights for an edge (V_i, V_j) as $|i-j|$. For the second spanning tree, the graph has weights for an edge (V_i, V_j) as $|i+j|$.
What is the difference between Total weights of 2 Spanning Trees?

(A) 12 (B) 14
(C) 16 (D) 18

64. Consider the following relation schema:
Student (RNo, SName, age, grade)
Register (RNo, CNo, Day)
Course (CNo, CName, Duration)
Which of the following query CANNOT be expressed by using SELECT, FROM, JOIN, DIVIDE, WHERE clauses?

(A) For each course, display the CNo and number of students in that course.
(B) Display the names of students whose CNo = 201
(C) Display the Names and CNo of students who registered on a day = 'Monday'
(D) Display the Names of students whose course duration is 6 months.

65. Consider the Relation *R*(*ABCDE*) and the following functional dependencies:
$A \rightarrow BC$
$A \rightarrow D$
$D \rightarrow E$
Which decomposition is required for *R* and Is the decomposition lossless?

(A) 2NF and loss less (B) 3NF and lossy
(C) 3NF and loss less (D) BCNF and lossy

Answer Keys

1. C	**2.** 5	**3.** B	**4.** A	**5.** D	**6.** A	**7.** B	**8.** A	**9.** A	**10.** B
11. B	**12.** C	**13.** D	**14.** A	**15.** 54	**16.** D	**17.** C	**18.** C	**19.** C	**20.** D
21. 2	**22.** A	**23.** C	**24.** B	**25.** B	**26.** D	**27.** D	**28.** A	**29.** 30	**30.** B
31. B	**32.** D	**33.** C	**34.** D	**35.** C	**36.** B	**37.** B	**38.** 1	**39.** A	**40.** D
41. C	**42.** A	**43.** C	**44.** B	**45.** 4.8	**46.** C	**47.** B	**48.** B	**49.** 8	**50.** D
51. B	**52.** C	**53.** B	**54.** B	**55.** B	**56.** C	**57.** 1602	**58.** 15872	**59.** C	**60.** C
61. A	**62.** C	**63.** B	**64.** A	**65.** C					

Hints and Explanations

1. The grammatically correct choice is (C) "fewer". The reason is "fewer" is used when the noun is countable; "Less" is used for uncountable things, as illustrated in "there's less dust on the furniture today; there was less noise in the class, there is less milk in the fridge". "Smaller" and "lesser" are irrelevant. Choice (C)

2. Let the weight of A be a kg and that of B be b kg.
After A and B join, total number of students in the class is 14.
$\therefore$ Before A and B joined, the strength of the class was 12. If we assume that the average weight of the 12 students is n, then after A joins, it is $\frac{12n + a}{13}$

$$\frac{12n + a}{13} = n + 1,$$

$\Rightarrow$ $12n + a = 13n + 13$ —— (1)
$\Rightarrow$ $a = n + 13$
After B joined, the average increases by 1/2.

$$\therefore \quad \frac{12n + a + b}{14} = n + 1 + \frac{1}{2},$$

$\Rightarrow$ $12n + a + b = 14n + 14 + 7$ —— (2)
(2) – (1) gives $b = n + 8$ and $a = n + 13$
$\therefore$ $a - b = 5$. Ans: 5

3. Since 90% of 4000 = 3600 and both 3600 and 4000 are adjacent to each other the sale price of the article should be = ₹3600. Choice (B)

4. Sentences (B) to (D) are all wrong for several reasons. The grammatically correct sentence is (A). The verb "adapt" is rightly used and therefore it is syntactically correct. In sentence (B) the correct word is "adopt" not "adapt". Childless women or couples adopt others' child or children. In sentence (C) the appropriate word is "emigrated", not "immigrated". In sentence (D) the wrong word is "emigrated". The correct word is "immigrated". Choice (A)

5. The Number of letters in the word REPTILE is 7 and $7^2 = 49$. Similarly the number of letters in the word CROCODILE is 9 and $9^2 = 81$.
The number of letters in the word ALLIGATOR is 9 and $9^2 = 81$.
$\therefore$ 81 is the code for the word ALLIGATOR.
Choice (D)

6. The correct sentence with respect to grammar and usage is sentence (A). In sentences (B), (C) and (D) the article "*a*" is omitted before 'few' and that is what makes them wrong and unacceptable. Choice (A)

