Mock Test 4

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**

Directions for question 1: Choose the most appropriate word from the options given below to complete the following sentence.

1. Despite its known toxicity, lead continues to be used, to the great _____ of human and environmental health.

(A) impediment (B) detriment
(C) chagrin (D) solace

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

2. A 7-year old child assembles an object from lego blocks. The object is in the shape of a cylinder surmounted by a hemisphere of radius 7 cm. If the height of the cylinder is 7 cm, find the volume of the object (in cm^3).

(A) $\frac{3\pi}{5}(7^2)$ (B) $\frac{5\pi}{3}(7^3)$
(C) 7^3 (D) $7^3\pi$

3. In a certain code language, if Zoology is called Anthropology, Anthropology is called Ornithology, Ornithology is called Biology, Biology is called Cosmology, Cosmology is called Ecology, Ecology is called Etymology, then what is the study of human called in that language?

(A) Biology (B) Ecology
(C) Ornithology (D) Cosmology

Directions for question 4: Select the pair that best expresses a relationship similar to that expressed in the capitalized pair.

4. BIOLOGY: LIFE

(A) Archaeology: Antiques (B) Astrology: Stars
(C) Cosmetology: Beauty (D) Mythology: Myths

Directions for question 5: Fill in the blanks from the options given below:

5. _____ summer monsoon _____ been showing a weakening trend _____ the past century with decreasing rainfall over large regions of _____ Indian subcontinent.

(A) The, has, over, the
(B) The, has, over, no article
(C) A, had, across, no article
(D) The, has, in, the

Directions for questions 6 to 10: Select the correct alternative form the given choices.

6. a, b, c, d are distinct positive integers such that:
$f(a, b, c, d) = \max(a, b, c, d)$
$g(a, b, c, d) = \min(a, b, c, d)$
$h(a, b, c, d)$ = remainder of $(c \times d/a \times b)$
If $(c \times d) > (a \times b)$
$h(a, b, c, d)$ = remainder of $(a \times b)/(c \times d)$
if $(c \times d) < (a \times b)$
Also, a function $fgh\ (a, b, c, d) = f(a, b, c, d) \times g(a, b, c, d) \times h(a, b, c, d)$
the value of $fg\ [h(12, 11, 8, 16), 17, 9, 16]$ _____

7. Textbooks of medicine say that there is no direct connection between the brain and the lymphatic system, yet a paper published in the journal *Nature* refers to the discovery of exactly such a connection.
Which one of the statements given below is logically valid and can be inferred from the above sentence.

(A) A paper published in the journal *Nature* corroborates the fact that there is no direct connection between the brain and the lymphatic system.
(B) Textbooks of medicine declare that there is no direct connection between the brain and the lymphatic system and this is affirmed by a paper published in the journal *Nature*.
(C) Texts of medicine proclaim that there is no direct connection between the brain and the lymphatic system but a paper published in the journal *Nature* says that such a connection is indeed there.
(D) While textbooks of medicine maintain that there is no direct connection between the brain and the lymphatic system, a paper published in the journal *Nature* claims that the brain and the lymphatic system are connected indirectly.

8. The last decade has witnessed a slow but steady realisation within the Indian government that the threats of the future will come from cyberspace. Unfortunately, while the realisation exists, the Indian security establishment has not been jolted into action in the manner in which the Kargil War or the 26/11 terrorist attack on Mumbai galvanised the nation into adopting a series of corrective measures.
Which of the statement(s) below is/are logically valid and can be inferred from the above passage?

(i) Although the Indian government realizes that the threats of the future will be from cyberspace, it is yet to accord the seriousness which is due to this threat.
(ii) Despite the fact that the Indian government realizes that the future threats will come from cyber-

space, it does not consider these threats as devious as other threats which spurred the government to adopt corrective measures.

(iii) The Indian government considers that the threats from cyberspace will not pose a serious threat to the security of the nation.

(iv) The Indian government fails to consider that the threats from cyberspace could pose a threat to the security of a nation.

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

9. 30 students in class of *BV* School, wrote a test with 4 questions. For each question the number of students who answered correctly, incorrectly and did not attempt are tabulated below. The marks for each question are also listed in the table. There is no negative marking or partial marking.

Q.No.	Marks	Answered correctly	Answered incorrectly	Did not attempt
1	3	15	5	10
2	2	10	7	13
3	2	20	9	1
4	1	11	10	9

If the number of students who attempted all questions is 5, what is the maximum possible number of students who left at least 2 questions unattempted?

(A) 3 (B) 16
(C) 8 (D) None of these

10. The given statement is followed by some courses of action. Assuming the statement to be true, decide which of the given courses of action logically follows for pursuing.

Statement:

There have been steep increases in the government's expenditures on garbage collection, sorting, storage and recycling.

Courses of action:

(i) Government should encourage people to sort their garbage, by providing them separate bins for dry and wet garbage.

(ii) Once garbage is collected from households, to the extent possible it should be directed towards recycling, so that it can cut down on storage costs.

(iii) The routes of the collection vehicles should be planned in such a way that they are used in a most efficient manner.

(A) Only (i) and (ii) follow
(B) Only (ii) and (iii) follow
(C) Only (i) and (iii) follow
(D) All (i), (ii) and (iii) follow

COMPUTER SCIENCE ENGINEERING

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

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

11. A letter is selected at random from each of the two words 'FRACTION' and 'DECIMAL'. Probability that the selected letter in a word should NOT be in the other word is _____

(A) 3/14 (B) 5/14
(C) 7/13 (D) 9/13

12. The value of $\lim_{x\to 3} \log_5[4x^3 + \sqrt{(3x^4 + 5x^2 + 1)}]$ is _____

13. The solution of the recurrence relation $a_n - a_{n-1} = n^2$; $n \geq 1$ with $a_0 = 2$ is _____

(A) $\frac{n^3 + 6n^2 + 2n + 6}{6}$ (B) $\frac{2n^3 + 3n^2 + n + 12}{6}$

(C) $\frac{n^3 + 3n^2 + 2n + 6}{12}$ (D) $\frac{2n^3 + 3n^2 + 4n + 12}{12}$

14. If $S = \{1, \{2, 3\}, 4\}$, then the cardinality of $P(P(A))$ (where $P(S)$ stands for the power set of the set S) is _____

15. If $P(x)$ and $Q(x, y)$ denote two predicate variables, then which of the following is NOT equivalent to the negation of $(\forall x)\,(P(x) \rightarrow Q(x, y))$?

(A) $\neg(\forall x)\,(\neg Q\ (x, y) \rightarrow \neg P(x))$
(B) $(\exists x)\,\neg(P(x) \rightarrow Q\ (x, y))$
(C) $(\exists x)\,(P(x) \wedge \neg Q\ (x, y))$
(D) $(\forall x)\,(P(x) \wedge \neg Q\ (x, y))$

16. Consider the below C program:

```
int main(void)
{
    int x =1023, c = 0 ;
    while (x ! = 0)
    {
    x = x & (x - 1);
    c = c + 1 ;
    }
    printf ("%d" , c);
}
```

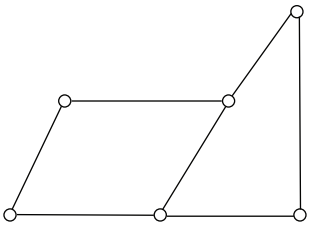
The above program prints _____.

