Mock Test 3

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*:** Select the pair that best expresses a relationship similar to that expressed in the pair:

1. Road : Footpath
(A) Drawing room : Kitchen
(B) River : Riverbank
(C) Box : Lock
(D) Window : Shutter

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

2. What is the total weight of 25 discs?
Statements:
I. Two-fifth of the weight of a disc is 13 kg.
II. The weights of no two discs are equal.
(A) Statement I alone is sufficient.
(B) Statement II alone is sufficient.
(C) Combining I and II sufficient.
(D) Both statements I and II together are not sufficient.

3. A function $f(x)$ is linear and has a value of 50 at $x = -4$, and a value of 6 at $x = 7$. The value of the function at $x = 8$ is _____.

***Directions for question* 4:** Fill in the blank with the correct idiom or phrase:

4. An upholder of the truth will never hesitate _____ .
(A) to let the grass grow under one's feet
(B) to see red
(C) to throw in the towel
(D) to call a spade a spade

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

5. The five corporate offices of *HUL* are located in five metros namely *A*, *B*, *C*, *D* and *E*. *E* is 5 km to the North-east of *A*, and is 2 kms to the South-east of *B*. *D* is 5 km to the North-east of *B*. *DE* = _____.
(A) 6.92 km (B) 29 km
(C) 47.27 km (D) 5.39 km

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

6. (A) In the olden days, people used to worship the nature.
(B) In the olden days, people used to be worshipping nature.
(C) In the olden days, people worshipped nature.
(D) In the olden days, people used to be worshipping the nature.

Directions for question 7: Read the following paragraph and choose the correct statement:

7. One can understand, although one cannot excuse, a frightened person misbehaving, even though there was no real reason for his fright. But what amazed and angered India was the contemptuous justification of the deed when General Dyer, who had been responsible for the firing at Amritsar, and his subsequent barbarous neglect of the thousands of wounded. "That was none of my business", he had said. Some people in England and in the British government mildly criticized Dyer, but the general attitude of the British people was displayed in a debate at the House of Lords, in which praise was showered on him. All this fed the flame of wrath in India, and a great bitterness rose all over the country.
(A) General Dyer is an example of a frightened person misbehaving.
(B) The general attitude of the British people was displayed in the fact that the victims of the massacre received a fair trial.
(C) When the British government saw a great movement uprising in India, their fears grew.
(D) General Dyer's actions can neither be understood nor excused.

Directions for questions 8: The following question is based on a short argument, a set of statements, or a plan of action. For each question, select the best answer from the given choices.

8. The coolant Freon used in refrigerators was found to damage the ozone layer of the earth. Hence an urgent need was felt to substitute Freon with some other coolant which will not damage the ozone layer.
Which of the following can be a direct inference from the above statements?
(A) A coolant cheaper than Freon is available for use in the refrigerator.
(B) Coolants which do not have any damaging effects are available for use in the refrigerators.
(C) The ozone layer is on the verge of extinction.
(D) Preserving the ozone layer intact is essential for the inhabitants of the earth.

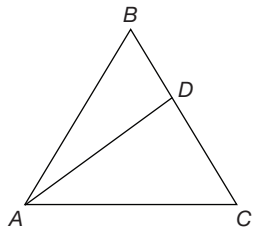
***Directions for question 9*:** In the following question, the first and the last sentence of a passage are in order and numbered 1 and 6. The rest of the passage is split into 4 parts and numbered 2, 3, 4 and 5. These 4 parts are not arranged in the proper order. Read the sentences and arrange them in a logical sequence to make a passage and choose the correct sequence from the given options.

9. 1. Upon the same tree there are two birds of beautiful plumage, most friendly to each other.
2. This is the picture of the human soul.
3. One of the birds is eating fruits noisily while the other is sitting calm and silent without eating.
4. But the other one on top is calm and majestic.
5. The one on the lower branch is eating sweet and bitter fruits and is becoming sad and happy by turns.
6. Man is eating sweet and bitter fruits of this life, pursuing gold, sensory pleasures and the vanities of life so he is immersed in sorrow.

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

***Directions for question 10*:** Select the correct alternative from the given choices.

10.



In triangle ABC, AD is the angle bisector of $\angle BAC$. $\angle CAD = 60°$ $AB = 10$ cm and $CA = 12$ cm. Find the length of AD.

(A) 5 cm (B) 5.45 cm
(C) 4.55 cm (D) 4.03 cm

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. If 10 apples are to be distributed among Mahesh, Naresh and Ramesh, then the probability that Mahesh and Naresh together get exactly 7 apples is _____.

(A) $\left(\frac{2}{3}\right)^{10}$ (B) $15\times\left(\frac{2}{3}\right)^{10}$
(C) $5\times\left(\frac{2}{3}\right)^{10}$ (D) $3\times\left(\frac{2}{3}\right)^{10}$

12. If p and q are any two statement variables and T_o and F_o denote tautology and contradiction respectively, then which of the following is NOT equivalent to p?

(A) $p \wedge (p \vee q)$ (B) $p \wedge T_o$
(C) $p \wedge F_o$ (D) $p \vee (p \wedge q)$

13. The value of the definite integral $\int_1^5 \frac{\sqrt{x+5}}{\sqrt{x+5}+\sqrt{11-x}}\,dx$ is _____.

14. For a non-empty set L, if $(L, *, \oplus)$ is a lattice with $*$ and $\oplus$ as binary operations on L and if $a, b, c \in L$, then which of the following NEED NOT be true?

(A) $a * b = b * a$
(B) $a \oplus (b \oplus c) = (a \oplus b) \oplus c$
(C) $a * (a \oplus b) = a$
(D) $a \oplus (b * c) = (a \oplus b) * (a \oplus c)$

15. Consider two automobile companies Alpha Motors and Beta Motors that manufacture the bikes "Zigma" and "Harze" respectively. Zigma comes in three models, six colours, four engine sizes and two transmission types where as Harze comes in four models, five colours, three engine sizes and two transmission types. If Rakesh wants to buy a bike that is either a Zigma or a Harze, then different choices for him is the number of _____.

16. What is the number of distinct binary trees with 3 nodes (labelled as A, B, C) when traversed in post-order gives the sequence B, C, A?

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

17. What is the time complexity of the following Recurrence relation?

$$T(n) = \begin{cases} 2 & \text{if } n = 1 \\ 3T\left(\frac{n}{4}\right) & \text{if } n > 1 \end{cases}$$

(A) $\theta(n)$
(B) $\theta(\log n)$
(C) $\theta(n \log n)$
(D) $\theta(n^{3/4})$

18. Consider the following:
I. Multi-valued attributes must be represented by separate relations.
II. Composite attributes are represented only by their simple component attributes in the basic relational model.

Which of the following is TRUE?

(A) I is related to 1NF
(B) II is related to 2NF
(C) I and II are related to 1NF
(D) I is related to 2NF

19. A transaction T_1 updates item A and then fails before completion, so the system must change A back to its original value. Before it can do so, Transaction T_2 reads the temporary value of A, which will not be recorded permanently in the database because of failure of T_1. The problem described above is _____.
(A) The lost update problem
(B) Dirty Read problem
(C) The Incorrect summary problem
(D) Unrepeatable read problem

20. Consider a disk with following specifications:
Block size = 512 bytes
Inter block gap size = 64 bytes
Blocks per track = 20
Tracks per surface = 400
What is the total capacity of a track?
(A) 10240 bytes
(B) 1280 bytes
(C) 11520 bytes
(D) 11250 bytes

21. Consider an m-way set-associative cache with 's' number of slots (or blocks), with a block size of 'b' bytes. The main memory address has n-bits. Then which of the following gives the number of tag bits in the address?
(A) $n - \log(s/m) - \log(b/m)$
(B) $n - \log b$
(C) $n - \log s - \log b$
(D) $n - \log(s/m) - \log b$

22. The bus cycle time of a 32-bit micro-processor is same as that of a 16-bit microprocessor. The instructions and operands mix has 20% of 32-bit long instructions, 50% of 16-bit long and 30% of 8-bit long. The percentage of improvement achieved by fetching these instructions and operands with 32-bit microprocessor over 16-bit micro processor (specify two places after decimal point) is _____.