7. $S = 1 + 3x + 5x^2 + 7x^3 + 9x^4 + \ldots$ $\rightarrow$ (1)
$Sx = x + 3x^2 + 5x^3 + 7x^4 + \ldots$ $\rightarrow$ (2)
---
(1) – (2) $S \Rightarrow (1 - x) = 1 + 2x + 2x^2 + 2x^3 \ldots \infty$
$= 1 + 2x\,(1 + x + x^2 + \ldots \infty)$

$$= 1 + \frac{2x}{1 - x}$$

$$S(1 - x) = \frac{1 + x}{1 - x}$$

$$S = \frac{1 + x}{(1 - x)^2} = 3$$

$3x^2 - 7x + 2 = 0$
$(3x - 1)\,(x - 2) = 0$
$\Rightarrow$ $x = \frac{1}{3}$ (or) $x = 2$

But $|x| < 1 \Rightarrow x = \frac{1}{3}$ Choice (B)

8. Sentences (1) and (6) remain constant and unchanged while the following and preceding four sentences will be shuffled and rearranged in their proper and logical sequence. Sentence (1) says the passage illustrates how an approach was adopted by an automaker to arrive at a new design for an automobile. The new design entailed constructing new plants (5). In the second sentence (3) the management invited the employees' ideas. In the third sentence (4) the employees were forthcoming with their ideas. In the fourth sentence (2) the author agrees that the workers know better if the wrench works well or not. The logical sequence of the sentences is (A) 5, 3, 4, 2. Choice (A)

9. According to the given information the possible arrangement is as follows.
6 bus 25 6 bus 45 15
$\therefore$ The total number of buses in the parking lot is 29.
Choice (A)

10. The above short passage is exclusively about the varied and unforeseen benefits of reading. Though the benefits can be denied or disputed by some, they are nonetheless real and verifiable. The passage says reading provided healing power by accident to some people. Not only that, reading affords consolation and support to those who are sincerely devoted to reading. Belittling it is of no consequence. The answer choices are (i) and (iv), that is (B). Choice (B)

11. Given matrix is $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$

The characteristic equation of A is $|A - \lambda I| = 0$

i.e., $\begin{bmatrix} 1 - \lambda & 0 & 0 \\ 0 & 2 - \lambda & 1 \\ 2 & 0 & 3 - \lambda \end{bmatrix} = 0$

$\Rightarrow$ $(1 - \lambda)\,(2 - \lambda)\,(3 - \lambda) = 0$

$\Rightarrow$ $\lambda = 1, 2, 3$

$\therefore$ The eigenvalues of A are 1, 2 and 3

If X is an eigenvector of A, corresponding to an eigenvalue λ, then $AX = \lambda X \rightarrow (1)$ for exactly one of $\lambda = 1, 2$ and 3.

Among the vectors given in the options, the vector $X = \begin{bmatrix} 2 \\ 2 \\ -2 \end{bmatrix}$ given in option (B) will satisfy the condition $AX = \lambda X$ for $\lambda = 1$

The vector $\begin{bmatrix} 2 \\ 2 \\ -2 \end{bmatrix}$ is an eigenvector of A

Choice (B)

12. We know that among all bipartite graphs with n vertices, the maximum number of edges occur in a complete bipartite graph.

Also, among all the complete bipartite graphs with n vertices, the complete bipartite graph $K_{\left(\frac{n-1}{2}\right)\left(\frac{n+1}{2}\right)}$ will have the maximum number of edges if n is odd.

Here $n = 11$

$\therefore$ The complete bipartite graph $K_{\left(\frac{11-1}{2}\right)\left(\frac{11+1}{2}\right)} = K_{5,6}$ will have the maximum number of edges with 11 vertices.

And the number of edges in $K_{5,6} = 5 \times 6 = 30$

Hence the number of edges in a bipartite graph With 11 vertices = 30 Choice (C)

13. Standard Results Choice (D)

14. Average number of telephone calls coming to a telephone exchange = $\lambda = 3$ calls per hour

$\therefore$ Probability that the number of telephone calls coming to a telephone exchange exceeds 3

$= P(x > 3) = 1 - P(x \le 3)$

$= 1 - [P(x = 0) + P(x = 1) + P(x = 2) + P(x = 3)]$

$$= 1 - \left[\frac{\lambda^0 e^{-\lambda}}{0!} + \frac{\lambda^1 e^{-\lambda}}{1!} + \frac{\lambda^2 e^{-\lambda}}{2!} + \frac{\lambda^3 e^{-\lambda}}{3!}\right]$$

$$= 1 - \left[e^{-3} + 3e^{-3} + \frac{9}{2}e^{-3} + \frac{9}{2}e^{-3}\right]$$

$= 1 - (13e^{-3}) = 0.3528$ Choice (A)

15. Given $f(x) = 2x$, $g(x) = 3x^2$ and $h(x) = 3$

$\therefore$ $(fogoh)(3) = f(g(h(3))) = f(g(3)) = f(27) = 54$

Ans : 54

16. The given numbers are 1, 2, 3, ..., 99.

Each key contains maximum 2-digits

Radix-sort is implemented 2-times (2-Iterations)

In each Iteration, we perform n-Enqueue operations and n-Dequeue operations, Total $(2n)$ operations.