17. Consider the adjacency matrix given below:

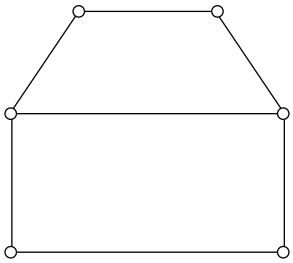
$$\begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \end{bmatrix}$$

In Adjacency matrix, rows and columns are indexed by Vertices of graph. Entry is 1 if corresponding vertices are connected by an edge and is 0 otherwise. Which of the following graphs has the above adjacency matrix?

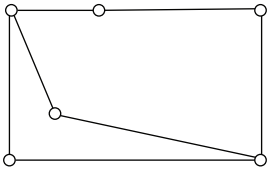
(i)



(ii)



(iii)



(A) (i) & (ii) (B) (i) & (iii)
(C) (ii) & (iii) (D) None of the above

18. An array A[- 32 ... 75] is stored in a memory whose starting address is 209. If each element takes 2 bytes. Then the location of A[50] is _____.

19. A direct access file has fixed size of 10 byte records. The logical location of first byte of record 9 will start at _____.

20. Consider a system with 6 processes (P_1, P_2, ..., P_6) with its resource distribution as given below:

Process-id	Allocated resources	Resources needed
P_1	2	2
P_2	3	3
P_3	4	3
P_4	2	2
P_5	2	2
P_6	2	3

The minimum number of processes should be killed to make the above system safe is:
(A) 1 (B) 2
(C) 3 (D) 4

21. Which of the following statement is FALSE?
(A) Every SLR(1) grammar is LALR(1).
(B) Operator precedence parser can parse both ambiguous and unambiguous grammar.
(C) Every operator precedence grammar is LR(0) grammar.
(D) None of the above.

22. Consider below code:

```
i = j = 0;
for (; ;)
{
j++;
if (i > x)
    break;
    i++;
}
```

The value of j, after the loop termination is:
(A) x (B) $x + 1$
(C) $x + 2$
(D) The loop doesnot terminate.

23. Assume that a new memory technology is developed, which is named as NextGenRAM. NextGenRAM is non-volatile. The access latency of NextGenRAM is twice that of an SRAM cell but same as that of a DRAM cell. The read/write capability of NextGenRAM is same as that of a DRAM energy. The cost of NextGenRAM is similar to DRAM, but the density of NextGenRAM is more than DRAM. Also the NextGenRAM cell stops functioning, after 2000 writes are performed to the cell. Then which of the following statement is TRUE?
I. There is an advantage of NextGenRAM over DRAM.
II. There is an advantage of NextGenRAM over SRAM.
(A) I only (B) II only
(C) Both I and II (D) Neither I nor II

24. Which of the following statement is FALSE?
(A) If the pipeline depth increases, then the latency to process a single instruction also increases.
(B) Having a 32-bit wide data bus to memory is a micro-architecture level design choice.
(C) Having a predicted instruction execution is ISA level design choice.
(D) A 2-level global branch prediction is ISA (Instruction set Architecture) level Design choice.

25. Consider the following languages:
$L_1 = \{a^n b^n \mid n \in N, N \text{ is a set of natural numbers}\}$
$L_2 = \{b^n a^n \mid n \in N, N \text{ is a set of natural numbers}\}$
Then the language $L_1 \cap L_2$ is:
(A) Regular (B) non-regular
(C) CFL but not regular (D) not a CFL

26. Consider a set of Turing decidable languages D and a set of Turing recognizable languages R. Then which of the following is always TRUE?
(A) $D \equiv R$ (B) $D \subset R$
(C) $R \subset D$ (D) $D \not\subset R$

27. Which of the following IPv4 address is used by hosts when they are being booted?
(A) 0.0.0.0 (B) 127.0.0.0
(C) 0.0.0.1 (D) 255.255.255.255

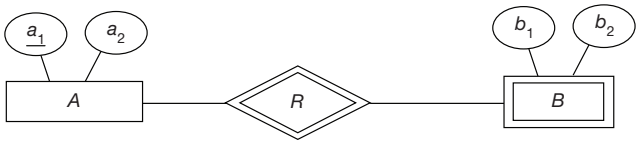
28. Which of the following statement(s) is/are TRUE?
I. A passive hub connects the wires coming from different branches.
II. A repeater can connect two LANs.
III. A Bridge can check the MAC address contained in the frame to forward or drop it.
(A) I, II only (B) II, III only
(C) I, III only (D) I, II, III

29. A Hash table T with 40 slots, stores 5000 elements, what is load factor ($\propto$)?
(A) 250 (B) 125
(C) 500 (D) 400

30. Consider the elements 1, 2, 3, 4, 5, 6, 7 construct a complete binary tree with the given elements in the given sequence. To convert the tree into MAX-HEAP what is the number of swaps required?
(A) 7 (B) 5
(C) 4 (D) 3

31. To calculate the value of a^n, by using Divide - and - conquer. Which of the following Recurrence relation shows the procedure?
(A) $T(n) = T(n-1) + T(1)$
(B) $T(n) = T\left(\frac{n}{2}\right) + T\left(\frac{n}{2}\right) + C$
(C) $T(n) = T\left(\frac{n}{4}\right) + \log n$
(D) $T(n) = T\left(\frac{n}{2}\right) + C$

32. Consider the following ER-Diagram:



For a weak entity set to be meaningful, it must be associated with another entity set, that is called
(A) Neighbor set (B) Strong Entity set
(C) Weak Entity set (D) None of the above

33. What does the following SQL query return?
SELECT *
FROM Student, Department.
(A) It returns the Natural JOIN of student and department.
(B) It returns the CROSS PRODUCT of student and department.
(C) It returns the JOIN of student and department.
(D) It returns the UNION of student and department.

34. Which of the following is/are functionally complete set of Boolean operators?
(A) (NOT, XOR) (B) (AND, OR)
(C) (NOT, OR) (D) All the above

35. Sensors are used to monitor the pressure and the temperature of a chemical solution stored in a boiler. The circuitry for each sensor produces a HIGH voltage (Logic 1) when a specified maximum value is exceeded. An alarm requiring a Low voltage (Logic 0) input must be activated when either the pressure or the temperature is excessive. The circuit for this application uses _____ gate.
(A) NAND (B) NOR
(C) AND (D) XOR

36. The maximum volume of a cylindrical cistern with open top of surface area (Area of bottom and side) 108π square feet is _____
(A) 216π cubic feet (B) 432 cubic feet
(C) 864 cubic feet (D) 1728 cubic feet

37. If the eigenvalues of a 3×3 matrix A are -1, 2 and 5 then the determinant of the inverse of the matrix $A + 2I_3$, where I_3 is the identity matrix of order 3×3 is _____
(A) $\frac{-1}{10}$ (B) $\frac{1}{10}$
(C) $\frac{-1}{28}$ (D) $\frac{1}{28}$

38. In a city, 60% of the youngsters are engineering graduates and 40% of the youngsters are science graduates. Among the engineering graduates, 45% are self employed where as 30% of the science graduates are self employed. If an youngster is selected at random from that city, who is self employed, then the probability that the person is a science graduate is _____

39. Which of the following statements is TRUE?
(A) The number of functions that can be defined from $A = \{2, 3, 5, 7, 9\}$ to $B = \{6, 4, 5, 3, 1\}$ is zero.
(B) The number of one-one functions that can be defined from $A = \{a, b, c, d, e\}$ to $B = \{3, 5\}$ is 32.
(C) The number of onto functions that can be defined from $A = \{p, q, r\}$ to $B = \{1, 2, 3, 4, 5\}$ is 60.
(D) The number of bijections that can be defined from $A = \{a, b, c, d, e\}$ to $B = \{p, q, r, s, t\}$ is 120.