23. Consider the set of all words over the alphabet $\{a, b, c\}$ where the number of b's is not divisible by 3 or 5 and no 'c' appears after 'a'. This language is:
(A) Regular
(B) Context-free but not regular
(C) Recursive but not context-free
(D) Recursively enumerable but not Recursive

24. Let L_1 and L_2 are languages over an alphabet Σ such that $L_1 \subseteq L_2$. Then which of the following is always TRUE?
I. If L_2 is regular, then L_1 must be regular.
II. If L_1 is regular, then L_2 must be regular.
III. Either both L_1 and L_2 are regular or L_1, L_2 are Not Regular.
(A) I only (B) II only
(C) I, III only (D) None of these

25. Consider the *CRC* generator function:
$x^{10} + x^9 + x^6 + x^3 + 1$
The (maximum) number of bits in the resulting frame check sequence will be _____.

26. Consider an Ethernet wire which has a propagation speed of 2×10^8 m/s. If the size of network is 1000 m and data transmission rate is 100 Mbits/sec, then the minimum packet size needed to detect collision is _____.

27. Consider the code fragment:

```
i = 0 ;  j = 0 ;  k = 0 ;
for (x =1; x < = 100;  x = x + 1)
{
k = k + x ;
if ((x % 2) = = 0)
{
i = i + x;
}
else
{
j = j + x;
}
}
```

The value of 'k' at the end of the loop will be:
(A) $k < i + j$ (B) $k > i + j$
(C) $k = i + j$ (D) none of the above

28. Consider a complete graph 'G' of 8 vertices. Simple path in a graph is one in which no vertex is repeated. Let x, y, z be 3 distinct vertices in 'G'. The simple paths from x to y going through 'Z' will be _____.

29. Consider a lower triangular matrix $A[10][10]$ (array indices starts from 1), if the elements are stored in Row major order and each data element takes 1 byte of storage. If the base address is 1000, then the address of $A[8][3]$ is _____.

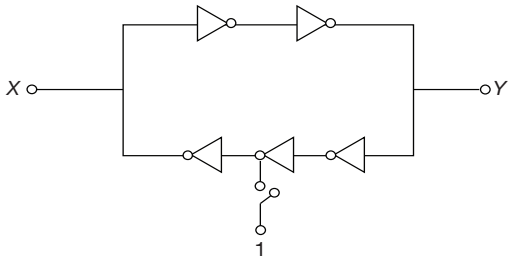
30. Consider the logical address space of 16 pages of 1024 bytes each, mapped onto a physical memory of 64 frames. How many bits are there in logical address?
(A) 4 (B) 10
(C) 14 (D) 6

31. Consider the page references 1, 3, 5, 6, 3, 1, 3, 5
Assume that main memory can accommodate 3 pages and the main memory already has the pages 1 and 3 with page 1 having been brought earlier than page 3. If LRU algorithm is used, then number of page faults that occur would be _____.

32. Consider the following three address code:
(1) $x = 1$ (2) $y = 1$
(3) if $x > i$ goto (9) (4) $y = y * x$
(5) $y = 10$ (6) $t = y * x$
(7) $x = t$ (8) goto (3)
(9) END
The number of basic blocks for above code is _____.

33. Which of the following statement is FALSE?
(A) In *L*-Attributed Syntax Directed Translations (SDT) attributes are evaluated using Depth first Search (Right to left) process.
(B) Every *L*-attribute can be converted into *S*-attribute.
(C) In *S*-attributed SDT, attributes are evaluated during Top down (or) Bottom up parsing.
(D) None of the above

34. In the circuit shown below, the switch is momentarily closed and then opened. Assuming the logic gates to have equal non-zero delay, at steady state, the logic states of *X* and *Y* are:



(A) *X* is latched to 0, *Y* is latched to 0
(B) *X* is latched to 0, *Y* toggles continuously
(C) *X* toggles continuously, *Y* is latched to 0
(D) *X* and *Y* both toggle continuously

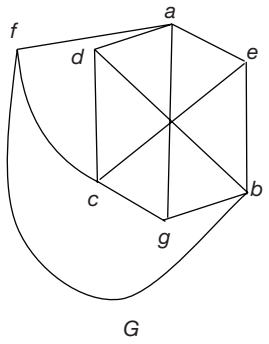
35. A semi-conductor RAM has 16 bit address register and an 8 bit data register. The total number of bits in the memory is:
(A) 1,024 bits
(B) 4,096 bits
(C) 5,24,288 bits
(D) 10,48,576 bits

36. If $P = \begin{bmatrix} 2 & 131 & -243 & 566 \\ 0 & -2i & 174 & -237 \\ 0 & 0 & 2i & 0 \\ 0 & 0 & -713 & -2 \end{bmatrix}$ then which of the following is equal to $16P^{-1}$, where P^{-1} is the inverse of the matrix *P*?
(A) P^2 (B) $P^2 + 16P$
(C) P^3 (D) $P^3 + 16P^2 + P$

37. In a PSU (Public Sector Undertaking), if an employee is selected at random, then
(i) Probability that the employee has a Two Wheeler (TW) or a Four Wheeler (FW) is $\frac{7}{10}$
(ii) Probability that the employee has both a TW and a FW is $\frac{2}{5}$ and
(iii) Probability that the employee has a TW given that the employee has a FW is $\frac{2}{3}$.
Then the probability that the randomly selected employee has a TW is _____.
(A) $\frac{3}{5}$ (B) $\frac{1}{2}$
(C) $\frac{1}{3}$ (D) $\frac{1}{4}$

38. In a men's hostel of a central university, out of 200 students who can speak atleast one of the three languages viz., Hindi, Punjabi and Gujarati, 120 students can speak Hindi, 35 students can speak both Hindi and Punjabi and 40 students can speak both Hindi and Gujarati but can't speak Punjabi. Then the number of students who can speak only Hindi is _____.
(A) 45 (B) 30
(C) 40 (D) 25

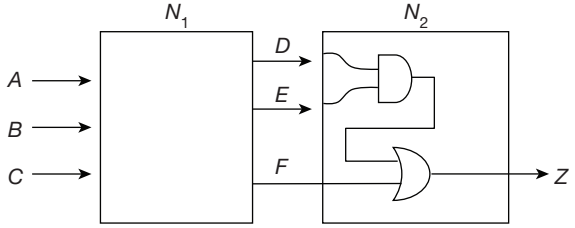
39. The chromatic number of the following graph *G* is _____.



G

40. Which of the following two statements is/are TRUE?
P: If $f(x)$ is continuous in $[a, b]$ then $f(x)$ assumes every value between $f(a)$ and $f(b)$
Q: If a function $f(x)$ assumes every value between $f(a)$ and $f(b)$, then $f(x)$ is continuous in $[a, b]$.
(A) *P* only
(B) *Q* only
(C) Both *P* and *Q*
(D) Neither *P* nor *Q*

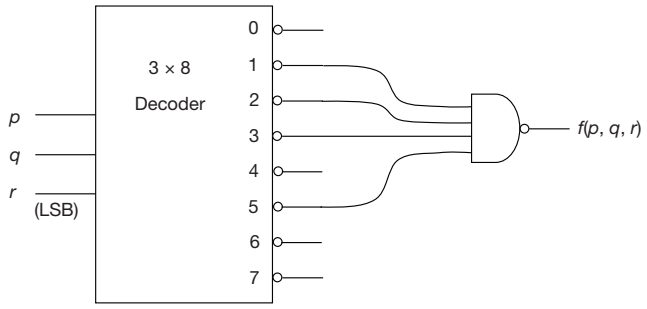
41. A combinational circuit is divided into two sub sections N_1 and N_2 as shown. The truth table of N_1 is given. Assume that the input combinations $ABC = 101$, and $ABC = 001$ never occur. Find the output expression for *Z*.



A	B	C	D	E	F
0	0	0	0	0	1
0	0	1	1	0	0
0	1	0	1	1	0
0	1	1	1	1	1
1	0	0	0	0	0
1	0	1	1	0	1
1	1	0	0	1	1
1	1	1	0	1	0

(A) $\bar{A}B + \bar{A}\bar{C} + B\bar{C}$ (B) $\bar{A} + \bar{B}C$
(C) $\bar{A} + B\bar{C}$ (D) $\bar{A} + \bar{B}C + B\bar{C}$

42. A 3 line to 8 line Decoder with active low outputs is used to implement a 3-variable Boolean function, as shown in the figure.
The simplified form of Boolean function $f(p, q, r)$ implemented in "sum of Products" form will be?