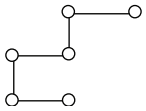
2^{nd}-Iteration also takes $(2n)$ operations

Let us assume, $k = 2$ (The number of digits in each key)

$\therefore$ Time complexity $O(k * n) = O(n)$

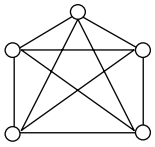
(k is very small) Choice (D)

17. I. Let us consider the following graph which is not a cyclic graph



Vertices (n) = 6
Edges (E) = 5
$E = n - 1$

II. Consider the following simple graph



Vertices (n) = 5
Edges (E) = 10
$E = \frac{(n-1)n}{2}$

Both statements are TRUE. Choice (C)

18. Latency or Rotational delay $= \frac{1}{2r}$

r = rotations per second

1 minute – 600 rotations

60 seconds – 600 rotations
1 second – r

$$r = \frac{600}{60} = 10 \quad \frac{1}{2r} = \frac{1}{2 \times 10} = \frac{1}{20} = 0.05 \text{ seconds}$$

Choice (C)

19. - B-tree construction on 10 elements, either ascending or descending order gives maximum number of Node splits.

- B^+-tree, only on descending order of elements gives worst-case, that is maximum number of node splits. Choice (C)

20. Statement I is FALSE. The lower frequency processor may have higher IPC than higher frequency processor.

II is also FALSE. Because the processor which executes more number of instructions does not imply that the processor always finishes a program faster.

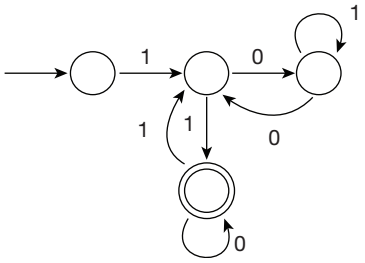
(Θ Different processors requires different number of instructions to execute). Choice (D)

21. The Dependencies will be resolved in the 3^{rd} stage. If the delay slot is 2 clock cycles then the pipeline ensures correct operation.

	1	2	3	4	5	6	7	8	
I_L			S_1	S_2	S_3	S_4	S_5		
I_{L+1}				S_1	S_2				
I_{L+2}					S_1				
I_T						S_1			

If the delay slot is 2 then in the 3rd stage the branch instruction will be evaluated and target instruction will be evaluated in the next cycle. Ans: 2

22. L consists of the binary strings
{11, 110, 1001, 1100, 1111, 10010, ...}
i.e., L consists of the numbers which are divisible by 3.
The DFA is shown below:



Choice (A)

23. Finding the emptiness of a CFL is decidable. Remaining three problems are undecidable. Choice (C)

24. Shutdown( ) will block the communication in both ways. Close( ) will destroy the socket. Choice (B)

25. A repeater does not connect two LANs. It connects segments of LANs. Choice (B)

26. Caesar Cipher is also referred as shift cipher.
In shift cipher, the encryption algorithm, "shift key characters down" i.e., towards the end of the alphabet. (with key as some number).
For GATECS with key = 10, the encrypted message is QKDOMC. Choice (D)

27. Binding can take place at language design time, language implementation time, compile time, load time and link time.

Choice (D)

28. According to static scoping, the value of 'x' will be 5, as fun1( ) will associate with global variable of 'x'.

Choice (A)

29. Number of binary tree structures with 3 elements is $\frac{{}^{6}C_{3}}{3+1} = 5$ (With 'n' element it is $\frac{{}^{2n}C_{n}}{(n+1)}$.)
Number of binary trees that can be formed with n nodes is $\left(\frac{{}^{2n}C_{n}}{n+1} \times n!\right) = 5 \times 3! = 30$ Ans: 30

