GATE

Subject : CS 2011 - SOLUTIONS

TECHNICAL SECTION (Q. NO. 1 – 25) 1 MARKS

1. $(P+\bar{Q}+\bar{R})(P+\bar{Q}+R)(P+Q+\bar{R})$

$= (P+\bar{Q}+R.\bar{R})(P+Q+\bar{R})$ $(\because (A+B)(A+C) = A+BC)$

$= (P+\bar{Q})(P+Q+\bar{R})$

$= P+PQ+P\bar{R}+P\bar{Q}+\bar{Q}\bar{R}$ (on expanding)

$= P(1+Q+\bar{R}+\bar{Q})+\bar{Q}\bar{R}$

$= P+\bar{Q}\bar{R}$

(B) is the answer.

2. (A) $\overline{A \oplus B} = A \odot B$

(B) $\overline{\bar{A} \oplus \bar{B}}$

$\bar{A} \oplus \bar{B} = A\bar{B}+\bar{A}B = A \oplus B$

$\therefore \quad \overline{\bar{A} \oplus \bar{B}} = \overline{A \oplus B} = A \odot B$

(C) $\bar{A} \oplus B = AB+\bar{A}\bar{B}$

$= A \odot B$

(D) The given circuit evaluates to

$= \overline{(A+\bar{B})\overline{A\bar{B}}}$

$= \overline{(A+\bar{B})(\bar{A}+B)}$

$= \overline{AB+\overline{A\bar{B}}}$

$= \bar{A}B+A\bar{B}$

$= A \oplus B$

$\neq A \odot B$

$\therefore$ (D) is the answer

3. For a mod-258 counter,

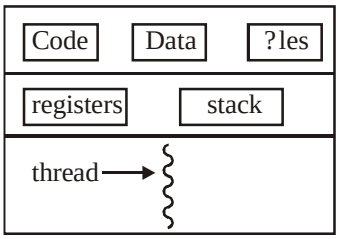
minimum number of D flip flops = $\log_2 \lceil 258 \rceil$

$= \log_2 \lceil 8.011 \rceil$

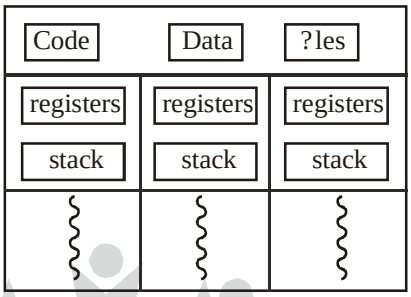
$= 9$

$\therefore$ (A) is the answer.

4.



Single threaded process



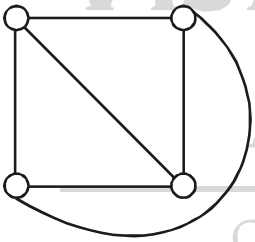
Multi threaded process
(with 3 threads)

Each thread has its own register and stack but they share common code, data and files. Threads share address space of process.

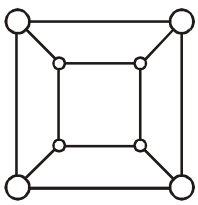
However, virtual memory is concerned with processes and not threads.

$\therefore$ (C) is the correct option.

5. K4 is planar. It can be redrawn in a plane as



Q3 is a cube graph. It is also planar. It can be redrawn as:



Hence both graphs are planar.

(B) is the answer.

6. $R = E(X^2) - (E(X))^2$

R is nothing but variance of X denoted by V(X). Variance is always a non-negative number

$\therefore \quad R \geq 0$

(C) is the answer.

7. Finite automata is used in the lexical analysis phase of the compiler.

Lexical analysis is the process of reading the source text of a program and converting it into a sequence of tokens. A common way to implement lexical analyser is to specify regular expressions for all of the kinds of tokens in the language. The disjunction of all the regular expressions thus describes any possible token in the language. And finally we convert the overall regular expression specifying all possible tokens into a deterministic finite automata (DFA). This DFA is then translated to a program that simulates the DFA. The program is nothing but the lexical analyzer.

(A) is the answer.