40. Match each of the graphs given in Group-I with its chromatic number in Group-II

Group-I	Group-II
P: A cycle graph of order 5	1. 2
Q: A wheel graph of order 6	2. 3
R: A bipartite graph of order 7	3. 4
S: A tree of order 8	4. 5

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

41. Consider the code segment:
int fun (int x)
{if ($x <= 1$) return 1; $x = (x-1)(x-1) - 2 - x * x + 3 * x$;
fun (x); print f ("%d", x)}
What is the output when fun(6) is called?
(A) 5 5 5 5 5 (B) 1 1 1 1 1
(C) 5 4 3 2 1 (D) 1 2 3 4 5

42. Consider below process table:

Process	Arrival time	Burst time
P_1	1	6
P_2	2	10
P_3	4	14
P_4	8	12

If the Longest remaining time First scheduling (LRTF) algorithm is used then the completion time of process P_3 is _____.

43. Consider a system with physical address "F" bits, logical address "L" bits and the page size "P" Mb. The size of page table (in bits) is _____.

(A) $[F - 20 - \log_2 P][2^{L-(20+\log_2 P)}]$ bits
(B) $[P - 20 - \log_2 F][2^{P-(20+\log_2 F)}]$
(C) $[F - 20 - \log_2 F][2^{P-(20+\log_2 P)}]$
(D) Date Inadequate

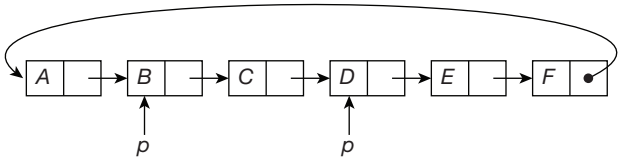
44. Consider a system with five processes P_1, P_2, P_3, P_4, P_5 with resources R_1, R_2, R_3, R_4, R_5:

	Allocated resources $R_1\ R_2\ R_3\ R_4\ R_5$	Maximum resources needed $R_1\ R_2\ R_3\ R_4\ R_5$
P_1	1 0 0 1 2	1 1 1 1 2
P_2	2 1 0 1 1	3 2 1 1 1
P_3	1 2 3 0 1	2 2 3 0 1
P_4	0 1 1 1 0	1 2 2 1 0
P_5	0 0 0 1 0	1 1 1 1 0

Which of the following resources availability makes above system deadlock free?

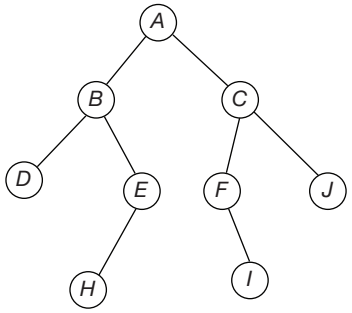
	R_1	R_2	R_3	R_4	R_5
(A)	1	0	0	0	0
(B)	0	0	0	1	0
(C)	0	0	0	0	1
(D)	0	0	1	0	0

45. Consider below linked list:



struct SL
{int data;struct SL *link;} ;
"p" and "q" are pointers pointing to the nodes as shown in above figure. Consider the code snippet:
struct node * temp;
$q = q \rightarrow$ link;
$q \rightarrow$ link $\rightarrow$ link $\rightarrow$ link = $p \rightarrow$ link $\rightarrow$ link;
$p \rightarrow$ link = NULL;
The above code results in:
(A) The list that remains same
(B) deletion of two elements.
(C) deletion of the node to which pointer "p" points.
(D) deletion of the node to which pointer "q" is pointing

46. Consider below binary tree:




```
Consider the routine fun ()
   struct BT
   {
   struct BT *left;
   int data;
   struct BT *right;
   };
struct BT* fun (struct BT * t)
   {
     if (t)
     {
       fun (t → left);
       printf ("%d", t → data);
       fun (t → right);
       printf("%d", t → data);
     }
   }
```

if root node is passed as a parameter to fun ( ), the output is:

(A) *D B H H E E B D A A C F F I I C J J*
(B) *A B B A D D E E H H C C F F I I J J*
(C) *D D B H H E E B A F I I F C J J C A*
(D) *D D B B H H E E A F F I I J J C C A*

47. Consider the grammar given below:
$A \rightarrow AA + \mid AA * \mid a$.
The grammar is:
(A) *LL*(1)
(B) *SLR*(1) but not *LL*(1)
(C) *LALR*(1) but not *SLR*(1)
(D) *LR*(1) but not *LALR*(1)

48. Consider the following SDT:
$X \rightarrow a\ X$ {print "*x*"}
$X \rightarrow b\ X$ {print "*y*"}
$X \rightarrow a$ {print "*z*"}
$X \rightarrow b$ {print "*z*"}
If the input is *a a b b a a b* then the output is:
(A) *z x y x x y x* (B) *x y x y x x z*
(C) x *x y y x x z* (D) *z x x y y x x*

49. Consider the following code segment (which is in a high-level language):

```
int a [1000];
int S1 = S2 = S3 = S4 = 0;
for (i = 0; i < 1000; i++)// loop 1
     a[i] = i + 1;
   for (i = 0;i < 1000; i++)//loop 2
   {
   if(i % 4 = = 0) // cond 1
     S1 + = a[i];
   else
     S2 + = a[i];
   if(i % 2 = = 0) // cond 2
     S3 + = a[i];
   else
     S4 + = a[i];
   }
```

What are the branch prediction accuracies of loop 2, cond 1, cond 2 using a 2-bit counter-based prediction scheme (Assume that initially Predictor has False)?
(A) 100%, 75%, 0% (B) 99.7%, 75%, 50%
(C) 99.7%, 25%, 50% (D) 100%, 25%, 0%

50. Consider a processor *P*1. The CPU has a one-level cache. The cache has 128 Bytes with a block size of 32 Bytes. The cache uses LRU replacement policy. The cache is direct mapped cache. A program is executed on this processor. The program tests only the memory read performance by issuing read requests to the cache. Initially the cache is empty. The cache accesses below blocks in the order from left to right.
A, B, A, H, B, G, H, H, A, E, H, D, H, G, C, C, G, C, A, B, H, D, E, C, C, B, A, D, E, F.
Each letter represents a unique cache block.
When the cache accessed for these blocks (as mentioned above), below cache misses occurred.
A, *B*, *A*, *H*, *B*, *G*, *A*, *E*, *D*, *H*, *C*, *G*, *C*, *B*, *D*, *A*, *F*.
By using this, identify which blocks are competing for same cache block?
I. *A* and *B* II. *A* and *E*
III. *D* and *H* IV. *C* and *F*
(A) I, II, III, IV (B) II, IV
(C) I, III (D) I, III, IV

51. Consider below sequence of instructions which are executed on a 5-stage pipeline having the stages:
Instruction Fetch (IF), Instruction Decode and Register Fetch (ID), Execute (EX), Memory access (MA) and Write Back (WB).
ID can happen in First-phase of clock cycle. WB can happen in the second-phase of the clock cycle.

I_1:	LOAD R_1, 50(R_6)	$R_1 \leftarrow M[50 + R_6]$
I_2:	ADD R_2, R_3, R_1	$R_2 \leftarrow R_3 + R_1$
I_3:	ADD R_1, R_6, R_4	$R_1 \leftarrow R_6 + R_4$
I_4:	STORE R_2, 20(R_4)	$M[20 + R_4] \leftarrow R_2$
I_5:	AND R_1, R_1 R_4	$R_1 \leftarrow R_1 \wedge R_4$

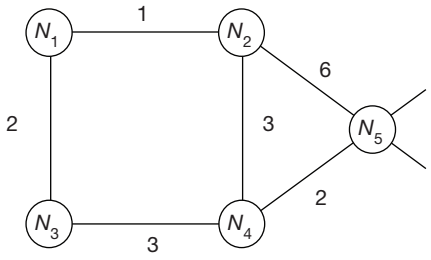
Each stage requires one clock cycle. If there is no forwarding to hazard detection then the number of stalls that occur during the execution of the program is _____.