30. Root directory is placed at fixed location on the disk

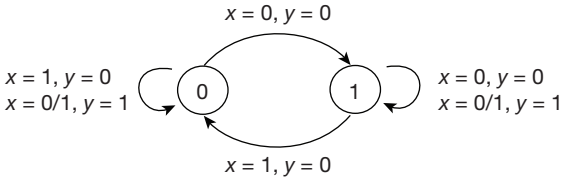
Choice (B)

31. Efficiency $= \frac{\text{Process execution time}}{\text{Waiting time + Process execution time}}$.
As the switching of the processes and the execution of process takes same amount of time, the efficiency will be 50%. Choice (B)

34. When $y = 1$, the output of or gate is 1, so NAND gate outputs will be $\overline{1 \cdot \bar{\bar{Q}}} = Q, \overline{1 \cdot Q} = \bar{Q}$ i.e., output Q, $\bar{Q}$ remains in same state as long as $Y = 1$, irrespective of X input.
When $Y = 0$, the circuit works as follows

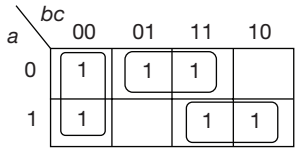
Y	X	Output OR gate 1	Output OR gate 2	Output (Q) NAND gates	Output NAND gates ($\bar{Q}$)
0	0	0	1	1	0
0	1	1	0	0	1

So when $y = 0$, next state depends on X value.
If $x = 0$, next state = 1
if $x = 1$, next state = 0

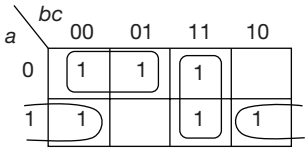


Choice (D)

35. $F(a, b, c) = \pi M(2, 5)$
$= \Sigma_m(0, 1, 3, 4, 6, 7)$



$= a^1c + b^1c^1 + ab$



$= a^1b^1 + bc + ac^1$
So both (A) and (B) choices are true. Choice (C)

36. Let p : Ramu is in the class
And q : Lokesh is in the playground
$\therefore$ The propositions S_1, S_2 and S_3 can be symbolically represented as
$S_1 : p \to q$; $S_2 : p$ and $S_3 : q$
$\therefore$ $p, p \to q \Rightarrow q$ (By modus ponens)
$\therefore$ S_3 logically follows from S_1 and S_2
Also, when p is false and q is true, $p \to q$ is true
i.e., when S_1 and S_3 are true, S_2 is false.
Hence S_2 does not logically follow from S_1 and S_3
Choice (B)

37. Among the options given, consider option (B), (S_2, X_6) where $S_2 = \{1, 2, 3, 4, 5\}$
For $3, 4 \in S_2$, $3\ X_6\ 4 = 0 \notin S_2$
$\therefore$ S_2 does not satisfy closure axiom under 'X_6'
Hence (S_2, X_6) is not an abelian group Choice (B)

38. Given $f(x) = 8x^5 - 15x^4 + 10x^2$

$f'(x) = 40x^4 - 60x^3 + 20x$

$f'(x) = 0 \Rightarrow 40x^4 - 60x^3 + 20x = 0$

$\Rightarrow \quad x(x-1)^2(2x+1) = 0$

$\Rightarrow \quad x = 0; x = 1, 1 \text{ and } x = \dfrac{-1}{2}$

$\therefore$ The stationary values of $f(x)$ are 0, 1 and $\dfrac{-1}{2}$

$f''(x) = 160x^3 - 180x^2 + 20$

At $x = 0; f^{II}(x) = 20 > 0$

$\therefore$ $f(x)$ has a minimum at $x = 0$

At $x = \dfrac{-1}{2}$, $f^{II}(x) = -45 < 0$

$\therefore$ $f(x)$ has a maximum at $x = \dfrac{-1}{2}$

At $x = 1; f^{II}(x) = 0$

$f'''(x) = 480x^2 - 360x$

At $x = 1; f^{III}(x) = 120 \neq 0$

$\therefore$ $f(x)$ has neither maximum nor minimum at $x = 1$

$\therefore$ The number of stationary values where $f(x)$ has neither maximum nor minimum = 1 Ans: 1

39. The number of ways of accommodating 30 students in 14 rooms, of which 5 are triple, 6 are double and 3 are single rooms = The number of ordered partitions of a set with 30 elements into 14 sets with first 5 sets containing 3 elements each, the next 6 sets containing 2 elements each and the last 3 sets containing one element each

$= P(30; 3, 3, 3, 3, 3, 2, 2, 2, 2, 2, 2, 1, 1, 1)$

$= \dfrac{30!}{(3!)^5 \times (2!)^6 \times (1!)^3}$ Choice (A)

40. Standard Results Choice (D)

41. From the given circuit, all flip flops are falling edge triggered flip flops and $T = 1$, so all flip flops will toggle their state when clk pulse occurs. clk input is connected to Q_0, so for every clk pulse Q_0 change its state.