(A) $p^1q + pr^1$ (B) $pq + q^1r^1$
(C) $p^1q + q^1r + p^1r$ (D) $p^1q + q^1r$

43. Consider the following grammars:
$G1$:
$S \rightarrow (S)\ I\ a$
$G2$:
$X \rightarrow X(X)\ I\ x$
$G3$:
$X \rightarrow (Y)\ I\ x$
$Y \rightarrow Y, X\ I\ X$
$G4$:
$S \rightarrow Xx\ Xy\ I\ Yx\ Yy$
$X \rightarrow \in$
$Y \rightarrow \in$
$G5$:
$S \rightarrow Sx\ Sy\ I\ S\ y\ S\ x\ I \in$
Which of the above grammars are unambiguous?
(A) $G1$, $G2$, $G3$ (B) $G1$, $G4$, $G5$
(C) $G1$, $G3$, $G5$ (D) $G1$, $G2$, $G3$, $G5$

44. Consider the grammar G:
$S \rightarrow Xx$
$S \rightarrow yXz$
$S \rightarrow Yz$
$S \rightarrow yYx$
$X \rightarrow p$
$Y \rightarrow p$
Consider the statements:
(I) Grammar (G) is LL(1).
(II) Grammar G is SLR(1).
(III) Grammar G is CLR (1).
Which of the above statements is/are TRUE?
(A) only (I) (B) (II) and (III)
(C) only (III) (D) (I) and (III)

45. Consider two processes P_1 and P_2. There is a need to synchronize these processes using binary semaphores M_1, M_2, M_3.

Process P_1:	**Process P_2:**
$P(M1)$	A;
$P(M2)$	B;
$P(M3)$	C;
Process P_1:	Process P_2:
$P(M1)$	A;
$P(M2)$	B;
$P(M3)$	C;
C.S /* critical section*I	C.S
$V(M1)$	A;
$V(M2)$	B;
$V(M3)$	C;
$V(M1)$	A;
$V(M2)$	B;
$V(M3)$	C;

Number of possibilities to fill at A, B, C using binary semaphore in order to not to have Deadlock and synchronize among processes is _____.

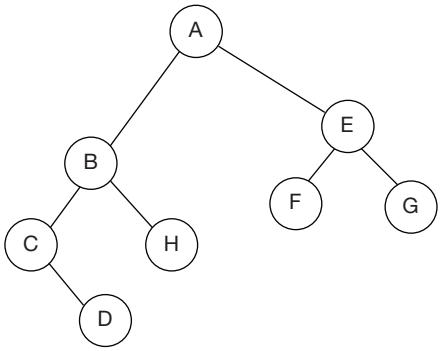
46. Consider a system in which a directory entry can store up to 32 disk block addresses for a file no larger than 32 blocks, the 32 addresses serve as the files index table. For files larger than 32 blocks, the addresses point to indirect blocks which in turn point to 512 file blocks each. Block size is 1024 bytes. The largest file size (in MB) is _____.

47. Consider the following:

Pid	Arrival time	Burst time
P_1	0	8
P_2	2	6
P_3	4	4
P_4	6	2

If Round Robin scheduling (with time slice = 3 units) preemptive SJF, and Highest Response Ratio Next (HRRN) were used. Which of the following specifies correct (ascending) order with respect to average turnaround time?
(A) RR, PSJF, HRRN
(B) P-SJF, HRRN, RR
(C) P-SJF, RR, HRRN
(D) RR, HRRN, P-SJF

48. Consider a Binary Tree



Consider the code fragment:

```
struct BTnode
{
struct BTnode *LC;
int data;
struct BTNode *RC;
}
void fun (struct BTnode *t)
{
if(t)
{
fun (t → LC)
printf ("%d", t →data):
fun (t → RC);
}
}
```

If the root node is passed as parameter to routine fun( ), the output is

(A) AEFGBCDH (B) FEGACDBH
(C) CDBHAFEG (D) FEGCDBHA

49. Consider a binary tree T on 200 vertices. let n_i be the number of vertices in T which have exactly i neighbours. Let $x = \sum_{i=1}^{200} i \cdot n_i$ then the value of x will be:

(A) 199 (B) 398
(C) $199 < x < 398$ (D) None of the above

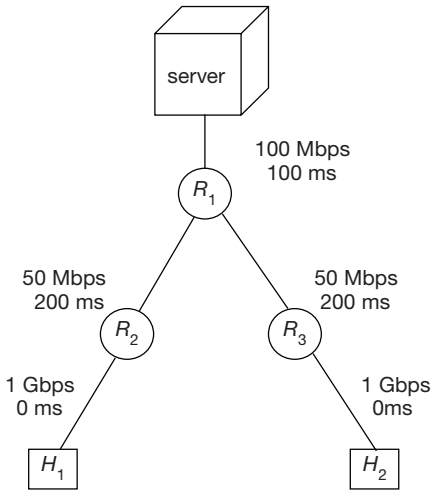
50. Consider the routine fun( ):

```
fun (x, y, k)
{
if (k = = 0)
return x + y;
else if ( y = = 0 && k = = 1)
return 0;
else if ( y = = 0 && k = = 2)
return 1;
else if ( y = = 0)
return x;
else
return fun (x, fun (x, y - 1, k), k
- 1);
}
```

The value returned when fun(2,3,3) called is _____.

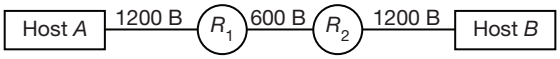
51. Suppose TCP uses Additive Increase Multiplicative Decrease (AIMD) Technique for its congestion control. The congestion window increases by 1MSS every time a batch of ACKs is received. Assume that the round-trip times are constant. If the initial window size is 5MSS, then the average throughput (in terms of MSS per RTT) for this TCP connection upto time 6RTT (MSS/RTT) is _____.

52. Consider below figure; in which a server is connected to a router, R_1 by a 100 Mbps link with a propagation delay of 100 ms. R_1 is connected to two routers R_2 and R_3 each over a 50 Mbps link with a propagation delay of 200 ms. The Routers R_2 and R_3 are connected to two hosts each with a 1 Gbps link and with no propagation delay.



All the packets in the network have 20,000 bits. If there are no caches, no queueing delays at the routers and if the packet processing delays at the routers and nodes are all zero then the end-to-end delay required by a client to receive a packet from server (in msec) is _____.

53. Consider below network:



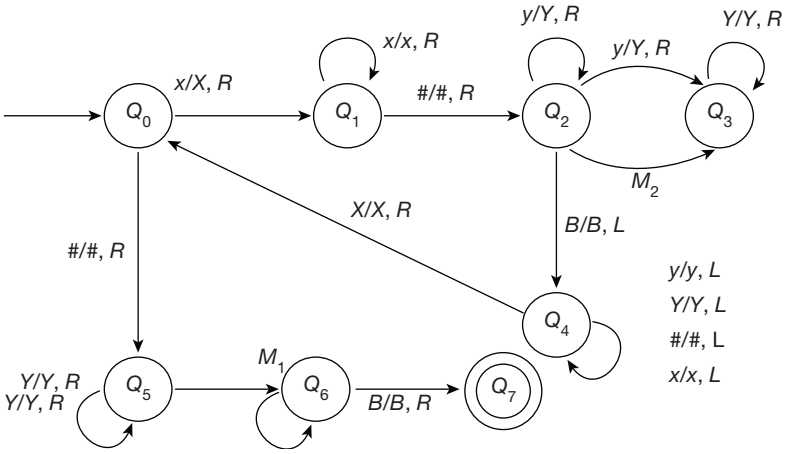
Two Hosts A and B have a separate shared Ethernet with a Maximum Transfer rate (MTU) of 1200 Bytes. The two Hosts are connected with a point-to-point link, which has a MTU of 600 Bytes. The MTU includes TCP, IP headers and data.
If Host A passes 2000 Bytes to TCP of Host B. Then the number of bits delivered to network layer in Host B (in Bytes) is _____.