8. Effective memory access time = p × (page fault service time) + (1 – p) × (Memory access time)

where p- page fault rate

$$\therefore \quad \text{EMAT} = \frac{1}{10^6} \times 10 \text{ msec} + \left(1 - \frac{1}{10^6}\right) \times 20 \text{ nsec}$$

$$= 10 \text{ nsec} + \underbrace{\left(1 - \frac{1}{10^6}\right)}_{} \times 20 \text{ nsec}$$

$$\{\text{approximately equal to 1 as } \frac{1}{10^6} \text{ is negligible}\}$$

$\therefore \quad \text{EMAT} = 30 \text{ nsec}$

$\therefore$ (B) is the answer.

9. The instruction type is

LW R1, 20(R2),

Here, a 32-bit word is read from memory and stored in a 32bit register RI. The effective address of memory location is obtained by adding the constant 20 and the contents of register R2.

The constant value 20 is also known as the displacement value and here R2 is the base register.

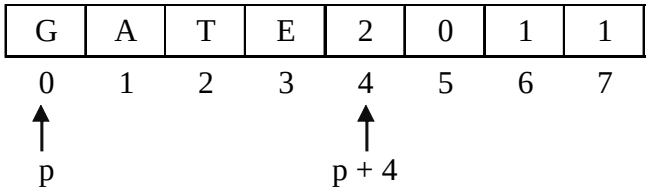
Hence this represents based indexed addressing mode.

This addressing mode is used to access an array whose elements are in successive memory locations.

(D) is the answer.

10. char c[ ] = "GATE 2011"

char *p = c // p is pointing to base address of the string "GATE2011"



p[3] = E

p[1] = A

∴ p[3] – p[1] will give the difference in the ASCII values of E and A which is 4.

So the expression in printf evaluates to p + 4 which is the base address of "2011". Hence 2011 will be printed.

∴ (C) is the answer.

11. Heaps are stored in the form of complete binary trees. Hence (A) is not the answer.

For a max-heap,

every parent ≥ its children

(B) satisfies this condition.

Option (C) and (D) fail to satisfy the max-heap property.

(B) is the answer.

12. The given algorithm finds the longest common subsequence using dynamic programming.

(A) is the answer.

13. L(P) = p*q* – It is regular

L(Q) = $\{p^n q^n \mid n \in N\}$ – It is a CFL

$P \cap Q = P - \overline{Q}$

We know that CFLs are not closed under complementation. $\overline{Q}$ may or may not be a CFL.

Hence we cannot say anything about $P \cap Q$ being regular or not.

$P - Q = P \cap \overline{Q}$

Similarly we cannot say if P – Q is regular or not.

$\Sigma^* - P = \overline{P}$

Regular languages are closed under complementation. Hence, $\Sigma^* - P$ is ALWAYS regular

$\Sigma^* - Q = \overline{Q}$ which may or may not be a CFL. But definitely not regular

Here for Q, $\Sigma^* - Q = \{p^n q^m \mid n \neq m, n, m \in N\}$ which is a CFL.

∴ (C) is the answer.

14. Keywords of a program are classified as tokens and tokens are identified in the lexical analysis phase of a compiler.

(C) is the answer.

15.
- A layer-4 firewall can block entire HTTP traffic by blocking the TCP port 80 (HTTP uses transport layer protocol TCP for communication)
- A layer-4 firewall can also block all ICMP traffic as ICMP is a network layer (i.e. layer-3) protocol.
- A layer-4 firewall can also stop incoming traffic from a specific IP address but allow outgoing traffic to the same IP address. IP addresses are part of layer-3 i.e. network layer and hence can be looked upon by a layer-4 protocol.
- A multi-user system is concerned with the application layer (layer above transport layer). It is layer 7. Hence a layer-4 firewall cannot block TCP traffic from a specific user on a multi-user system during 9:00 PM and 5:00 AM.

$\therefore$ (D) is the answer.

16. When two fair coins are tossed,

S = {HH, HT, TH, TT}

It is given that atleast one of the outcomes is known as head

$\therefore$ A = {HT, TH, HH}

$\therefore$ $P(A) = \frac{3}{4}$

Let B be the event that both outcomes are head

$\therefore$ B = {HH}

$P(B) = \frac{1}{4}$

P(B/A) is the required probability

$\therefore$ $P(B/A) = \frac{P(B \cap A)}{P(A)}$

$= \frac{1/4}{3/4}$

$= \frac{1}{3}$

$\therefore$ (A) is the answer.