$\bar{Q}_0$ is connected to negative edge triggered flip flop (Q_1)

So Q_1 will change (toggle) when $\bar{Q}_0$ changes from 1 to 0. (i.e., Q_0 changes from 0 to 1)

Q_1 is connected to next stage (Q_2), so whenever Q_1 has change from 1 to 0, then Q_2 will get toggle. we can summarize as below:

Q_0 – toggles for every clk pulse

Q_1 – toggles when Q_0 changes from 0 to 1

Q_2 – toggles when Q_1 changes from 1 to 0

Clk	Q_2	Q_1	Q_0
0	0	0	0
1	0	1	1
2	0	1	0
3	1	0	1
4	1	0	0
5	1	1	1
6	1	1	0
7	0	0	1
8	0	0	0

So sequence is 0, 3, 2, 5, 4, 7, 6, 1, 0….

Choice (C)

42. Option (A): it is LL(1), SLR(1) and LR(0)

Option (B): it is neither LL(1), LR(0) nor SLR(1)

Option (C): it is not LL(1), LR(0) but SLR(1)

Option (D): it is not LL(1), LR(0) but SLR(1)

Choice (A)

43. The parse table for the grammar is:

	a	b	e	i	t	$
S	$S \to a$			$S \to iCtSS^1$		
S^1			$S^1 \to \in$ $S^1 \to eS$			$S^1 \to \in$
C		$C \to b$				

$M[S^1, e]$ contains multiple entries

Choice (C)

44. Given SDD is an attribute grammar as it does not have any side effects.

It is also *S*-attributed as given SDD only involves synthesized attributes. (val and lexval are synthesized attributes).

It is also *L*-attributed as the attributes are synthesized.

Choice (B)

45. $q = \dfrac{t - ns}{(n-1)} = \dfrac{36 - 6 \times 2}{5} = \dfrac{24}{5} = 4.8$ Ans: 4.8

46. 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 5

1
2
~~3~~ 6
~~4~~ 3
~~5~~ ~~6~~ 5

= 9 page faults Choice (C)

47. The maximum value of count is infinite only if $P1$ is in the system and executes $P1(\,)$ infinite times.

The solution guarantees progress among the processes. Both the processes can be in critical section at the same time if P_2 executes 1st instruction in $P2(\,)$ followed by process $P1$ executing $P1(\,)$. No mutual-exclusion is guaranteed.

Choice (B)

48. Choice (B)

49. **In-order:**

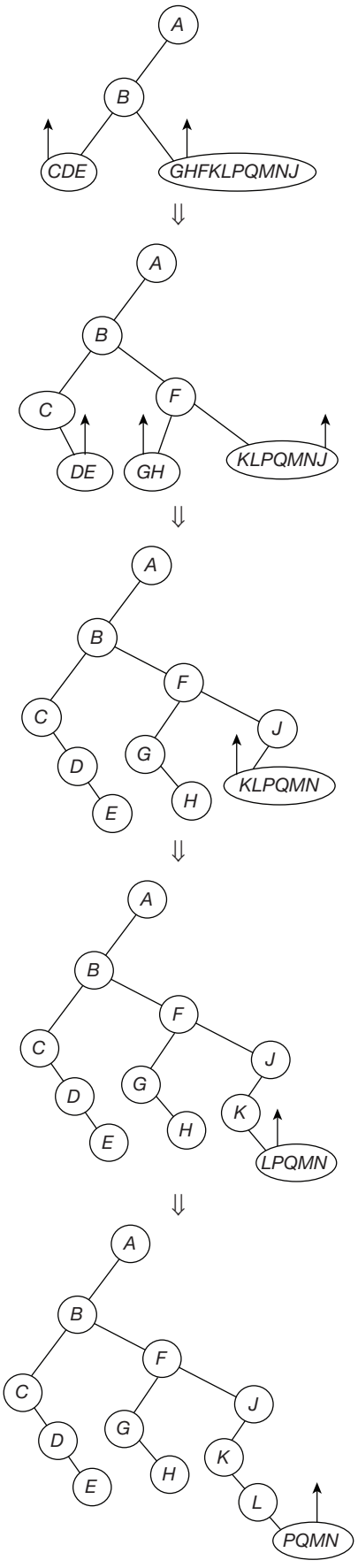
C D E B G H F K L P Q M N J (A)