54. Consider the below languages which are defined over $\Sigma = \{0, 1\}$:
$L_1 = \{w/w$ contains an even number of 0's and an odd number of 1's$\}$
$L_2 = \{w/n_1(w) = k * n_0(w)$ for some $k \in N\}$

$L_3 = \{w/ \text{ I } n_0(w) - n_1(w) \text{ I mod } 3 = 0\}$
$L_4 = \{w/ \text{ I } n_0(w) - n_1(w) \text{ I mod } 3 = 1\}$
(here $n_0(w)$ is number of 0's in w, $n_1(w)$ is number of 1's in w)
Which of these languages are regular?
(A) I, III only (B) I, III, IV only
(C) I, II, IV only (D) I, II, III, IV

55. Consider a push down automata with the following instantaneous description:
$\delta(q_0, a, \in) = \{[q_0, A]\}$
$\delta(q_0, a, A) = \{[q, AA]\}$
$\delta(q_0, \in, \in) = \{[q_1, \in]\}$
$\delta(q_0, b, A) = \{[q_2, \in]\}$
$\delta(q_1, \in, A) = \{[q_1, \in]\}$
$\delta(q_2, b, A) = \{[q_2, \in]\}$
$\delta(q_2, \in, A) = \{[q_2, \in]\}$
Here q_0 is the initial state. Initially stack has empty symbol, $\in$.
Both states q_1, q_2, reach a final state with no input left and empty stack.
The stack symbol is $\{A\}$.
Input alphabet is $\{a, b\}$. Each δ transition has the form
δ(current state, input, top of stack)
$= \{[\text{Resultant state}, X]\}$
X can be either the symbol which is written in-place of top of stack (if X is $\in$) or new item placed on top of stack.
What is the language accepted by the given PDA?
(A) $\{a^i b^j \text{ I } i! = j\}$
(B) $\{a^i b^j \text{ I } 0 \le i \le j \text{ or } 0 \le j \le i\}$
(C) $\{a^i b^j \text{ I } 0 \le i \le j\}$
(D) $\{a^i b^j \text{ I } 0 \le j \le i\}$

56. Consider the below Turing machine, M.



M is accepting the language $\{x^n\#\ y^{2^n} \text{ I } n \ge 0\}$
X, Y are symbols written in-place of x and y respectively. each transition has a form $(a/b, D)$, where a is symbol read, b is symbol to be written and D is direction of head movement. Analyze the Turing machine and choose the missing transitions M_1 and M_2 for the correct functioning of M:
(A) $M_1 : y/y, L\ M_2 : y/y, L$
(B) $M_1 : y/y, R\ M_2 : y/y, R$
(C) $M_1 : y/y, L\ M_2 : y/y, R$
(D) $M_1 : y/Y, R\ M_2 : y/Y, L$

57. To increase the efficiency in program controlled I/O technique, the I/O software is written in such a way that the processor periodically checks the status of the device. If the device is not ready, the processor can jump to other tasks. After some time interval, the processor comes back to check status again.
Consider a device, keyboard with a single character buffer. On an average, characters are entered at a rate of 5 characters per second. The time interval between two consecutive key depressions can be 50 ms. Then at what frequency does the processor scans the keyboard?
(A) 200 ms (B) 150 ms
(C) 50 ms (D) Data insufficient

58. A 20 MHz processor has a cache which takes two clock cycles. Data access from main memory over the bus to the processor takes three clock cycles, with no wait states. The data is delivered to the processor in parallel with delivery to cache. If the cache has a hit ratio of 0.9 then the effective duration of memory access (in nano seconds) is _____

59. Consider the Relation R with attributes, Teacher, Course, Textbook, Project, Location, Hours .
For every course, Textbook there is only one Teacher.

For every Location, Hours, Teacher there is only one Course. There is only one Project for any Location and Hours.

P. Course, Textbook → Teacher
Q. Location, Hours, Teacher → Course
R. Project → Location, Hours, Teacher
S. Course → Location , Hours
W. Teacher → Course, Textbook

Which of the following functional dependencies can be inferred from the given statements?

(A) P, Q, R only (B) R, S only
(C) R, S, W only (D) P, R, S only

60. Given an undirected weighted graph $G = (V, E)$ with non-negative edge weights, we can compute a minimum cost spanning Tree $T = (V, E')$. We can also compute, for a given source vertex $S \in V$, the shortest paths from S to every other vertex in V. we now increase the weight of every edge in the graph by 1.

I. All the shortest paths from S to other vertices are unchanged.
II. T is still a minimum cost spanning Tree.

Which of the following is TRUE?

(A) I only (B) II only
(C) Both I and II (D) None of the above

61. Consider the following 2 transactions T_1 and T_2.

T_1:

$x = x - 50$
$y = y + 50$

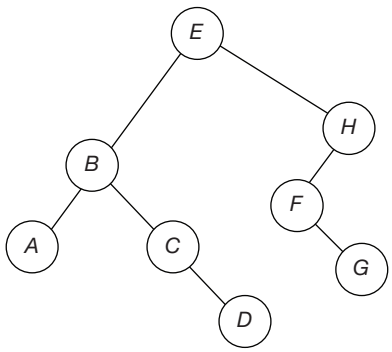
T_2:

$a = a + x$
$a = a + y$

Suppose we start with initial values of 100 for x, 200 for y, and 0 for a, and then T_1 and T_2 run concurrently, that is, at each step we either execute one statement from T_1 or one statement from T_2. Which of the following is not a possible final value of a?

(A) 200 (B) 250
(C) 300 (D) 350

62. In a binary search tree given below, finding node E required one comparison and finding node D requires four comparisons. What is the expected number of comparisons requires to find a node chosen at random?



(A) 3
(B) 2.25
(C) 3.25
(D) 2.75

63. Insert the characters of the string "s, m, o, w, g, v, e, k, y" into a Hash table of size 10. Hash function is $H(X) = (\text{ASCII}(X) - \text{ASCII}(C) + 1) \bmod 10$

Hashing technique is Linear probing, while Hashing which characters, collision occurs?

(A) e, y, v
(B) w, e, k
(C) o, w, e
(D) w, e, y

64. Consider the following 2 tables.

R

X	Y
11	A
12	B
13	C

S

X	Y
11	A
12	B
16	D

The result of $R \cap S$, can be obtained by using which of the following operations (Rational algebra expression should contain same operator any number of times)?

(A) $\cup$ (union)
(B) $-$ (set difference)
(C) $\bowtie$ (natural JOIN)
(D) None of the above

65. Consider the following sequence of elements

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

Assume that the last element of the set is used as pivot element in quick sort, to sort the given elements. Which sequence takes maximum time.

(A) I Only
(B) I and II
(C) I and III
(D) I, II and III

Answer Keys

1. B	**2.** D	**3.** 2	**4.** D	**5.** D	**6.** C	**7.** D	**8.** D	**9.** B	**10.** B
11. B	**12.** C	**13.** 2	**14.** D	**15.** 264	**16.** D	**17.** A	**18.** C	**19.** B	**20.** C
21. D	**22.** 16.67	**23.** A	**24.** D	**25.** 10	**26.** 1000	**27.** C	**28.** 1631	**29.** 1030	**30.** C
31. 4	**32.** 4	**33.** D	**34.** D	**35.** C	**36.** C	**37.** B	**38.** A	**39.** 2	**40.** A
41. C	**42.** D	**43.** A	**44.** C	**45.** 2	**46.** 16	**47.** B	**48.** C	**49.** B	**50.** 65536
51. 7.5	**52.** 300.62	**53.** 2140	**54.** A	**55.** D	**56.** B	**57.** C	**58.** 105	**59.** C	**60.** B
61. A	**62.** D	**63.** D	**64.** B	**65.** A					

Hints and Explanations

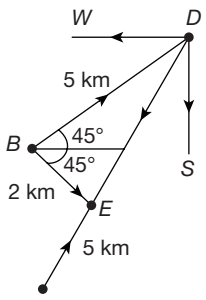
1. Choice (B) is correct. A footpath runs along the road on either side. Similarly, a riverbank runs along the river on either side. Choice (B)

2. I. 2/5th of the weight of a single disc is 13 kg. But we don't know if each disc has the same weight or not. I alone is not sufficient.
We do not know the weight of each disc.
∴ We cannot find the total weight of 25 discs.
II alone is not sufficient
I, II we still cannot answer the question.
Choice (D)

3. Let $f(x) = ax + b$ where a and b are constants.
$f(-4) = 50$ and $f(7) = 6$
$-4a + b = 50$ ..... (1)
$7a + b = 6$ ..... (2)
$-11a = 44$
$a = -4$
Substituting in (1), we get
$16 + b = 50 \Rightarrow b = 34$
∴ $f(x) = -4x + 34$.
When $x = 8$
$f(x) = -4(8) + 34 = -32 + 34 = 2$
∴ $f(8) = 2$. Ans: 2

4. The right choice is "to call a spade a spade" which means to speak very frankly and openly. None of the other options go as they are negative in connotation. "To see red" is to be afraid, "to throw in the towel" is to accept defeat and "to let the grass grow under one's feet" is to idle too long without any work. Choice (D)

5.