52. Which of the following language(s) is/are regular?
L_1 = {ω/ω is the binary representation of a number greater than 3}
L_2 = {ω/ω is some string from *L* with exactly one character deleted}. (Here *L* is regular)
$L_3 = \{a^n\ a^n\ a^n \mid n \geq 0\}$
(A) L_1 and L_2 only (B) L_2 and L_3 only
(C) L_1 only (D) L_1, L_2, L_3

53. Consider the following grammar:
$S \rightarrow 0S1 \mid 1X \mid X0$
$X \rightarrow 1X \mid 0X \mid \varepsilon$
Which of the following specifies the language accepted by this grammar?
(A) {ω/ω contains unequal number of 0's and 1's}
(B) {ω/ω contains more number of 1's than 0's}
(C) Complement of the language $\{0^n\ 1^n \mid n \geq 0\}$
(D) {ω/ω contains more number of 0's than 1's}

54. Which of the following language is not context-free but decidable?
I. $\{a^n\ b^m\ a^n\ b^m \mid m, n >= 0\}$
II. {ω ∈ {*a*, *b*}* | The length of ω is odd and first half contains all *a*'s}
III. {ω ∈ {*a*, *b*}* | the number of *b*'s in ω is a multiple of the number of *a*'s in ω}
IV. {ω ∈ {*a*, *b*}* | the number of times '*ab*' appears as a substring is equal to the number of times'*ba*' appears as a substring}
(A) I, III only (B) II, IV only
(C) I, II, III (D) I, II, III, IV

55. Consider the network shown below:



Assume that each node knows the cost to reach its neighbours. By using Distance-vector algorithm, what could be the forwarding table at node N_5?

(A)

Destination	Next hop
N_1	N_2
N_2	N_2
N_3	N_4
N_4	N_4

(B)

Destination	Next hop
N_1	N_4
N_2	N_2
N_3	N_2
N_4	N_4

(C)

Destination	Next hop
N_1	N_4
N_2	N_4
N_3	N_4
N_4	N_4

(D)

Destination	Next hop
N_1	N_2
N_2	N_4
N_3	N_4
N_4	N_2

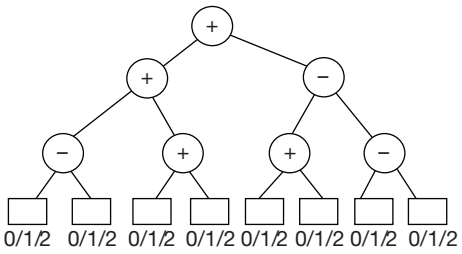
56. Which of the following IP addresses belong to the subnet 137.132.96.0/20?

(i) 137.132.100.0 (ii) 137.132.115.255
(iii) 137.132.102.255 (iv) 137.132.111.0

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

57. Consider the Transmission of a 10000 bit frame on 10 Mbps channel with a propagation delay of 250 ms. The sender window size is 7 and probability of error in single frame is 0.001 then the channel utilization for go-back-N protocol (in percentage) is _____ .

58. Consider the given expression tree, Each leaf represents a numerical value, which can be 0 or 1 or 2. What is the maximum possible value of the tree?



(A) 9 (B) 11
(C) 10 (D) 12

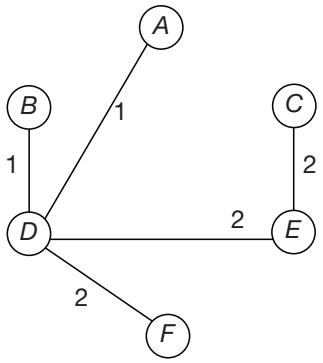
59. Consider the given Recurrence Relation:

$$T(n) = 4T\left(\frac{n}{2}\right) + n^2/\log n$$

What is the time complexity of given recurrence relation?

(A) $\theta(n^2.\log n)$ (B) $\theta(n^3)$
(C) $\theta(n^2.\log.\log n)$ (D) $\theta(n.\log n)$

60. Consider the following weighted undirected graph G,



What is the total weight of minimum spanning tree T, such that the nodes A, B, C must be leaf nodes in the tree T?

(A) 8 (B) 5
(C) 7 (D) 6

61. Consider the following Relation:
Student

RNo	Name

Assume that there are 100 tuples in the student Relation. Both the columns individually contains unique values, then which of the following is correct?

(A) Student Relation is in 1 NF only
(B) Student Relation is in 1 NF, 2 NF only
(C) Student Relation is in 1 NF, 2 NF, 3 NF only
(D) Student Relation is in 1 NF, 2 NF, 3 NF, BCNF

62. In a Relational database there are 3 relations:
Student (Sname)

Department (DName)
Register (Sname, DName)
Which of the following relational algebra expression returns the name of departments that have no students at all?

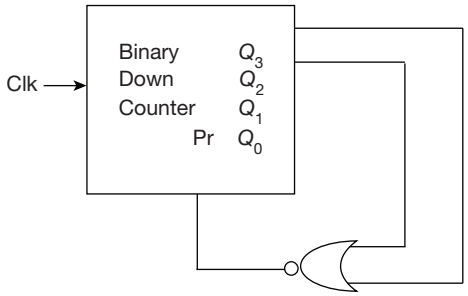
(A) Department – π_{Dname} (Register)
(B) π_{Dname} Department
(C) Department – π_{Dname} ((Student × Department) – Register)
(D) None of the above

63. Let $f(w, x, y, z) = \Sigma m(0, 2, 5, 6, 7, 8, 9, 10, 11, 13, 15)$. Which of the following expressions are not equivalent to f?

(P) $w^1x^1z^1 + w^1yz^1 + xz + wx^1$
(Q) $x^1z^1 + wz + xz + w^1x$
(R) $wz + xz + x^1z^1 + w^1yz^1$
(S) $x^1z^1 + xz + w^1xy + wx^1$

(A) P and Q (B) R only
(C) Q and S (D) Q only

64. A Binary down sequence, asynchronous counter with synchronous and active high present input is shown in following figure. With the decoding logic shown the counter works as a (consider initially all flip flops at preset state)



(A) Mod - 3 counter (B) Mod - 12 counter
(C) Mod - 13 counter (D) Mod - 14 counter

65. Plain Text: THIS TASK IS IMPOSSIBLE
Key: WANTED
Convert the above plain text to cipher text with key being WANTED, by using Transposition cipher.