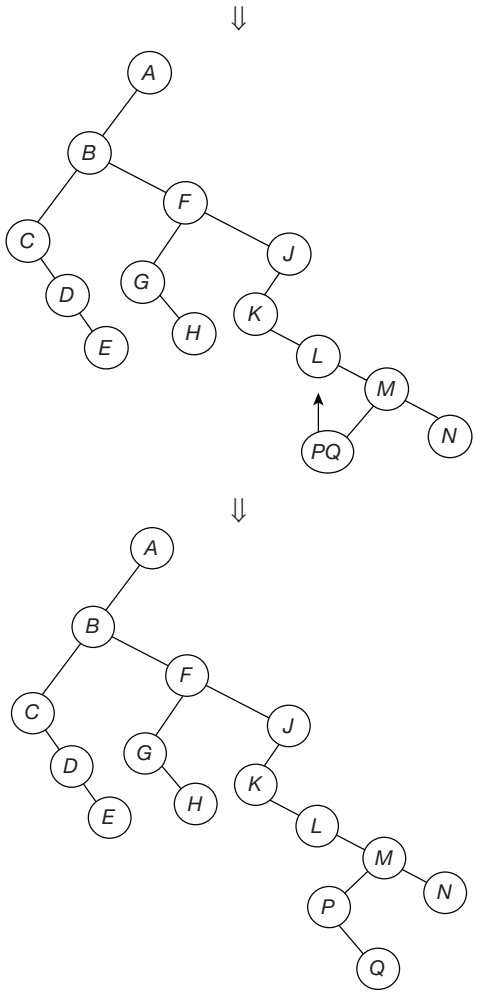
In order for the traversal is

C D E B G H F K L P Q M N J (A)

Pre-order: *A B C D E F G H J K L M P Q N*

C D E B G H F K L P Q M N J





The number of nodes with single child node is 8.

Ans: 8

50. The value of $s1$ and $s2$ will be 42 and 400, if the evaluation order is from left to right.
The value of $s1$ and $s2$ will be 44 and 300, if the evaluation order is from right to left.

Choice (D)

51. Given 32-bit of IPv4 header is
$(4500\ 139C)_{16}$
$= (0100\ 0101\ 0000\ 0000\ 0001\ 0011\ 1001\ 1100)_2$
First 4-bits represents version 4.
Next 4-bits represents header length (in multiple of 4).
$5 \times 4 = 20$ Bytes
Next 8-bits are for service field.
Next 16-bits represents Total length (Header + Data)
5020 bytes.
Fragmentation information is not included in these 32-bits.

Choice (B)

52. Distance between Stations = 1200 km
Signal propagation speed = 3×10^8 m/s

$$\text{Maximum propagation time} = \frac{\text{Distance}}{\text{Speed}}$$

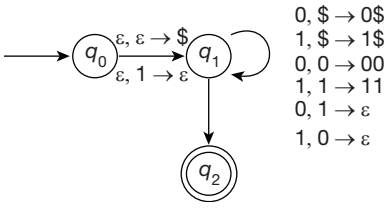
$$= \frac{1200 \times 10^3}{3 \times 10^8} = 4 \text{ msec}$$

For number of attempts, $k = 2$, the range of values is $\{0, 1, 2, 3\}$.

T_B (Back-off time) = Random number in range of values * propagation time.

$\therefore$ Possible Back-off time values are 0 ms, 4 ms, 8 ms, 12 ms. Choice (C)

53. The PDA which accepts more number of 1's than 0's is shown below:



The PDA pushes a zero or one on to the stack and pops a zero or one with inputs one or zero respectively. It pushes 0's (or 1's) with Top of stack 0's (or 1's).

And finally it reaches final state if there is atleast one 1 remained on the stack. Choice (B)

54. L_1 is not regular. In L_1, sum of number of x, y, z are more than 10 and we have to check the equality of m, n or n, p, which is not possible with *FA*.

L_2 is regular. The sum of number of x, y, z is less than or equal to 10 and we can easily check the equality of m, n or n, p (as the number of combinations is Limited). i.e., we can have one x, one y and number (z's) ≤ 8.

Two x's, Two y's and number (z's) ≤ 6

Three x's, Three y's and number (z's) ≤ 4 etc.

Choice (B)

55. $L_1 = \{a^i b^{2i} \mid i \in \{1, 2, ...\}\}$

L_1 is CFL but not regular. PDA can be designed, which pushes 2 a's for each a and pop an 'a' for each b.