17. For a connected planar graph,

$R = E - V + 2$

R – faces or regions

E – Edges

V – Vertices

$\therefore \quad R = 15 - 10 + 2$

$\therefore \quad R = 7$

So we have a total of 7 faces out of which 6 will be bounded and 1 face will be unbounded

Note : For any connected planar graph with 'R' faces, (R – 1) are bounded faces and one face is an unbounded one.

$\therefore$ (D) is the answer.

18. Let LOC of L1 = x

$\therefore \quad$ LOC of L2 = 2x

As per the given conditions,

$$\left(\frac{x}{10000}\right) \times 1000000 + 5 \times 100000 = \frac{2x}{10000} \times 750000 + 5 \times 50000$$

$$100x + 500000 = 150x + 250000$$

$\therefore \quad 50x = 250000$

$\therefore \quad x = 5000$

$\therefore \quad$ LOC of L1 is 5000

(B) is the answer.

19. Process switch also includes a mode switch (i.e. from user to kernel mode or kernel to user mode)

$\therefore \quad$ Context switch time between two processes is greater than the time taken to switch between user and kernel modes

$\therefore \quad t_2 > t_1$

(C) is the answer.

20. For COCOMO (cost constructive mode)

$$\text{Effort applied(E)} = a(\text{KLOC})^b \text{ person-months}$$

$$= 2.8 \times (40)^{1.20}$$

$$= 2.8 \times 83.65$$

$$= 234.25$$

(A) is the answer.

21.
- DFA and NFA have the same expressive power.
- Deterministic TM and non-deterministic TM have the same expressive power. Also inter conversions between them are possible.
- Deterministic single-tape TM and non-deterministic single tape TM also have the same expressive power. Interconversions between them are also possible.
- But a DPDA (Deterministic push down automata and a NPDA (Non-deterministic push down automata) have different expressive powers. There is no interconversion possible between a DPDA and a NPDA.

(B) is the answer.

22. (A) can be done using the <object> element.

(B) can be done using the tag

<meta http-equiv = “refresh”>

(C) can be achieved by link to a page with the download source.

(D) is impossible using pure HTML. It can be done using Javascript.

(D) is the answer.

23. A software requirements specification (SRS) is a description of a software system to be developed. It lays of functional and non-functional requirements.

Functional requirements may be calculations, technical details, data manipulation and processing. Non functional requirements include design and implementation constraints.

Algorithms for software implementation are not included in the SRS.

(D) is the answer.

24. Devices with high speed transfer such as magnetic disks are given high priority and slow devices like keyboard, mouse receive low priority.

However interrupt from CPU temperature sensor can lead to serious problems if ignored. Hence it must be the given the highest priority. Order of interrupt priority is as follows:

CPU temperature sensor > Hard disk > Keyboard > Mouse

(D) is the correct answer.

25. BankAccount_Num cannot be a candidate key as a student can have multiple accounts or joint accounts. Hence a student can have more than one BankAccount_Num or two or more students can have the same BankAccount_Num.

∴ (A) is the answer.

TECHNICAL SECTION (Q. NO. 26 – 55) 2 MARKS

26. Order of growth of functions is:

exponential > polynomial > lags

$\therefore$ f_3 will have lowest complexity and f_1 will have highest.

Among f_2 anf f_4, f_2 will have lower complexity than f_4

$\therefore$ correct order is

f_3, f_2, f_4, f_1

(A) is the answer.

27.

Matrix	**Order**
M_1	10×100
M_2	100×20
M_3	20×5
M_4	5×80

For the given matrices, following are the possible ways for performing matrix multiplication.

1. $(M_1M_2)\ (M_3M_4)$
2. $((M_1\ M_2)\ M_3)\ M_4$
3. $M_1(M_2(M_3\ M_4))$
4. $M_1((M_2\ M_3)M_4)$
5. $(M_1(M_2\ M_3))M_4$

Out of which 5 gives the optimal number of scalar multiplication.

$(M_2\ M_3)_{100 \times 5} = 100 \times 20 \times 5 = 10000$

$(M_1(M_2M_3))_{10 \times 5} = 10 \times 100 \times 5 = 5000$

$((M_1(M_2M_3))M_4)_{10 \times 80} = 10 \times 5 \times 80 = 4000$

$\therefore$ Total scalar multiplications = 10000 + 5000 + 4000 = 19000

(C) is the answer.