(A) IISA SSSB TIIC HKOE AMBD TSPL
(B) AMBD HKOE TIIC IISA SSSB TSPL
(C) HKOE AMBD TIIC IISA SSSB TSPL
(D) TIIC HKOE AMBD IISA SSSB TSPL

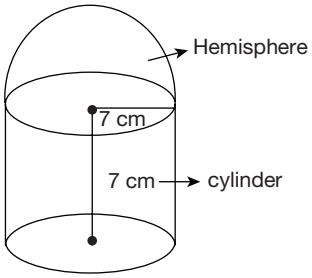
Answer Keys

1. B	**2.** B	**3.** C	**4.** D	**5.** A	**6.** 68	**7.** C	**8.** A	**9.** C	**10.** D
11. B	**12.** 3	**13.** B	**14.** 256	**15.** D	**16.** 10	**17.** A	**18.** 373	**19.** 81	**20.** A
21. C	**22.** C	**23.** C	**24.** D	**25.** A	**26.** B	**27.** A	**28.** C	**29.** B	**30.** C
31. D	**32.** B	**33.** B	**34.** C	**35.** B	**36.** A	**37.** D	**38.** 0.29 to 0.31		**39.** D
40. C	**41.** D	**42.** 42	**43.** A	**44.** A	**45.** B	**46.** C	**47.** B	**48.** D	**49.** B
50. C	**51.** 3	**52.** D	**53.** C	**54.** A	**55.** C	**56.** B	**57.** 1.38	**58.** D	**59.** C
60. A	**61.** D	**62.** A	**63.** D	**64.** C	**65.** C				

Hints and Explanations

1. 'Toxicity' gives the clue to the correct answer. Something which is toxic is detrimental (harmful). Hence it is logical to say that despite its known 'toxicity', lead continues to be used to the detriment of human and environmental health. The word solace (relief; comfort) runs contrary to what is stated in the sentence. The word chagrin (annoyance) is too mild to be used for something which is toxic. The word impediment (hindrance; obstacle) does not make sense here. Choice (B)

2.



Volume of the hemisphere $= \left(\frac{1}{2}\right)\left(\frac{4}{3}\right)\pi r^3$

$= \left(\frac{2}{3}\right)(\pi)(7^3)$

Volume of the cylinder $= \pi r^2 h = 7^3\pi$

Total volume $= (\pi)7^3\left[1 + \frac{2}{3}\right] = \frac{5\pi}{3}(7^3)$ Choice (B)

3. The study of man is called Anthropology. Form the point, "Anthropology is called ornithology", we can say that Ornithology is the word that is used to refer to Anthropology. Choice (C)

4. Biology is the study of life, Mythology is the study of myths. Archaeology is not the study of antiques, it is the specific study of historic or prehistoric peoples and their cultures by analysis of their antifacts, inscriptions, monuments etc, especially those that have been excavated. Astrology is the study that assumes and attempts

to interpret the influence of heavenly bodies on human affairs. Cosmetology is the art or profession of applying cosmetics. Only option D expresses a relationship which is similar to that expressed by the headwords. Choice (D)

5. The reference is to a specific monsoon hence, the definite article 'the' is more appropriate in the first blank. The present perfect continuous tense 'has been showing' is apt in the second blank because here, the reference is to a trend which started sometime in the past and is still continuing. In the third blank, the reference is to something which took place during a specific time period. This is best denoted using the preposition 'over'. The definite article is required in the fourth blank because the reference is to a particular subcontinent. Choice (A)

6. $h\,(12, 11, 8, 16) = 12 \times 11 > 8 \times 16$
$132 > 128$
Remainder when 132 is divided by 128 = 4.
$fg\,(h(12,11,8,16),17,9,16) = fg\,(4,17,9,16)$
$= f\,(4,17,9,16) \times g\,(4,17,9,16)$
$= 17 \times 4 = 68.$
Ans: 68

7. Options A and B run contrary to what is stated. Option D is incorrect because it is not mentioned that the brain and the lymphatic system are connected 'indirectly'. Only option C can be logically inferred from the given sentence. Choice (C)

8. Only statement (i) can be inferred from the given passage. It cannot be inferred from the passage that the government does not consider cyber threats as serious as other security threats. Options (iii) and (iv) are illogicall. Choice (A)

9. There are 33 instances of students leaving out a question (The sum of the 4 numbers in column 5) Exactly 5 students attempted all 4 questions. We distribute there 33 instances over all the remaining 25 students there would be 8 more instances. We can collect them to at the most 8 students.
$\therefore$ The maximum possible number of students who left out at least 2 questions is 8. Choice (C)

10. All I, II and III are appropriate and apt courses of action. Choice (D)

11. The number of ways of selecting one letter each from the words 'FRACTION' and 'DECIMAL' is $8 \times 7 = 56$.
The selected letter in a word will not be in the other word only if the common letters are not selected.
The common letters in the two words are A, C and I.
The number of ways of selecting the letters from the words such that the selected letter in a word should not be in the other word = (The number of ways of selecting a letter from F, R, T, O and N) $\times$ (The number of ways of selecting a letter from D, E, M and L)
$= 5 \times 4 = 20$
$\therefore$ The required probability $= \frac{20}{56} = \frac{5}{14}$. Choice (B)

12. We have $\lim\limits_{x\to 3} \log_3[4x^3 + \sqrt{(3x^4 + 5x^2 + 1)}]$
$= \log_5\left(\lim\limits_{x\to 3}[4x^3 + \sqrt{(3x^4 + 5x^2 + 1)}]\right)$
$= \log_5(108 + \sqrt{289})$
$= \log_5 125$
$= \log_5 5^3$
$= 3$ Ans: 3

13. Given recurrence relation is:
$a_n - a_{n-1} = n^2;\ n \geq 1 \rightarrow (1)$
and $a_0 = 2$
$a_n - a_{n-1} = n^2$
$\Rightarrow \quad a_n = a_{n-1} + n^2$
$\therefore \quad a_1 = a_0 + 1^2$
$a_2 = a_1 + 2^2 = a_0 + 1^2 + 2^2$
$a_3 = a_2 + 3^2 = a_0 + 1^2 + 2^2 + 3^2$
$a_4 = a_3 + 4^2 = a_0 + 1^2 + 2^2 + 3^2 + 4^2$
$a_n = a_{n-1} + n^2 = a_0 + 1^2 + 2^2 + 3^2 + \ldots + n^2$
$= a_0 + \frac{n(n+1)(2n+1)}{6}$
$= 2 + \frac{n(2n^2 + 3n + 1)}{6}$
$= \frac{2n^3 + 3n^2 + n + 12}{6}$ Choice (B)

14. Given $A = \{1, \{2, 3\}, 4\}$
$\therefore$ The cardinality of the set $P(A)$ = Numbers of elements in $P(A) = 2^{n(A)} = 2^3 = 8$
$\therefore$ The cardinality of $P(P(A)) = 2^{n(P(A))} = 2^8 = 256$.
Ansr: 256

15. We have negation of $(\forall x)\,(P(x) \rightarrow Q(x, y))$
$\Leftrightarrow \neg[(\forall x)\,(P(x) \rightarrow Q(x, y))]$
$\Leftrightarrow \neg(\forall x)\,(\neg Q(x, y) \rightarrow \neg P(x))$
$(\because A(x) \rightarrow B(x) \Leftrightarrow \neg B(x) \rightarrow \neg A(x))$
which is same as option (A)
$\Leftrightarrow (\exists x)\,\neg(\neg(\neg Q\,(x, y)) \vee \neg P(x))$
$(\because \neg(\forall x)\,A(x) \Leftrightarrow (\exists x)\,\neg A\,(x)$
and $A(x) \rightarrow B(x) \Leftrightarrow \neg A\,(x) \vee B(x))$
$\Leftrightarrow (\exists x)\,(\neg Q(x, y)\ \neg P(x))$
$(\because \neg(\neg A\,(x)) \Leftrightarrow A(x)$ and $\neg(A\,(x) \vee B(x))$
$\Leftrightarrow (\neg A\,(x) \wedge \neg B(x)))$
$\Leftrightarrow (\exists x)\,(P(x) \wedge \neg Q\,(x, y))$
$(\because A(x) \wedge B(x) \Leftrightarrow B(x) \wedge A\,(x))$
which is same as option (C)
Also, consider $\neg((\forall x)\,(P(x) \rightarrow Q(x, y)))$
$\Leftrightarrow (\exists x)\,\neg(P(x) \rightarrow Q(x, y))$
Which is same as option (B)
And the predicate formula given in option (D) is NOT equivalent to the negation of $(\forall x)\,(P(x) \rightarrow Q(x, y))$
Choice (D)