$\angle B = 90°$

$DE = \sqrt{DB^2 + BE^2}$
$= \sqrt{5^2 + 2^2}$ km $= \sqrt{29}$ km ≈ 5.39 km. Choice (D)

6. "Nature" is not preceded by "the" so choices (A) and (D) are ruled out. In (B) the tense is incorrect for a completed action. Choice (C) uses the simple past tense for a completed action and it is correct. Choice (C)

7. All the statements except (D) can be proved false by the passage itself. (A) is not what General Dyer was. Statement (B) too is a distortion of what is stated in the passage. The passage does not state that the victims got a fair trial. In fact, the trial was a travesty of justice and the public supported general Dyer's actions. Statement (C) is out of the scope of the text. Statement (D) is correct as understood from the first two lines of the passage. General Dyer was not a frightened person misbehaving so his actions can neither be understood nor excused. Choice (D)

8. Freon damages ozone layer. A need is felt to substitute Freon with some other coolant. This means that damage to ozone layer is harmful. Hence (D) is the correct answer.
As the cost is not the focus of the argument, (A) is wrong. (B) and (C) cannot be inferred. Choice (D)

9. Choice (B) is apt. The para, when rearranged, is the story of human life, metaphorically presented. 1 mentions two birds. In 3 both are described as "one" eating and the other not eating. 5 follows next as it tells as to what is being eaten, and more importantly, where it is sitting. 4 is a continuation of 5 as it tells the position of the other bird. So 5 and 4 is a definite pair. 2 is then concluding the analogy. 6 explains why it is the story of the human soul. Choice (B)

10. Area of triangle ABC = Area of ABD + Area of ADC
$\frac{1}{2}(AB)(AC)\sin\angle A = \frac{1}{2}(AB)(AD)\sin\angle BAD + \frac{1}{2}$
$(AD)(AC)\sin\angle DAC = (AB)(AC)\sin 120°$
$= (AB)(AD)\sin 60° + (AD)(AC)\sin 60°$
$AD = \frac{(AB)(AC)\sin 120°}{AB\sin 60° + AC\sin 60°}$

$= \frac{(AB)(AC)}{AB + AC} = \frac{60}{11} = 5.45$ cm. Choice (B)

11. Total number of ways of distributing 10 apples among three persons Mahesh, Naresh and Ramesh = 3^{10}

Mahesh and Naresh together has to get exactly 7 apples

$\Rightarrow$ Mahesh and Naresh together gets 7 apples and Ramesh gets 3 apples

The number of ways of selecting 7 apples from 10 to distribute to Mahesh and Naresh = $^{10}C_7$

The number of ways of distributing these 7 apples to Mahesh and Naresh = 2^7

$\therefore$ The total number of ways of distributing 10 apples among the three persons such that Mahesh and Naresh together get 7 apples = $^{10}C_7 \times 2^7$

$\therefore$ Required probability $= \frac{^{10}C_7 \times 2^7}{3^{10}} = \frac{\frac{10!}{3! \times 7!} \times 2!}{3^{10}}$

$= 15 \times \left(\frac{2}{3}\right)^{10}$ Choice (B)

12. The statement formulas given in options (A), (B) and (D) are all equivalent to p.

The statement formula given in option (C),

i.e., $p \wedge F_o \Leftrightarrow F_o$ = contradiction

and NOT equivalent to p. Choice (C)

13. We have $\int_1^5 \frac{\sqrt{x+5}}{\sqrt{x+5} + \sqrt{11-x}} dx$

$= \int_1^5 \frac{\sqrt{x+5}}{\sqrt{x+5} + \sqrt{(1+5-x)+5}} dx = \frac{5-1}{2}$

$(\because \int_a^b \frac{f(x)}{f(x) + f(a+b-x)} dx = \frac{b-a}{2}$ and here

$f(x) = \sqrt{5+x}$; $a = 1$ and $b = 5) = 2$ Ans: 2

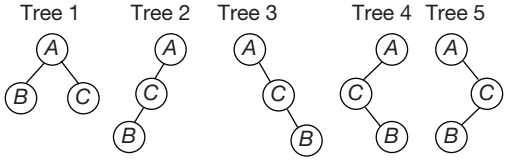
14. We know that every lattice need not satisfy distributive laws. So, the relation given in option (D) need not be true. Choice (D)

15. The number of different choices available for Rakesh to buy a Zigma = $3 \times 6 \times 4 \times 2 = 144$

The number of different choices available for Rakesh to buy a Harze = $4 \times 5 \times 3 \times 2 = 120$

$\therefore$ The total number of different choices available for Rakesh to buy either a Zigma or a Harze = 144 + 120 = 264. Ans: 264

16. Post-order sequence *BCA*



All the five trees gives post order sequence *BCA*.

Choice (D)

17. $T(n) = 3T\left(\frac{n}{4}\right) + n$

$T(n) = aT\left(\frac{n}{b}\right) + f(n)$

$a = 3, b = 4, f(n) = n$

compare $f(n)$ Vs $n^{\log_b^a}$

n Vs $n^{\log_4^3}$

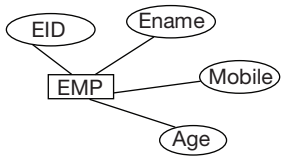
n Vs $n^{0.792}$

$f(n) > n^{\log_b^a}$

Case 1 of master theorem

Time complexity $T(n) = \theta(f(n))) = \theta(n)$ Choice (A)

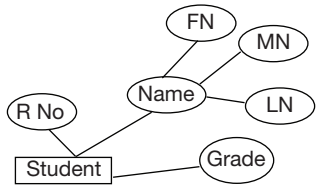
18. Example:



Mobile is a multi valued attribute, so keep mobile attribute in a separate relation (This is defined in 1*NF*)

Eld	Ename	Age

Eld	Mobile



Name $\rightarrow$ is a composite attribute

FN, *MN*, *LN* $\rightarrow$ are simple component attributes

In the relation only simple component attributes will appear (This is defined by 1NF)

Student

RNo	FN	MN	LN	Grade

Choice (C)

19. The value of item A that is read by T_2 is called dirty data because it has been created by a transaction that has not completed and committed yet, hence this problem is also known as the "dirty read problem".

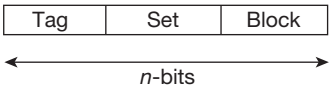
Choice (B)

20. One track contains 20 blocks, means the same track also contains 20 inter block gaps.

Capacity of one track = 20 * 512 + 20 * 64

= 10240 + 1280 = 11520 byes Choice (C)

21. Main memory has n - bit address.



Block size = b bytes

$\Rightarrow$ Bits required for block offset = $\log b$

The cache is m-way set associative.

Number of blocks = s

$\Rightarrow$ number of sets $= \frac{s}{m}$

Bits required for set field = $\log (s/m)$

$\therefore$ Tag = $n - \log (s/m) - \log b$ Choice (D)

22. Number of cycles required using 16-bit processor (for 100 instructions) = (2 * 20) + 1 * 50 + 1 * 30 = 120

Number of cycles required on 32-bit processor for 100 instructions = 100

$\therefore$ Percentage of improvement $= \frac{20}{120} * 100$

= 16.67% Ans:16.67

23. The words are defined over $\{a, b, c\}$ such that number of b's is not divisible by 3 or 5 and no 'c' appears after 'a'.

This can be written as

$(L_1 \cup L_2)L_3$ where

L_1 = { number of b's is not divisible by 3}

L_2 = { number of b's is not divisible by 5}

L_3 = { no 'c' appears after 'a'}

L_1, L_2 & L_3 are regular and regular languages are closed under union & concatenation.

$\therefore$ Given language is regular. Choice (A)

24. **Statement I:**

$L_2 = \{w/w \in \{a, b\}^*\}$

$L_1 = \{a^n b^n \text{ I } n \geq 0\}$

L_2 is regular but L_1 is not regular.