28. If a record having a particular value is to be accessed, we will do hashing.

If a range of values are to be accessed, ordered indexing will perform better.

$\therefore$ (C) is the answer.

29. The given matrix is an upper triangular matrix.

Hence the eigen values will be the diagonal elements.

$\therefore$ 1, 4, 3 are the eigenvalues of the given matrix.

(A) is the answer.

30. For a non-pipelined approach,

maximum delay(t_{np}) = 5 + 6 + 11 + 8 (sum of all stage delays)

= 30 ns

For a pipelined processor,

Maximum delay (t_p) = maximum stage delay + register delay

= maximum (5, 6, 11, 8) + 1 ns

= 11 + 1

= 12 ns

Under ideal conditions,

$$\text{speed up of pipeline} = \frac{t_{np}}{t_p}$$

$$= \frac{30}{12}$$

$$= 2.5$$

(B) is the answer.

31. Over $\Sigma = \{a\}$

$L = \{a^{nk} \mid k > 0$ and n is a positive integer constant.

If n = 2, we need to accept the language as:

$L = \{aa, aaaa, aaaaaa, ...\}$

$\therefore$ DFA for L is

$\therefore$ No. of states in a minimized DFA = 3 = 2 + 1

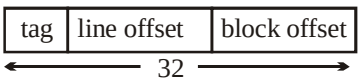
$\therefore$ For n, we will required n + 1 states.

(B) is the answer.

32. 8KB direct mapped cache

Block size = 32B

For direct mapping, format is as follows:



$$\#\text{cache line} = \frac{\text{cache size}}{\text{block size}}$$

$$= \frac{8\,\text{KB}}{32\,\text{B}}$$

$= 2^8$

$= 256$

$\therefore$ line offset $= \log_2 \lceil \text{cache lines} \rceil$

$= \log_2 \lceil 256 \rceil$

$= 8$ bits

block offset $= \log_2 \lceil \text{Block size} \rceil$

$= \log_2 \lceil 32 \rceil$

$= 5$ bits

$\therefore$ tag bits $= 32 - (8 + 5)$

$= 19$ bits

But it is given that cache controller maintains the tag information for each cache block as:

1 valid bit and

1 modified bit

$\therefore$ tag bits in cache controller $= 19 + 1 + 1$

$= 21$ bits

$\therefore$ Size of tag memory = #tagbits × #cache lines

$= 21 \times 256$

$= 5376$ bits

(D) is the answer.

33. 6000 rotations ---------- 1 minute

$\therefore$ x rotations ---------- 1 second

$\therefore$ $x \times 60 = 60000$

$x = 100$ rotations per second (RPS)

$\therefore$ Rotational delay $= \frac{1}{100}$ sec

$= 0.01$ sec

$= 10$ msec

Average rotational delay $= \frac{1}{2} \times 10 = 5$ msec

Average seek time = 10 msec

For one library,

Average data transfer time = Average seek time + Average rotational delay

$= 10 + 5$

$= 15$ msec

$\therefore$ For loading 100 libraries,

Total time $= 15 \times 100$ msec

$= 1.5$ sec

(B) is the answer.

34. The given DFA doesn't accept strings starting with 'bb'.

It accepts the language

$L(D) = a(a + b)^* + ba(a + b)^*$

(A) accepts the same language as L(D).

(B) does not accept ab.

(C) accepts bb

(D) accepts bba

$\therefore$ (A) is the answer.

Alternate solution:

Q/Σ	a	b
p	s	q
q	t	r
r	r	r
s*	s	s
t*	t	t

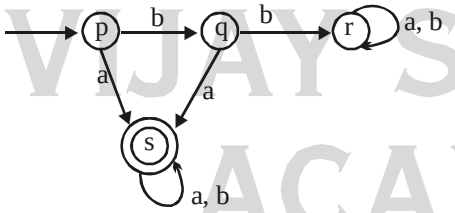
Merge these two states

Using partition algorithm, we get states as:

p, q, r, {s, t}

$\therefore$ Merge states s and t to a single state

We get the following DFA



(A) is the correct option.

35. Discriminant for a quadratic equation

$ax^2 + bx + c = 0$ is calculated as

$D = b^2 - 4ac$

For test cases T_1 and T_2,

coefficient of a is 0 and hence return value is –1. Hence they belong to same equivalence class.