$L_2 = \{a^i b^{i^2} \mid i \in \{1, 2, ...\}\}$

L_2 is not CFL. (Its complement is also not CFL). But we can design a Halting Turing machine to recognize strings of the form $a^i b^{i^2}$. Choice (B)

56. The immediate value has 16-bit length. For branch instructions, the immediate value takes signed 2's complement representation. The range of signed 2's complement numbers is

-2^{n-1} to $2^{n-1} - 1$ (n is number of bits)

Here $n = 16$

$\therefore$ $X = 2^{15} \times 4$

$Y = (2^{15} - 1) \times 4$

(Θ Each instruction requires 4 locations).

$X = 131072$

$Y = 131068$ Choice (C)

57. Given code,

Loop: I_1: LOAD R_1, 0(R_2)

I_2: ADD R_1, R_1 #1

I_3: STORE R_1, 0(R_2)

I_4: ADD R_2, R_2, #4

I_5: SUB R_4, R_3, R_2

I_6: BNEZ R_4, Loop

Initially value of R_3 is R_2 +400. In every iteration R_2 is incremented by 4. Based on R_4 value the loop will get executed.

$R_4 = R_3 - R_2$

Both R_3 and R_2 will have equal value after 100 $= \left(\frac{400}{4}\right)$ iterations.

The timing diagram for the 1st iteration of the loop is shown below:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
I_1	IF	ID	EX	MA	WB														
I_2		IF	Stall	Stall	ID	EX	MA	WB											
I_3					IF	Stall	Stall	ID	EX	MA	WB								
I_4								IF	ID	EX	MA	WB							
I_5									IF	Stall	Stall	ID	EX	MA	WB				
I_6												IF	Stall	Stall	ID	EX	MA	WB	
I_7																	IF	ID	

From the Timing diagram we can observe that 2 stages of two iterations are overlapped. So for 1st 99 iterations it takes 16 clock cycles and 100th iteration takes 18 clock cycles.

∴ Number of clock cycles for 100 iterations

= 99 × 16 + 18 = 1602 Ans: 1602

58. Given number is $(5403E)_{16}$

= 0101 0100 0000 0011 1110

Sign = 0 = positive

excess – 64 exponent

= 101 0100 = 84

Exponent = 84 – 64 = 20

Mantissa = 0.0000 0011 1110 = $(0.015)_{10}$

∴ Given number = $(0.015)_{10} \times 2^{20} = 15872$

Ans: 15872

59. When we have M:N relation, A separate relation is taken to place all primary keys of participating entities.

Option (C)

Test (TID, RNo, TName)

If we include RNo in Test entity, there is a scope of lot of Redundant values.

Choice (C)

60. Lets Assume some tuples for all three tables:

Sailor

Sid	S. Name	Rating	age
11	Anu	7	30
12	Radha	8	20
13	Sita	6	40
14	Karan	7	20
15	Sita	7	30

Reserves

Sid	bid
11	201
11	203
12	201
13	203
14	202
15	201

Boats

bid	bname	color
201	A	black
202	B	blue
203	C	white
204	C	red

Option (A):

$$\sigma^{(Boats)}_{color='black'} \cap \sigma^{(Boats)}_{color='white'}$$

201	A	black	∩	203	C	white	= ϕ

Option (B)

Sid	Sname	Rating	age	bid	bname	color
11	Anu	7	30	201	A	black
12	Radha	8	20	201	A	black
15	Sita	7	30	201	A	black

Sid	Sname	Rating	age	bid	bname	color
11	Anu	7	30	203	C	white
13	Sita	6	40	203	C	white

Result = ϕ (ϕ values should be same under all the columns of 2-tables)

Option (C)

π_{sid} from First part of query

Sid
11
12
15

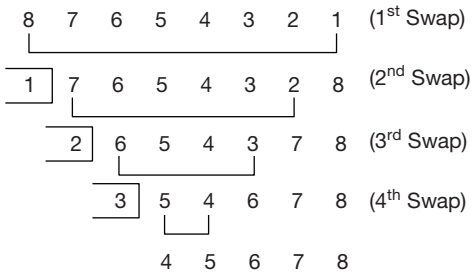
π_{sid} from second part of query

Sid
11
13

Sid		Sid		Sid
11	∩	11	=	11
12		13		
15				

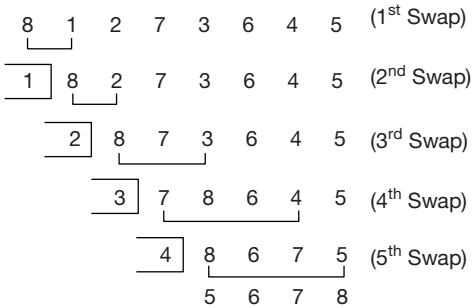
Choice (C)