$\therefore$ I is not always true.

Statement II:

$L_1 = \phi$

$L_2 = \{a^n b^n \text{ I } n \geq 0\}$

L_1 is regular but L_2 is not regular.

Statement III is also not true always. Choice (D)

25. CRC generator has 11-bits, so the remainder cannot be more than 10.

$\therefore$ Maximum 10-bits present in resulting frame check sequence. Ans: 10

26. 1-way propagation time $= \frac{\text{distance}}{\text{speed}}$

$= \frac{1000 \text{ m}}{2 \times 10^8 \text{ m/s}} = 0.5 \times 10^{-5}$ sec

Minimum packet size required is = 2 * propagation time * Bandwidth

$= 2 * 0.5 \times 10^{-5} * 100 \times 10^6$

= 1000 bits. Ans: 1000

27. Choice (C)

28. Let 'V' be the set of vertices. A path between x to y through z is formed by a subset V' of V I $\{x, y, z\}$ and forming a permutation of $V' \cup \{z\}$ for each $i \leq 5$, there are $\binom{5}{i}$ subsets V' of size i, and $(i + 1)!$ permutations of $V' \cup \{z\}$

Thus the number of required paths is

$$\binom{5}{0}1! + \binom{5}{1}2! + \binom{5}{2}3! + \binom{5}{3}4! + \binom{5}{4}5! + \binom{5}{5}6!$$

= 1631

Ans: 1631

29. The address of $A[8][3]$ is $= B + \frac{i(i-1)}{2} + j - 1$

$= 1000 + \frac{8 \times 7}{2} + 3 - 1 = 1030$

Ans: 1030

30. Total virtual memory required = 16 × 1024

$= 2^4 \times 2^{10} = 2^{14}$

$\therefore$ 14 bits for logical address.

Choice (C)

31.

1, 3, 5, 6, 3, 1, 3, 5

~~1~~	~~3~~	5
3		
~~5~~	1	

= 3 page faults

Ans: 4

32.

B1 $\begin{cases} (1) x = 1 \rightarrow \text{leader} \\ (2) y = 1 \end{cases}$

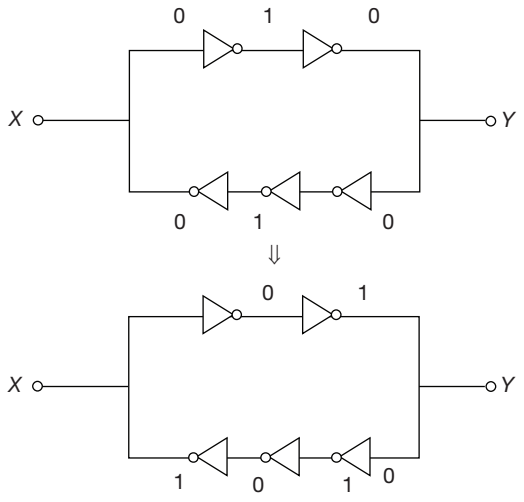
B2 {(3) if $x > i$ goto (9) $\rightarrow$ leader

B3 $\begin{cases} (4) y = y * x \\ (5) y = 10 \\ (6) t = y * x \\ (7) x = t \\ (8) \text{ goto (3)} \end{cases}$

B4 {(9) END $\rightarrow$ leader

33. Choice (D)

34.



Choice (D)

35. Memory is specified as (2^{Addr} × data) bits
So $2^{16} \times 8$ bits = 5, 24, 288 bits Choice (C)

36. Given $P = \begin{bmatrix} 2 & 131 & -243 & 566 \\ 0 & -2i & 174 & -237 \\ 0 & 0 & 2i & 0 \\ 0 & 0 & -713 & -2 \end{bmatrix}$

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

$$\Rightarrow \begin{bmatrix} 2-\lambda & 131 & -243 & 566 \\ 0 & -2i-\lambda & 174 & -237 \\ 0 & 0 & 2i-\lambda & 0 \\ 0 & 0 & -713 & -2-\lambda \end{bmatrix} = 0$$

$\Rightarrow (2-\lambda)(-2i-\lambda)(2i-\lambda)(-2-\lambda) = 0$
$\Rightarrow (2-\lambda)(2+\lambda)(2i+\lambda)(2i-\lambda) = 0$
$\Rightarrow (4-\lambda^2)(-4-\lambda^2) = 0$
$\Rightarrow -(4-\lambda^2)(4+\lambda^2) = 0$
$\Rightarrow 16 - \lambda^4 = 0$
$\Rightarrow \lambda^4 - 16 = 0$
$\therefore$ The characteristic equation of P is $\lambda^4 - 16 = 0$
Hence by Cayley-Hamilton theorem, we have
$P^4 - 16I_4 = 0 \rightarrow (1)$
Where I_4 = Identity matrix of order 4.
Multiplying (1) on both sides with P^{-1}, we have
$P^{-1}(P^4 - 16\,I_4) = P^{-1} \times 0$
$\Rightarrow P^3 - 16\,P^{-1} = 0$
$\Rightarrow 16P^{-1} = P^3$ Choice (C)

37. Let A and B denote the events of a randomly selected employee having a Two Wheeler (TW) and a Four Wheeler (FW) respectively.

$\therefore P(A \cup B) = \frac{7}{10}, P(A \cap B) = \frac{2}{5}$ and $P(A/B) = \frac{2}{3}$

We know that $P(A/B) = \frac{P(A \cap B)}{P(B)}$

$$\Rightarrow P(B) = \frac{P(A \cap B)}{P\left(\frac{A}{B}\right)} = \frac{\frac{2}{5}}{\frac{2}{3}}$$

$$\Rightarrow P(B) = \frac{3}{5}$$

We know that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$$\Rightarrow \frac{7}{10} = P(A) + \frac{3}{5} - \frac{2}{5}$$

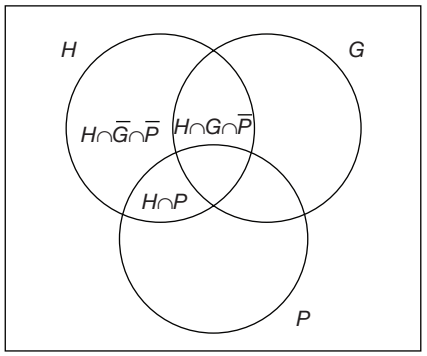
$$\Rightarrow P(A) = \frac{7}{10} - \frac{3}{5} + \frac{2}{5}$$

$$\Rightarrow P(A) = \frac{1}{2}$$

Hence probability that a randomly selected employee has two wheeler (TW) $= \frac{1}{2}$. Choice (B)

38. Let H, P and G denote the sets of students, who can speak Hindi, Punjabi and Gujarati respectively.

$\therefore$ $n(H) = 120$, $n(H \cap P) = 35$ and
$n(H \cap G \cap \bar{P}) = 40$
We know that $n(H) = n(H \cap \bar{G} \cap \bar{P}) + n(H \cap P) + n(H \cap G \cap \bar{P})$
$\Rightarrow 120 = n(H \cap \bar{G} \cap \bar{P}) + 35 + 40$
$\Rightarrow n(H \cap \bar{G} \cap \bar{P}) = 45$
$\therefore$ The number of students who can speak only Hindi $= n(H \cap \bar{G} \cap \bar{P}) = 45$.



Choice (A)

39. In the given graph G, one can observe that the vertex set $\{a, b, c, d, e, f, g\}$ can be partitioned into two sets $M = \{a, b, c\}$ and $N = \{d, e, f, g\}$ such that any edge in G is between a vertex in M and a vertex in N.
Hence G is a bipartite graph (in fact, a complete bipartite graph).
$\therefore$ The chromatic number of $G = X(G) = 2$ Ans: 2

40. Statement P is nothing but the intermediate value theorem and hence is TRUE.

Counter Example for statement Q:

Let $f(x) = \begin{cases} x; & \text{if } 0 \le x < 1 \\ x-1; & \text{if } 1 \le x \le 3 \end{cases}$

Then, $f(x)$ assumes every value between $f(0)$ (=0) and $f(3)$ (=2). But $f(x)$ is not continuous at $x = 1 \in [0, 3]$

$\therefore$ Statement Q is not TRUE. Choice (A)

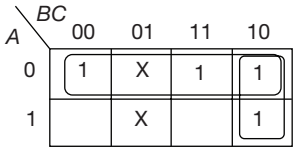
41. From the given circuit $Z = DE + F$

We need expression of Z in terms of A, B, C

ABC = 101, 001 combinations do not occur.