For test cases T_3 and T_4,

D = 0. Hence, return value is 0. These belong to same equivalence class

For test case T_5,

D = 16 and hence return value is 0. This belongs to a separate equivalence class.

For test case T_6,

D = –15 and hence return value is –1. This also belongs to a separate equivalence class.

Thus, we have for equivalence classes.

Test case	Equivalence Class
T_1	1
T_2	1
T_3	2
T_4	2
T_5	3
T_6	4

(C) is the correct choice as T_2, T_4, T_5 and T_6 belong to different equivalence classes and are hence appropriate for black box testing.

36.

S.Borrower	**S.Bank_Manager**	**T.Bank_Manager**	**T.Loan_Amount**
Ramesh	Sunderajan	Sunderajan	10000.00
Ramesh	Sunderajan	Sunderajan	7000.00
Suresh	Ramgopal	Ramgopal	5000.00
Mahesh	Sunderajan	Sunderajan	10000.00
Mahesh	Sunderajan	Sunderajan	7000.00

The above 5 tuples are returned by the given SQL query.

(C) is the answer.

37. Given expression is : $(7 \downarrow 3 \uparrow 4 \uparrow 3 \downarrow 2)$

Precedence of $\downarrow$ is lower than $\uparrow$

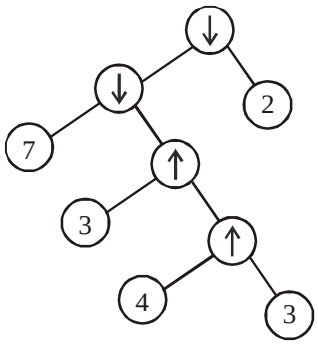
$\uparrow$ is right associative

$\downarrow$ is left associative.

$\therefore$ Expression will be evaluated as

$(7 \downarrow (3 \uparrow (4 \uparrow 3))) \downarrow 2$

$\therefore$ Parse tree is



(B) is the answer.

38. L1 is a regular language represented by the regular expression 0*1*

L2 is a CFL represented as $\{0^p\ 1^p \mid p, q \in N\}$

L3 is a CFL represented as $\{0^p\ 1^p\ 0^p \mid p \in N\}$

(A) is true as PDA can be used to recognize CFLs. If a language is regular, it is also a CFL.

(B) is true

(C) is false as L3 is not context free. It is a context sensitive language.

(D) is true as Turing Machine can accept regular languages, CFLs, CSLs, recursive languages as well as recursively enumerable languages.

$\therefore$ (C) is the answer.

39. Using interrupt driven I/O,

initialization takes 2 cycles.

LOOP takes (2 + 2 + 1 + 1 + 1) = 7 cycles

But LOOP executes 500 times

$\therefore$ Total cycles taken = $2 + 7 \times 500 = 3502$

using DMA controller,

initialization takes 20 cycles

Each DMA transfer takes 2 clock cycles

Here we have 500 DMA transfer

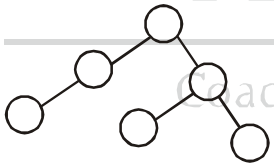
$\therefore$ Total cycles taken = $20 + 2 \times 500 = 1020$

Speed up using DMA = $\frac{3502}{1020} = 3.43$

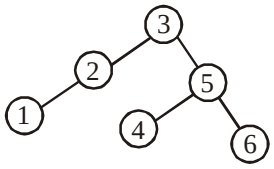
(A) is the answer.

40. Given a set of n distinct elements and an unlabeled binary tree with n nodes, we can populate the tree so that it becomes a binary search tree in only ONE way.

Let n = 6 and distinct elements are {1, 2, 3, 4, 5, 6} and the unlabeled binary tree be as follows:



We can populate it as follows so that it becomes a binary search tree



There is no other way in which it would be a binary search tree.

$\therefore$ (B) is the answer.

41. P(x) being true means that $x \neq 1$
and for all y, there exists z such that
$x = y * z$ and $y = x$ or $y = 1$
i.e. x has only two factors either 1 or x itself.
This implies x is a prime number.
(A) is the answer.