16. Given program prints number of 1's in the binary representation of given number (i.e., 'x'). As x =1023 it prints 10. Ans: 10

17. Choice (A)

18. Address $(A[5]) = 209 + (50 - (-32) \times 2$
$= 209 + (82) \times 2$
$= 373$

Ans: 373

19. Record 9 will start at byte
$((9-1) \times 10) + 1$
$= 80 + 1 = 81$

Ans: 81

20. Kill any 1 process to make the system safe.

Choice (A)

21. Choice (C)

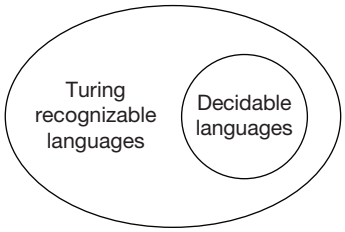
22. Choice (C)

23. The developed NextGenRAM has an advantage over DRAM, as it is non-volatile.
Also NextGenRAM has an advantage over SRAM, as it has lower cost than SRAM. Choice (C)

24. A 2-level global branch prediction is micro-architecture level Design choice. Choice (D)

25. Given, $L_1 = \{a^n b^n \mid n \in N\}$
$L_2 = \{b^n a^n \mid n \in N\}$
$\Rightarrow \quad L_1 \cap L_2 = \varnothing$
and $\varnothing$ is regular so $L_1 \cap L_2$ is regular. Choice (A)

26. Decidable languages are subset of Turing recognizable languages.



Choice (B)

27. The address used by hosts during booting is 0.0.0.0.

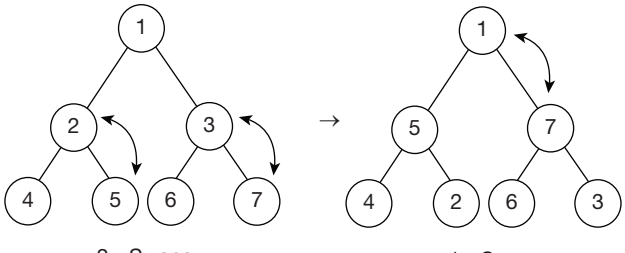
Choice (A)

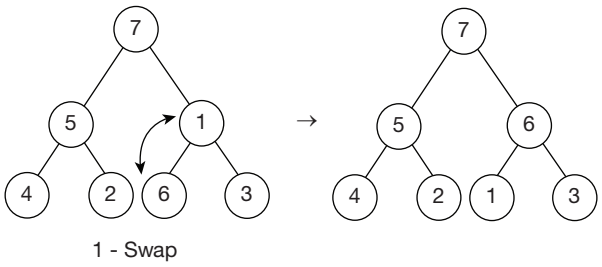
28. A repeater can't connect two LANs. It is used to connect two segments of the same LAN. Choice (C)

29. Load factor $(\alpha) = \dfrac{\text{Number of elements}}{\text{Number of slots}} = \dfrac{5000}{40} = 125$

Choice (B)

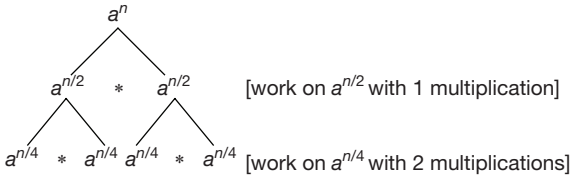
30. Given elements 1, 2, 3, 4, 5, 6, 7
First construct a complete binary tree with the given sequence,





$\therefore$ 4-Swaps required to convert the tree into MAX-HEAP. Choice (C)

31.



At each level we consider only 'half' problem, so the recurrence relation would be

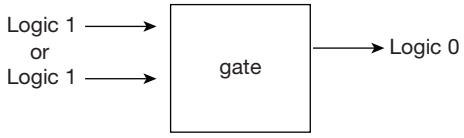
$$T(n) = T\left(\frac{n}{2}\right) + C$$ Choice (D)

32. B is weak entity set, it should be associated with the attributes of strong entity set that is A. Choice (B)

33. If no specific condition is given, the query will return cross product of student and department. Choice (B)

34. Functionally complete set are
(NOT, AND) and (NOT, OR) Choice (C)

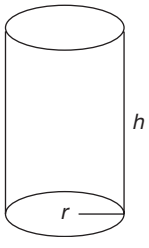
35. The boiler temperature or pressure when exceeds a specific maximum value, then alarm has to be activated. Pressure, temperature sensors produce HIGH voltage (Logic 1) when exceeds maximum value. Alarm requires low voltage (Logic 0) to get activated.



The above circuit can be implemented by NOR gate.

Choice (B)

36.



Let r and h be the radius and height of the cylindrical cistern with surface = 108π sq. feet

$\therefore \quad 2\pi rh + \pi r^2 = 108\pi$

$\Rightarrow \quad 2rh = 108 - r^2$

$\Rightarrow \quad h = \dfrac{108 - r^2}{2r} \rightarrow (1)$

Volume of the cylindrical cistern = $C = \pi r^2 h$

$= \pi r^2 \left(\dfrac{108 - r^2}{2r} \right)$

$\therefore \quad V = \dfrac{\pi}{2}(108r - r^3) \rightarrow (2)$

Let $f(r) = \dfrac{\pi}{2}(108r - r^3)$

$\therefore$ We have to find the maximum value of V.

$f'(r) = \dfrac{\pi}{2}(108 - 3r^2)$

$f'(r) = 0$

$\Rightarrow \quad \dfrac{\pi}{2}(108 - 3r^2) = 0$

$\Rightarrow \quad 108 - 3r^2 = 0$

$\Rightarrow \quad r^2 = 36 \quad \Rightarrow \quad r = 6$

And $f''(r) = -3\pi r < 0$ for $r = 6$

$\therefore$ $f(r)$ is maximum at $r = 6$

Hence the maximum volume of the cistern

$= V$ at $x = 6$

$= \dfrac{\pi}{2}(108 \times 6 - 6^3)$

$= 216\pi$ cubic feet. Choice (A)

37. Given –1, 2 and 5 are the eigenvalues of A.

$\therefore$ $-1 + 2, 2 + 2$ and $5 + 2$ are the eigenvalues of $A + 2I_3$

i.e., 1, 4 and 7 are the eigenvalues of $A + 2I_3$

$\therefore$ Det $(A + 2I_3) = |A + 2I_3|$ = Product of the eigenvalues of $A + 2I_3$

$= 1 \times 4 \times 7 = 28$

$\Rightarrow$ Determinant of inverse of $A + 2I_3$

$= |(A + 2I_3)^{-1}| = \dfrac{1}{|A + 2I_3|} = \dfrac{1}{28}$ Choice (D)

38. Let B_1 and B_2 denote the events of selecting an engineering graduate and a science graduate respectively.

Let A be the event of selecting a youngster who is self employed.

$\therefore \quad P(B_1) = \dfrac{60}{100} = 0.6, P(B_2) = \dfrac{40}{100} = 0.4$

$P(A/B_1) = \dfrac{45}{100} = 0.45$ and $P(A/B_2) = \dfrac{30}{100} = 0.3$

If the youngster selected is found to be self employed, then the probability that the person is a science graduate

$$= P(B_2/A) = \frac{P(B_2) \cdot P\left(\frac{A}{B_2}\right)}{P(B_1) \cdot P\left(\frac{A}{B_1}\right) + P(B_2) \cdot P\left(\frac{A}{B_2}\right)}$$

(By Baye's Theorem)

$$= \frac{0.4 \times 0.3}{(0.6 \times 0.45) + (0.4 \times 0.3)} = \frac{12}{39} = 0.3077$$

Ans: 0.29 to 0.31

39. We know that, one can define a function from any finite non-empty set to any finite non-empty set.

One can define a one-one function from A to B, only if $n(A) \le n(B)$.