A	B	C	D	E	F	Z = DE + F
0	0	0	0	0	1	1
0	0	1	1	0	0	X
0	1	0	1	1	0	1
0	1	1	1	1	1	1
1	0	0	0	0	0	0
1	0	1	1	0	1	X
1	1	0	0	1	1	1
1	1	1	0	1	0	0

$Z(A, B, C) = \Sigma\, m(0, 2, 3, 6) + \phi(1, 5)$

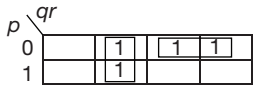


$Z = \overline{A} + B\overline{C}$ Choice (C)

42. The output of Decoder are active low outputs so

$f(p, q, r) = \overline{\overline{Y}_1, \overline{Y}_2, \overline{Y}_3, \overline{Y}_5} = Y_1 + Y_2 + Y_3 + Y_5$

$= \Sigma m(1, 2, 3, 5)$



$= p^1q + q^1r$ Choice (D)

43. Grammars $G1$, $G2$, $G3$ are unambiguous, while $G4$ and $G5$ are ambiguous. Choice (A)

44. The grammer is $LR(1)$. Choice (C)

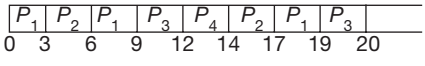
45. At A we need to place $P(M1)$ to not have Deadlock, at B and C we can place either $P(M2)$ or $P(M3)$ which can be done in 2! ways. Ans: 2

46. The larger possible file will have $32 = 2^5$ indirect blocks. Since each indirect block can point to $512 = 2^9$ blocks the largest file has $512 * 32 = 2^{9+5}$ blocks. Given block size = 1024 bytes = 2^{10} B

The maximum file size is 2^{9+5+10} B

$= 2^{24}$ B = 16 MB Ans: 16

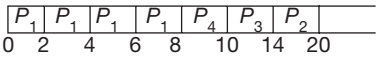
47. RR (T. S. = 3 units):



Ready Queue: $P_1 < P_2, P_1, P_3, P_4, P_2, P_1, P_3$

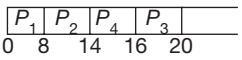
Average Turnaround Time $= \dfrac{19 + 15 + 16 + 8}{4} = 14.5$

P-SJF:



Average Turnaround Time $= \dfrac{8 + 18 + 10 + 4}{4} = 10$

HRRN:



At $t = 8$

Response Ratio of process P_2

$(RR_2) = \dfrac{6 + 6}{6} = 2$

$RR_3 = \dfrac{4 + 4}{4} = 2$

$RR_4 = \dfrac{2 + 2}{2} = 2$

At $t = 14$

$RR_3 = \dfrac{10 + 4}{4} = 3.5$

$RR_4 = \dfrac{8 + 2}{2} = 5$

Avg. TAT $= \dfrac{8 + 12 + 10 + 16}{4} = 11.5$

The order is P – SJF, HRRN, RR. Choice (B)

48. The fun ( ) prints the Inorder traversal of the tree. Choice (C)

49. Tree is connected graph. The value of x will be $(2 \times 200 - 2) = 398$ Choice (B)

50. fun $(x, y, 1)$ will evaluate to xy

fun $(x, y, 1) \Rightarrow$ fun $(x,$ fun $(x, y - 1, 1), 0)$

$\Rightarrow$ fun $(x, x\,(y - 1), 0)$

$\Rightarrow$ $x + x\,(y - 1)$

$\Rightarrow$ xy

Similarly fun $(x, y, 2)$ will evaluate to x^y

This can be proved by induction

fun $(x, 0, 2) = 1 = x^0$

fun $(x, 1, 2) = x = x^1$

Similarly fun $(x, y - 1, 2) = x^{y-1}$

fun $(2, 3, 3)$ = fun $(2,$ fun $(2, 2, 3), 2)$

= fun $(2, 16, 2)$ [$\because$ fun $(2, 2, 3)$ evaluate to 2^4)

$= 2^{16} = 65536$ Ans: 65536

51. In 1st RTT, 5MSS is sent.
In 2nd RTT, 6 MSS is sent.
In 3rd RTT, 7 MSS is sent.
In 4th RTT, 8 MSS is sent.
In 5th RTT, 9 MSS is sent.
In 6th RTT, 10 MSS is sent.

∴ Average throughput till 6^{th}

$$RTT = \frac{5+6+7+8+9+10}{6} = \frac{45}{6}$$

$$= 7.5\ MSS/RTT.$$ Ans :7.5

52. Packet size = 20000 bits

Time to transmit the packet from sever to R_1 over 100 Mbps link is $\frac{20000}{100\times10^6}$ = 200 μsec.

Time to transmit the packet from R_2 over 50 Mbps link is $\frac{20000}{50\times10^6}$ = 400 μsec.

Time to transmit the packet from R_2 to $H1$ over 1 Gbps link is $\frac{20000}{1\times10^9}$ = 20 μ sec.

∴ End-to-end delay = sum of propagation delays of the links + sum of link transmission times

= (100 + 200 msec) + (200 + 400 + 20) μsec

= 300 msec + 620 μsec

= 300 msec + 0.620 msec

= 300.62 msec Ans : 300.62

53. The MTU between Host A and R_1 is 1200 Bytes. The data to be transferred is 2000 Bytes. So 2 packets required and each with both TCP & IP headers.

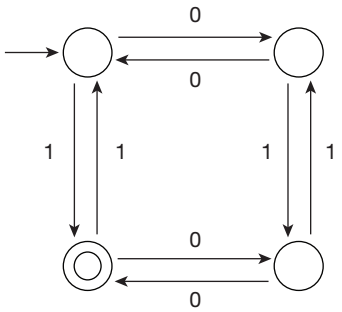
The link R_1 to R_2 has a MTU of 600 B so 1^{st} packet fragmented to 3 packets with separate IP headers.

Also the 2^{nd} packet fragmented to 2 packets with separate IP headers.

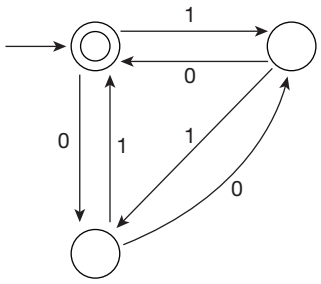
Host B receives 5 packets in which 2 have both TCP & IP headers, 3 have only IP header & 2000 Bytes of data.

∴ Data received by the Network layer of Host B is 2000 + 5 * 20 + 2 * 20 = 2140 Bytes. Ans :2140

54. L_1 is regular. The DFA for L_1 is shown below:



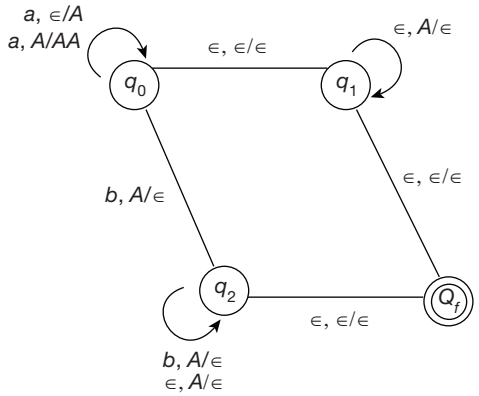
L_2 is not regular. For $k = 1$, we need to construct a DFA which accepts the strings with equal number of 0's and 1's. This is not possible to construct a DFA for this language. L_3 is regular. The DFA for L_3 is shown below.



L_4 is not regular. We can prove this using pumping lemma.

Choice (A)

55. Based on the given description, the PDA will be as below:



State q_0 writes 'A' for each 'a' in input. With no input it goes to q_1 to pop all the pushed A's, and reaches final state.

q_1, is used to accept any number of a's.

q_0 goes to q_2 with input b and top of stack A and replaces A with ∈.

q_2 pops A's for each b. There need to be A's on stack even after processing all b's. With no input it goes to final state.

From this we can observe that the PDA accepts strings of the form, $\{a^i b^j \text{ I } 0 \le j \le i\}$. Choice (D)

56. Given TM, M accepts the language,

$\{x^n \# y^{2^n} \text{ I } n \ge 0\}$

After analyzing the machine we can identify that the logic is to "Replace an 'x' with X and traverse till #. Now replace half of the (remaining) y's with Y". This needs to be repeated till a y is remained in the input and with that accept the string.