42. $\int_0^{\pi/2} \frac{\cos x + i \sin x}{\cos x - i \sin x} dx$

We know that $e^{i\theta} = \cos\theta + i \sin\theta$

$= \int_0^{\pi/2} \frac{e^{ix}}{e^{-ix}} dx$

$= \int_0^{\pi/2} e^{2ix} dx$

$= \left[\frac{e^{2ix}}{2i}\right]_0^{\pi/2}$

$= \frac{1}{2i}[e^{i\pi} - e^0]$

$= \frac{1}{2i}[\cos\pi + i\sin\pi - 1]$

$= \frac{1}{2i}[-1-1]$

$= \frac{-2}{2i}$

$= \frac{-1}{i}$

$= \frac{-i}{i^2}$

$= i$

(D) is the answer.

43. Initially X = 1, Y = 1

$X_{new} = MX + 1$

$Y_{new} = 2*MY + 1$

Where MX – maximum value of X and

MY – maximum value of Y

X	Y
1	1
2	3
3	7
4	15
5	31
6	63
7	127
8	255
⋮	

upto X = 128

For X = 7, Y = 127

∴ (A) is the answer.

44. $y_i = ax_i + b$

$\mu(y_i) = \mu(ax_i + b)$

∴ $\mu_{yi} = a\ \mu_{xi} + b$

We know that standard deviation is defined as

$$\sigma_y = \sqrt{\frac{1}{n}\Sigma(\mu_y - Y_i)^2}$$

$$\sigma_y = \sqrt{\frac{1}{n}\Sigma(a\mu_x + b - (aX_i + b))^2}$$

$$\sigma_y = \sqrt{\frac{1}{n}\Sigma(a\mu_x - aX_i)^2}$$

$$\sigma_y = a\sqrt{\frac{1}{n}\Sigma(\mu_x - X_i)^2}$$

$\sigma_y = a\ \sigma_x$

Also addition or multiplication of a constant to original distribution will not change the index position of median or mode.

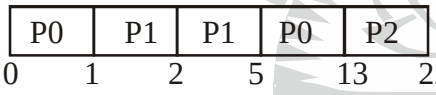
(D) is the answer.

45. Total ways of removing two cards one of a time = 5 × 4
= 20 ways
Let A be the event that the number on the first card is one higher than the number on the second card.
A = {(2, 1), (3, 2), (4, 3), (5, 4)}
∴ n(A) = 4
Required probability P(A) = $\frac{4}{20} = \frac{1}{5}$
(A) is the answer.

46.

Process	A.T.	B.T.	C.T.	TAT(C.T. – A.T.)	WT(TAT – BT)
P0	0 ms	9 ms	13	13	4
P1	1 ms	4 ms	5	4	0
P2	2 ms	9 ms	22	20	11

Using pre emptive SJF,



∴ Average waiting time = $\frac{4+0+11}{3}$ = 5 msec.
(A) is the answer.

47. $R_1 \leftarrow c$
$R_2 \leftarrow d$
$R_1 \leftarrow R_1 + R_2$
$R_2 \leftarrow e$
$R_2 \leftarrow R_2 - R_1$
To calculate (a – b) we need to load a and b into registers but we also need the content of R_2
∴ use another register R_3
$R_1 \leftarrow a$
$R_3 \leftarrow b$
$R_1 \leftarrow R_1 - R_3$
$R_1 \leftarrow R_1 + R_2$
∴ We need a minimum of 3 registers
(D) is the answer.

48. foo(513, 2)
    = (513% 2) + foo(256, 2)
    = 1 + (256% 2) + foo(128, 2)
    = 1 + 0 + (128% 2) + foo(64, 2)
    = 1 + 0 + 0 + (64% 2) + foo(32, 2)
    = 1 + 0 + 0 + 0 + (32% 2) + foo(16, 2)
    = 1 + 0 + 0 + 0 + 0 + (16% 2) + foo(8, 2)
    = 1 + 0 + 0 + 0 + 0 + 0 + (8% 2) + foo(4, 2)
    = 1 + 0 + 0 + 0 + 0 + 0 + 0 + (4%2) + foo(2, 2)
    = 1 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + (2% 2) + foo(1, 2)
    = 1 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + (1% 2) + foo(0, 2)
    = 2
    (D) is the answer

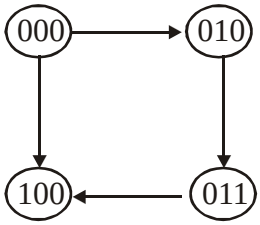
49. foo(345, 10)
    = (345% 10) + foo(34, 10)
    = 5 + (34% 10) + foo(3, 10)
    = 5 + 4 + (3% 10) + foo(0, 10)
    = 5 + 4 + 3
    = 12
    (B) is the answer.