One can define an onto function from A to B only if $n(A) \ge n(B)$.

Hence options (A), (B) and (C) are not true.

One can define a bijection from A to B, if $n(A) = n(B)$.

$\therefore$ The number of bijections from $A = \{a, b, c, d, e\}$ to $B = \{p, q, r, s, t\}$ is 5! = 120. Choice (D)

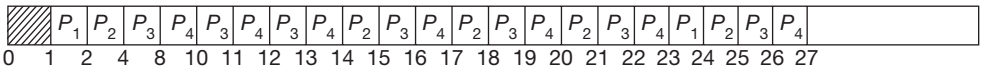
40. We know that the chromatic number of a cycle graph of odd order is 3, a wheel graph of even order is 4 and a bipartite graph as well as a tree is 2.

$\therefore$ The correct matching is

$P - 2, Q - 2, R - 1$ and $S - 1$ Choice (C)

41. fun (6) prints 1 2 3 4 5. Choice (D)

42.



In this way process P_3 completes 42 Ans: 42

43. Page size = $\forall P$" Mb

$= 2^{20 + \log_x^p}$

Bits required for page = $(20 + \log_2 P)$ bits

Number of frames $= 2^{[F - (20 + \log_2 P)]}$

Number of pages $= 2^{[L - (20 + \log_2 P)]}$

Page table size $= [F - 20 - \log_2 P] * 2^{[L - (20 + \log_2 P)]}$ bits

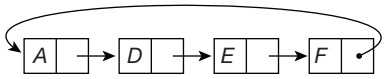
Choice (A)

44. Need matrix = max – Allocated

	R_1	R_2	R_3	R_4	R_5
P_1	0	1	1	0	1
P_2	1	1	1	0	0
P_3	1	0	0	0	0
P_4	1	1	1	0	0
P_5	1	1	1	0	0

Choice (A)

45. It deletes two elements. The resultant list will be

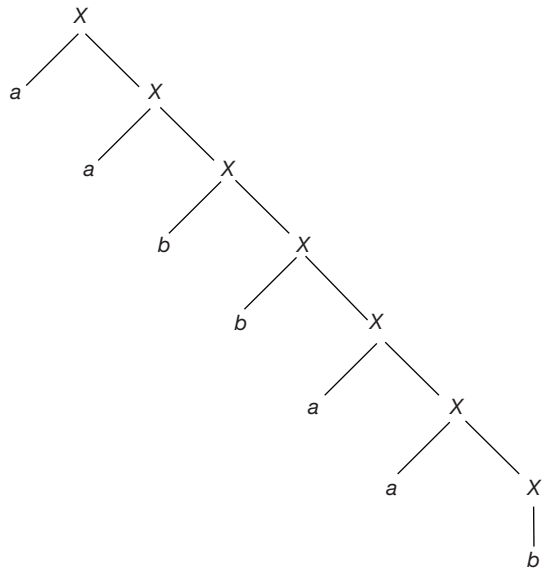


Choice (B)

46. Choice (C)

47. Given grammar is SLR(1) but not LL(1). Choice (B)

48.



Choice (D)

49. Using a 2-bit counter-based prediction scheme, the predictor will be initially False.
This scheme needs two consecutive wrong predictions to change its prediction.
For loop 2, first two predictions are *F* and *F*. And in 3rd prediction it predicts *T*. This prediction continues till $i = 1000$. But this is wrong prediction.

$\therefore$ In total 1001 predictions, 3 are wrong predictions.

$\therefore$ prediction accuracy for loop 2 is $\frac{998}{1001} \times 100 = 99.7\%$

For cond 1, which is tested for 1000 times, correct predictions using 2-bit predictor is 750.
Initially the predictor has Not-taken. (NT). Then the 2-bit predictor will not change to Taken, until two successive mis-predictions happen. But this will never happen.
The predictor mis-predicts 250 times. (1000/4 = 250).

$\therefore$ Cond 1 prediction accuracy $= \frac{750}{1000} \times 1000 = 75\%$.

For cond 2, which is tested for 1000 times, correct predictions using 2-bit predictor is 500.
Initially the predictor has Not-taken. Then the 2-bit predictor will not change to taken until two successive Mis-predictions happen. But this will never happen.

$\therefore$ The predictor Mis-predicts 500 times. (1000/2 = 500).

$\therefore$ Cond 2 prediction accuracy $= \frac{500}{1000} \times 100 = 50\%$.

Choice (B)

50. Required cache blocks by the program are:
A, *B*, *A*, *H*, *B*, *G*, *H*, *H*, *A*, *E*, *H*, *D*, *H*, *G*, *C*, *C*, *G*, *C*, *A*, *B*, *H*, *D*, *E*, *C*, *C*, *B*, *A*, *D*, *E*, *F*.
Cache has 128 Bytes.
Block size = 32 Bytes.

Blocks in cache $= \frac{128}{32} = 4$.

Misses occurred for the blocks:
A, *B*, *A*, *H*, *B*, *G*, *A*, *E*, *D*, *H*, *C*, *G*, *C*, *B*, *D*, *A*, *F*.
As there is a miss for *A* (in 3rd position), we can understand that both *A* and *B* are competing for same block location.
D and *H* are competing for same block (as after accessing *D*, we are getting a miss for *H*).
C and *G* are competing for same block (as after accessing *C*, we are getting a miss for *G*).
E and *F* are competing for the same block.

Choice (C)

51. The pipeline diagram during the execution of the program is shown below:

	1	2	3	4	5	6	7	8	9	10	11	12
I_1	IF	ID	EX	MA	WB							
I_2		IF	Stall	Stall	ID	EX	MA	WB				
I_3			IF			ID	EX	MA	WB			
I_4				IF			Stall	ID	EX	MA	WB	
I_5					IF				ID	EX	MA	WB

$\therefore$ 3-stalls occur during the execution.
I_2 stalled till R_1 value is available. I_4 stalled till R_2 is available.

Ans: 3

52. L_1 is regular and its regular expression is
0* 1 (0 + 1) (0 + 1) (0 + 1)*
L_2 is regular. We can check this by taking an example regular language.

If L contains even number of 1's then L_2 contains odd number of 1's (by deleting '1' from all the strings of L).
L_3 is regular. It can be written as, $\{a^{3n} \mid n \geq 0\}$.
i.e., L_3 contains number of a's which is a multiple of a.
Choice (D)

53. Given grammar,
$S \rightarrow 0S1 \mid 1X \mid X0$
$X \rightarrow 1X \mid 0X \mid \varepsilon$
Let us derive some strings from given productions:

$S \rightarrow 0S1$
$\rightarrow 01X1$
$\rightarrow 011$
$n_0(\omega) < n_1(\omega)$

$S \rightarrow 0S1$
$\rightarrow 0X01$
$\rightarrow 001$
$n_0(\omega) > n_1(\omega)$

$S \rightarrow 0S1$
$\rightarrow 01X1$
$\rightarrow 010X1$
$\rightarrow 010X1$
$\rightarrow 0101 \Rightarrow n_0(\omega) = n_1(\omega)$

$S \rightarrow 1X$
$\rightarrow 11X$
$\rightarrow 11$

The strings can start with either 0 or 1. From these derivations, we can conclude that given grammar is complement of $\{0^n 1^n \mid n \geq 0\}$ Choice (C)