Example: for $n = 3$,

$x\ x\ x\ \#\ y\ y\ y\ y\ y\ y\ y\ B$

⇓

$X\ x\ x\ \#\ Y\ y\ Y\ y\ Y\ y$

⇓

$X\ X\ x\ \#\ Y\ Y\ Y\ y\ Y\ Y\ y$

⇓

$X\,X\,X\,\#\,Y\,Y\,Y\,Y\,Y\,Y\,Y\,y$

We can replace that left out y with Y and accept the string. (i.e., for each x, strike-off half of y's and for zero x there will be one y).

Hence M_1 is y/y, R

M_2 is y/y, R. Choice (B)

57. The keyboard has single character buffer.

The time interval between two consecutive depressions is 50 ms.

To avoid overwriting of data the processor needs to check the keyboard once every 50 ms. Choice (C)

58. Processor has 20 MHz frequency.

$$\text{Cycle time} = \frac{1}{20\times10^{6}} = 0.05\times10^{-6} \text{ sec.}$$

$= 50 \times 10^{-9}$ sec $= 50n$ sec.

Cache access time = 2 cycles = $2 \times 50 = 100n$ sec.

Main memory access time = 3 cycles = $3 \times 50 = 150n$ sec.

Effective memory access time = 0.9 * 100 + 0.1 * 150

$= 90 + 15 = 105n$ sec. Ans:105

59. Functional dependency $X \rightarrow Y$

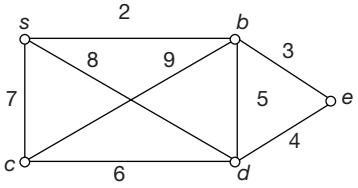
Unique values

R. Project → Location, Hours

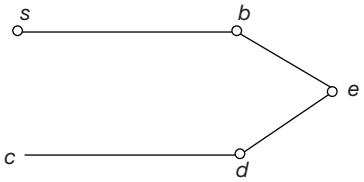
S. Course → Location, Hours, Teacher

W. Teacher → Course, Textbook Choice (C)

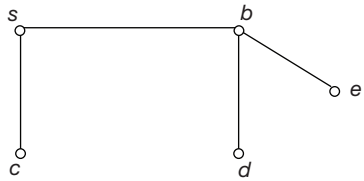
60. Consider the given graph.



Minimum spanning Tree:



Shortest path from s:



Solution set [s]

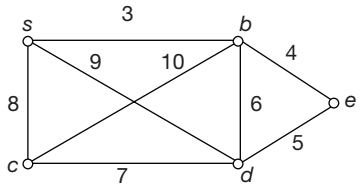
I. Distance [b] = 2
Distance [c] = 7
Distance [d] = 8
Distance [e] = ∞

II. Solution set [sb]
Distance [c] = min {7, 11} = 7
Distance [d] = min {8, 7} = 7
Distance [e] = min {∞, 5} = 5

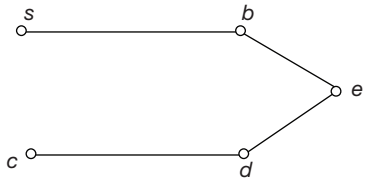
III. Solution set [sbe]
Distance [c] = min {7, ∞} = 7
Distance [d] = min {7, 9} = 7

IV. Solution set [$sbec$]
Distance [d] = min {7, 13} = 7

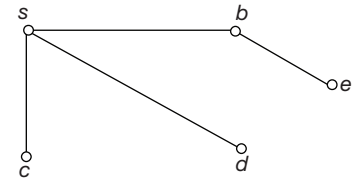
Consider the same graph, with edge weights increased by 1.



Minimum spanning Tree:



Shortest path tree:



Shortest path from node s:

I. Solution set [s]
Distance [b] = 3
Distance [c] = 8
Distance [d] = 9
Distance [e] = ∞

II. Solution set [sb]
Distance [c] = min {8, 13} = 8
Distance [d] = min {9, 9} = 9
Distance [e] = min {∞, 7} = 7

III. Solution set [sbe]
Distance [c] = min {8, ∞} = 8
Distance [d] = min {9, 12} = 9

IV. solution set [$sbec$]
Distance [d] = min {9, 15} = 9

∴ Spanning Tree is same

∴ Shortest path tree may varies. Choice (B)

61. Lets assign a number to statements

	T_1:	T_2:
(1)	$x = x - 50$	$a = a + x$
(2)	$y = y + 50$	$a = a + y$

Sequence 1:
1, 3, 2, 4
$x = 50$
$a = 50$
$y = 250$
$\boxed{a = 300}$
Sequence 2:
3, 1, 2, 4
$a = 100$
$x = 50$
$y = 250$
$\boxed{a = 350}$
Sequence 3:
1, 3, 4, 2
$x = 50$
$a = 50$
$a = 250$
$y = 250$
$\therefore$ The value 200 is not possible for 'a'. Choice (A)

62. The number of comparisons required for,
Node $A = 3$
Node $B = 2$
Node $C = 3$
Node $D = 4$
Node $E = 1$
Node $F = 3$
Node $G = 4$
Node $H = 2$
The expected number of comparisons required to find a node at random

$$= \frac{3+2+3+4+1+3+4+2}{\text{Number of nodes}} = \frac{22}{8} = 2.75$$ Choice (D)

63. (1) ASCII (s) = 115
$H(115) = ((115 - 99) + 1) \bmod 10$
$= 17 \bmod 10 = 7$
(2) ASCII (m) = 109
$((109 - 99) + 1) \bmod 10$
11 and 10 = 1
(3) ASCII (o) = 111
$((111 - 99) + 1) \bmod 10$
13 and 10 = 3
(4) ASCII(w) = 119
$((119 - 99) + 1) \bmod 10$
21mod 10 = 1 (collision)
(5) ASCII (g) = 103
$((103 - 99) + 1) \bmod 10$
$5 \bmod 10 = 5$
(6) ASCII (v) = 118
$((118 - 99) + 1) \bmod 10$
$20 \bmod 10 = 0$
(7) ASCII (e) = 101
$((101 - 99) + 1) \bmod 10$
$3 \bmod 10 = 3$ (collision)
(8) ASCII (k) = 107
$((107 - 99) + 1) \bmod 10$
$9 \bmod 10 = 9$
(9) ASCII (y) = 121
$((121 - 99) + 1) \bmod 10$
$23 \bmod 10 = 3$ (collision)
$\therefore$ Collision occurred while hashing 'w', 'e', 'y'
Choice (D)

64. $R \cap S =$

X	Y
11	A
12	B

The same result can be obtained by $R - (R - S)$
$R - S$

X	Y
13	C

$R - (R - S)$

x	y
11	A
12	B
13	C

$-$

x	Y
13	C

$=$

x	y
11	A
12	B

Choice (B)

65.
I. 1 2 3 4 5 6 7 8
Quick sort gives worst case Time complexity (maximum time) on a sorted array, that is $O(n^2)$ Time.

II. 1 8 2 6 3 7 4 5 (pivot 5)
Swap
First Iteration: 1 5 2 6 3 7 4 8
1 5 2 4 3 7 6 8
1 3 2 4 [5] 7 6 8
Second Iteration: 1 3 2 4 [5] 7 6 8
Pivot = 4 Pivot = 8
1 3 2 [4] [5] 7 6 [8]
Third iteration [1 3 2] [4] [5] [7 6] [8]
Pivot = 2 Pivot = 6
1 5 2 4 3 7 6 8
$\therefore$ The time required is $O(n \log n)$
III. first iteration:
5 4 7 3 1 8 2 6 (pivot 6)
5 4 6 3 1 8 2 7
5 4 2 3 1 [6] 8 7
Second iteration:
5 4 2 3 1 [6] 8 7
Pivot 1 Pivot 7

1 4 2 3 5 [6] [8] [7]

[1] 4 2 3 5 [6] [7] [8]

Third iteration:

4 2 3 5 (pivot 5)

4 2 3

Fourth iteration:

4 2 3 (pivot 3)

3 2 4

2 3 4

$\therefore$ The time required is $O(n \text{ long } n)$

$\therefore$ I – takes maximum time. Choice (A)