50. On analysing the given circuit, we get
    $P_{new} = R$
    $Q_{new} = \overline{P + R}$
    $R_{new} = Q\overline{R}$
    Given that P, Q and R have values 0, 1 and 0, new values after next clock edge will be
    $P_{new} = 0$
    $Q_{new} = \overline{(0+0)} = 1$
    $R_{new} = 1.\overline{0} = 1$
    (D) is the answer.

51. Initially all flipflops are set to 0,

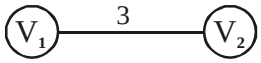
P	Q	R	P_{new}	Q_{new}	R_{new}
0	0	0	0	1	0
0	1	0	0	1	1
0	1	1	1	0	0
1	0	0	0	0	0

$\therefore$ We get 4 distinct states



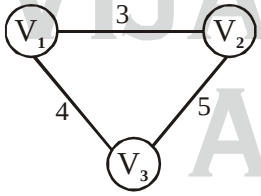
(B) is the answer.

52. For n = 2,

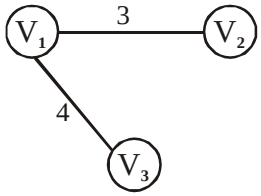


MST weight = 3

For n = 3

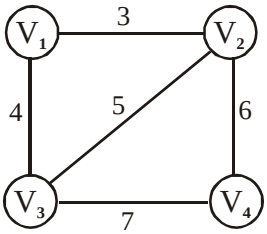


MST will be

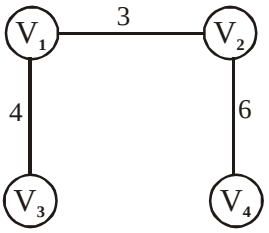


MST weight = 3 + 4 = 7

For n = 4



MST will be



MST weight = 3 + 4 + 6 = 13

Thus, we can see that when we add nth node to the tree, the weight of the minimum spanning tree increases by 2n – 2.

The recurrence relation can be written as

$\therefore$ $T(n) = T(n-1) + 2n - 2$

$T(1) = 0$ and $T(2) = 3$

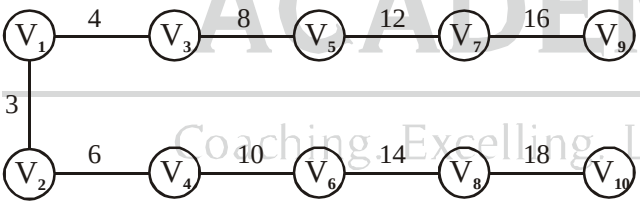
on solving we get,

$$T(n) = (2n-2) + (2n-4) + (2n-6) + \ldots\ldots + 4$$
$$= 2(n-1) + 2(n-2) + 2(n-3) + \ldots\ldots + 2 + 1$$
$$= 2\left[\frac{n(n-1)}{2}\right] + 1$$

$\therefore$ $T(n) = n^2 - n + 1$ is the solution of the recurrence relation.

(B) is the answer.

53. For n = 10, MST will be as follows:



$\therefore$ Path from V_5 to V_6 will have weight as

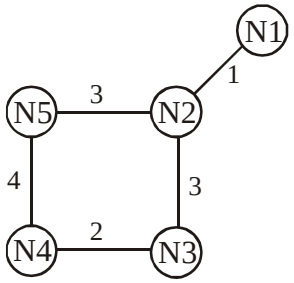
$= V_5 - V_3 + V_3 - V_1 + V_1 - V_2 + V_2 - V_4 + V_4 - V_6$

$= 8 + 4 + 3 + 6 + 10$

$= 31$

(C) is the answer.

54. Given that the cost of link N2 – N3 reduces to 2,



∴ New distance vector at node N3 will be

$$\text{For } N_3 = \begin{matrix} N1 & N2 & N3 & N4 & N5 \\ (3 & 2 & 0 & 2 & 5) \end{matrix}$$

(A) is the answer.

55. After the previous update, the link N1 – N2 goes down. Hence in next round, N3 will receive distance from N2 to N1 as infinite. It will receive distance from N4 to N1 as 8.
So it will update N1 as (8 + 2) = 10
(C) is the answer.