61. I.



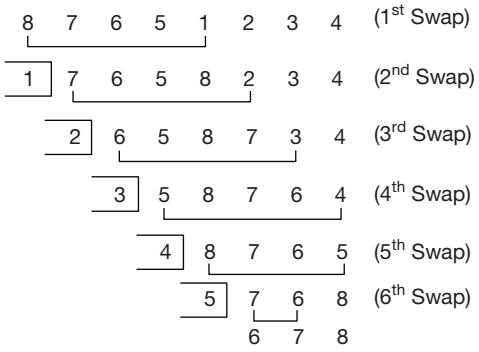
∴ 4-swap operations.

II.



∴ 5 swap operations.

III.



∴ 6 swap operations Choice (A)

62. Solution set $S[A]$

I-Iteration:

$S[A]$ source $= A$
dist $[B] = 2$
dist $[C] = 1$
dist $[D] = 6$
dist $[E] = \infty$
dist $[F] = \infty$

II-Iteration:

$S[AC]$
dist $[B] = \min\{2, \infty\} = 2$
dist $[D] = \min\{6, \infty\} = 6$
dist $[E] = \min\{\infty, \infty\} = \infty$
dist $[F] = \min\{\infty, 8\} = 8$

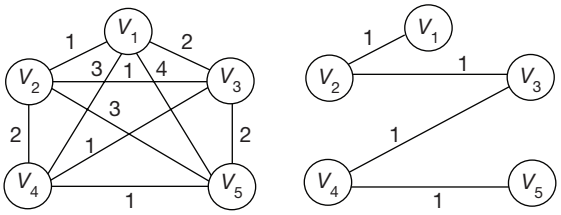
III – Iteration

$S[ACB]$
dist $[D] = \min\{6, \infty\} = 6$
dist $[E] = \min\{\infty, 6\} = 6$
dist $[F] = \min\{8, 4\} = 4$

IV-Iteration

$S[ACBF]$
dist $[D] = \min\{6, \infty\} = 6$
dist $[E] = \min\{6, 8\} = 6$
Next we can take either D (or) E Choice (C)

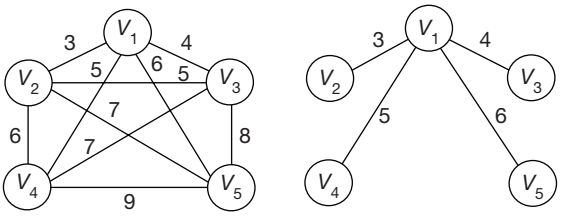
63. **Graph 1** **Minimum spanning Tree 1**



Total weight = 1 + 1 + 1 + 1 = 4

Total weight = 1 + 1 + 1 + 1 = 4

Graph 2 **Minimum spanning Tree 2**



Total weight = 3 + 4 + 5 + 6 = 18

Total weight = 3 + 4 + 5 + 6 = 18

∴ Difference between both Spanning Trees total weight is 18 – 4 = 14

Choice (B)

64. **Option (A)**

SELECT CNo, count (*)
FROM Register
WHERE -
GROUPBY CNo

Option (B)

SELECT SName
FROM student JOIN Register ON(RNo)
WHERE CNo = 201

Option (D)

SELECT SName
FROM student JOIN Register ON(RNo),
Register JOIN Course ON(CNo)
WHERE Duration = 6 months

Option (C)

SELECT SName, CNo
FROM student JOIN Register ON(RNo)
WHERE Day = 'Monday'

Option (A) Cannot be expressed, because we need GROUPBY clause

Choice (A)

65. $A \rightarrow BC$
$A \rightarrow D$
$D \rightarrow E$

L	M	R
A	D	BC

$A^+ = \{ABCDE\}$
key $= A$
$A \rightarrow D$ Transitivity exists
$D \rightarrow E$ It violates 3NF
We need to perform 3NF – Decomposition.
The decomposed tables are $R_1(ABCD)$, $R_2(DE)$

Check for lossless decomposition:

	A	B	C	D	E
R_1 (ABCD)	*	*	*	*	*
R_2 (DE)				*	*

∴ It is loss less decomposition.

Choice (C)