54. $\{a^n b^m a^n b^m \mid m, n >= 0\}$
This language is decidable but not context-free. The PDA can't check this kind of equality. (Let the PDA pushed n a's and m b's onto the stack but next it has to compare m b's with n a's. So this is not CFG).
$\{\omega \in \{a, b\}^* \mid$ the length of ω is odd and the first half is all a's$\}$:
We can design a FA which checks whether the length of a string is odd or not. So is CFG. But checking whether the first half is all a's or not is done by using a stack memory.
Hence this is CFL.
$\{\omega \in \{a, b\}^* \mid$ the number of b's in ω is a multiple of the number of a's in $\omega\}$:
This is not CFL. But is decidable. A non-deterministic TM is required to guess the multiple k such that the number of b's is k times the number of a's.
$\{\omega \in \{a, b\}^* \mid$ the number of times 'ab' appears as a substring is equal to the number of times 'ba' appears as a substring$\}$:
This is regular. The regular expression is given as $\varepsilon + a(a + bb^* a) + b(b + aa^* b)^*$.
Hence the correct choice is (A). Choice (A)

55. Using Distance vector routing, the initial distance table entries are shown below:

Neighbours	N_1	N_2	N_3	N_4	N_5
N_2	∞	∞	∞	∞	∞
N_4	∞	∞	∞	∞	∞
N_5	∞	6	∞	2	0

Neighbours	N_1	N_2	N_3	N_4	N_5
N_2	1	0	∞	3	6
N_4	∞	3	3	0	2
N_5	7	5	5	2	0

Neighbours	N_1	N_2	N_3	N_4	N_5
N_2	1	0	3	3	5
N_4	4	3	3	0	2
N_5	6	5	5	2	0

Neighbours	N_1	N_2	N_3	N_4	N_5
N_2	1	0	3	3	5
N_4	4	3	3	0	2
N_5	6	5	5	2	0

For warding table of N_5:

Destination	Next hop
N_1	N_4
N_2	N_4
N_3	N_4
N_4	N_4

Choice (C)

56. Given subnet 137.132.96.0/20.
IP address is 137.132.96.0
Its Binary equivalent is
10001001.10000100.01100000.00000000
Subnet mask is /20. i.e., the IP address of mask is
11111111.11111111.11110000.00000000
So the address range using this mask is 137.132.96.0 to
10001001.10000100.01101111.11111111
i.e., from 137.132.96.0 to 137.132.111.255
only (i), (iii) and (iv) are in this range. Choice (B)

57. Channel utilization for go-back-N protocol is

$$= \frac{N(1-P)}{(1+2a)(1-P+NP)}$$

N is window size.
P is probability of error in a frame

$$a = \frac{\text{Propagation delay}}{\text{Transmission delay}}$$

$$\text{Transmission delay} = \frac{10000}{10 \times 10^6} = 1 \text{ msec}$$

$$a = \frac{250}{1} = 250$$

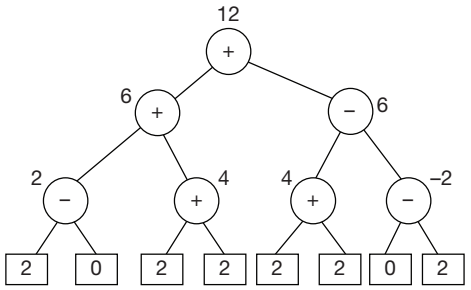
Channel utilization

$$= \frac{7 \times (1 - 0.001)}{(1 + 2 \times 250)(1 - 0.001 + 7 \times 0.001)} = \frac{6.993}{504.006}$$

$= 0.0138$

$\cong 1.38\%$ Ans: 1.38

58.



The maximum possible value of the tree is 12.

Choice (D)

59. $T(n) = 4T\left(\frac{n}{2}\right) + \frac{n^2}{\log n} \Rightarrow 4T\left(\frac{n}{2}\right) + n^2 \log^{-1} n$

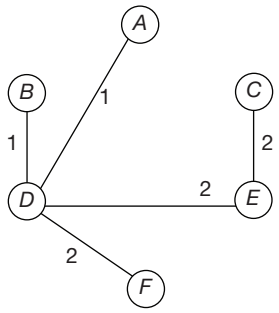
Compare the given Relation with

$T(n) = aT\left(\frac{n}{b}\right) + n^k \log^p n$

If $p = -1$, then according to master method time complexity is $T(n) = \theta(n^{\log_b^a} \cdot \log \cdot \log n)$

$= \theta(n^2 \cdot \log \cdot \log n)$ Choice (C)

60. Minimum spanning Tree T:



Leaf node:

The degree of node must be 1.

In the Tree $T(A, B, C)$ nodes are leaf nodes.

Total weight = 2 + 2 + 2 + 1 + 1 = 8 Choice (A)

61. A Relation with only two attributes with unique values will be in 1 NF, 2 NF, 3 NF, BCNF.

Student

RNo	Name

Case 1:

It can have one FD

RNo → Name

It is in 1 NF, 2 NF, 3 NF, BCNF.

Case 2:

It can have one FD

Name → RNo

It is in 1 NF, 2 NF, 3 NF, BCNF.

Case 3:

It can have 2 FDs.

RNo → Name

Name → RNo

It is in 1 NF, 2 NF, 3 NF, BCNF Choice (D)

62. Assume some data:

Student

SName
A
B
C

Department

DName
Sales
Tax
Finance

Register

Sname	**DName**
A	Sales
B	Tax

Department π_{Dname} (Register)

DName
Sales
Tax
Finance

−

DName
Sales
Tax

=

DName
Finance

In the Finance department, there are no students.

Choice (A)

63. Minterms of P

$w^1x^1z^1 + w^1yz^1 + xz + wx^1$

00×0 0×10 ×1×1 10××

0, 2 2, 6 5,7,13,15 8,9,10,11

$\Sigma m(0, 2, 5, 6, 7, 8, 9, 10, 11, 13, 15)$

min terms of Q

$x^1z^1 + wz + xz + w^1x$

$x0x0$ $1xx1$ $x1x1$ $01x\,x$

0, 2, 8, 10 9, 11, 13, 15 5, 7, 13, 15 4, 5, 6, 7

$\Sigma m(0, 2, 4, 5, 6, 7, 8, 9, 10, 11, 13, 15)$

which is not equal to f

Choice (D)

64.

Clk	Q_3	Q_2	Q_1	Q_0	Preset = $\overline{Q_3 + Q_2}$
0	1	1	1	1	0
1	1	1	1	0	0
2	1	1	0	1	0
:	:	:	:	:	:
:	:	:	:	:	:
10	0	1	0	1	0
11	0	1	0	0	0
12	0	0	1	1	1
13	1	1	1	1	0

Active high preset, so when output of NOR gate is 1, then preset activated, and output becomes 1111 in next clk pulse (synchronous input)

From the above table, we can understand that after 13 clk pulses the counter came to original state. So it is Mod 13 counter Choice (C)

65.

6	1	4	5	3	2
W	*A*	*N*	*T*	*E*	*D*
T	*H*	*I*	*S*	*T*	*A*
S	*K*	*I*	*S*	*I*	*M*
P	*O*	*S*	*S*	*I*	*B*
L	*E*	*A*	*B*	*C*	*D*

Give the numbering to the letters in the keyword. Plain text is written as it is. If some gaps are there, fill it with *A*, *B*, C, ..., *Z*

In the cipher text, the letters under Number 1 column would appear first then Number 2 column and so on

1. HKOE 2. AMBD
3. TIIC 4. IISA
5. SSSB 6. TSPL Choice (C)