GENRAL APTITUDE SECTION (Q. NO. 56 – 65) 15 MARKS

56. Let $\log P = \frac{1}{2}\log Q = \frac{1}{3}\log R = k$

Consider the base of log as b

$$\log_b P = k$$

$$\therefore \quad P = b^k$$

$$\frac{1}{2}\log_b Q = k$$

$$\therefore \quad Q = b^{2k}$$

$$\frac{1}{3}\log_b R = k$$

$$\therefore \quad R = b^{3k}$$

$$\therefore \quad Q^2 = (b^{2k})^2 = b^{4k}$$

and $$PR = b^k . b^{3k} = b^{4k}$$

$$\therefore \quad Q^2 = PR$$

(B) is the answer.

57. Here the verb used is 'contemplated'. Hence it should be followed by a gerund (verb + ing from).

∴ visiting is the correct alternative.

(C) is the answer.

58. The strengthen the meaning of given sentence, the word used should be similar meaning to tentative and understated.

hyperbolic – deliberately exaggerated

augmentative – to increase, elevate

indifferent – unconcerned

restrained – unemotional, dispassionate, subdued

∴ restrained is the best choice.

(B) is the answer.

59. Amalgamate means to combine or merge together.

Hence the best choice of antonym would be "split". Even though separate is closely related to split, it is a more generalized term.

(B) is the answer.

60. Inexplicable means something that cannot be explained in words. Incomprehensible means the same thing.

(A) is the answer.

61. It is given that danger to human beings varies proportionately with the toxicity, potency and growth attributed to a microbe.

Potency is the probability that microbe will overcome human immunity system.

∴ Danger $\propto$ Potency

Toxicity is defined as milligrams of microbe required to destroy half of the body mass in kilograms.

$$\therefore \text{ Danger} \propto \frac{1}{\text{Toxicity}}$$

as less weight microbe will be more toxic as per the definition.

Growth of a microbe is the area of each circle indicating the survival of the microbe in human immunity system within 24 hours.

∴ Growth $\propto$ (Radius)^2 ($\because$ Area of a circle = πR^2)

For P,

$$\text{Danger} = k.\ \frac{0.4\times(25)^2}{800} = 0.3125k$$

For Q,

$$\text{Danger} = \frac{k.0.5\times(20)^2}{600} = 0.34k$$

For R,

$$\text{Danger} = \frac{k.0.4\times(15)^2}{300} = 0.3k$$

For S

$$\text{Danger} = \frac{k.(10)^2\times 0.8}{200} = 0.4k$$

where k is the constant of proportionality.

Thus we can conclude that S is the most dangerous microbe and therefore needs to be targeted by the company first.

(D) is the answer.

62. Total cost = V + F

$$= 4q + \frac{100}{q}$$

We have to minimize the total cost

$$f(q) = 4q + \frac{100}{q}$$

$$f'(q) = 4 - \frac{100}{q^2}$$

$$f'(q) = 0$$

$$\therefore \quad 4 - \frac{100}{q^2} = 0$$

$$4q^2 = 100$$

$$q^2 = 25$$

$$q = \pm 5$$

Number of units of production cannot be negative

$$\therefore \quad q = 5$$

(A) is the answer.

63. Let one truck do one unit of work per day and k be the backlog. W be the unit of work done in a day

$$k + 4W = 7 \times 4 \quad \text{.....(1)}$$

$$k + 10W = 3 \times 10 \quad \text{.....(2)}$$

On solving (1) & (2), we get

$$k = \frac{80}{3} \text{ and } W = \frac{1}{3}$$

We have to find out

$$K + 5W = 5 \times T \quad \text{(T is the no. of trucks required)}$$

$$\therefore \quad 5T = \frac{85}{3}$$

$$T = \frac{17}{3}$$

$$\therefore \quad T = 5.67$$

Hence we need atleast 6 trucks to get the work done by the end of fifth day.

(C) is the answer.

64. 1 litre spirit is replaced with water thrice subsequently.

$$\therefore \quad \text{Volume of spirit left} = 10\left(1-\frac{1}{10}\right)^3$$

$$= 10\left(\frac{9}{10}\right)^3$$

$$= 7.29 \text{ litres}$$

(D) is the answer.

65. Clearly (A), (B) and (D) would be included in a unit on bereavement.

(C) does not make sense.

(C) is the answer.