All India Mock GATE Test Series
Test series 4
Computer Science and Information Technology

Answer Keys and Explanations

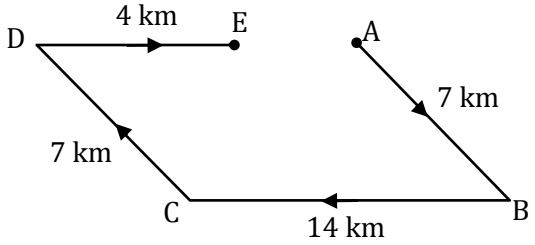
General Aptitude:

1. **[Ans. A]**
Meaning: slow to move or act
Part of Speech: Adjective

2. **[Ans. *] Range: 9 to 9**
Clearly $5 \times 2 = 10, 10 \times 2 = 20, 20 \times 2 = 40, \ldots$
So, the series is a G.P. in which $a_1 = 5$ and $r = 2$
To find the n^{th} term of a Geometric progression, the formula is $a_n = a_1 r^{n-1}$
Let 1280 be the n^{th} term of the series
Then, $5 \times 2^{n-1} = 1280 \Leftrightarrow 2^{n-1} = 256 = 2^8 \Leftrightarrow n - 1 = 8 \Leftrightarrow n = 9$

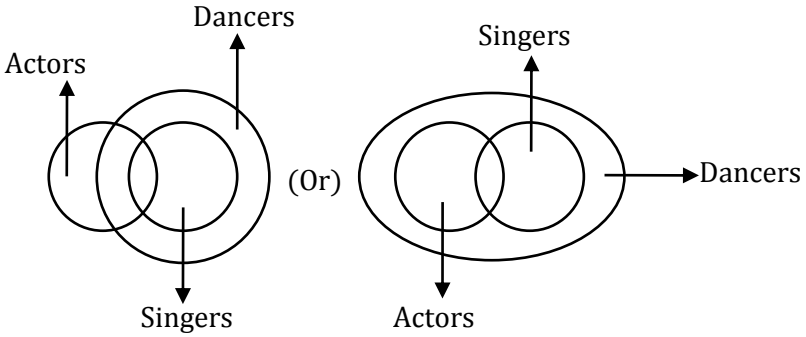
3. **[Ans. A]**
For this type of question take the LCM of speeds and assume the LCM as the distance
Then the time taken at speed of 60 km/hr $= \frac{300}{60} = 5$ hrs
Again the time taken at speed of 50 km/hr $= \frac{300}{50} = 6$ hrs
Thus we see that in place of 5 hrs trains take 6 hrs. Its means train takes 1 hr extra and this one hour is stopping period in the total time of 6 hrs. Thus in 6 hrs train halts for 1 hr. so in 1 hr train will stop for $^1/_6$ hours or 10 minutes.

4. **[Ans. *] Range: 10 to 10**
Let assume, Radha is at Point 'A'



Required distance = AE = AD − DE
Since ABCD is a parallelogram
AD= BC
∴ AE = BC − DE
= 14 − 4 = 10

5. [Ans. A]



Only (1) Follows

6. [Ans. *] Range: 6 to 6

Given:

$$\begin{matrix} R \to x+10 \\ L \to x+6 \\ B \to x+5 \\ H \to x+4 \\ A \to x \end{matrix} \Bigg| \begin{matrix} x \\ x \\ x+ \\ x \\ x \end{matrix} \quad (25) \quad \Bigg| \begin{matrix} x+5 \\ x+5 \\ x+5 \\ x+5 \\ x+5 \end{matrix} \Bigg| \begin{matrix} \textcircled{5}^{+} \\ \textcircled{1}^{+} \\ \textcircled{1}^{-} \\ \textcircled{5}^{-} \end{matrix}$$

Thus total 6 coins have to be transferred.

7. [Ans. B]

The numbers are given in pair of 4 and 9.

The unit digit of each pair is 4, and there are 50 such pairs which are mutually multiplied together.

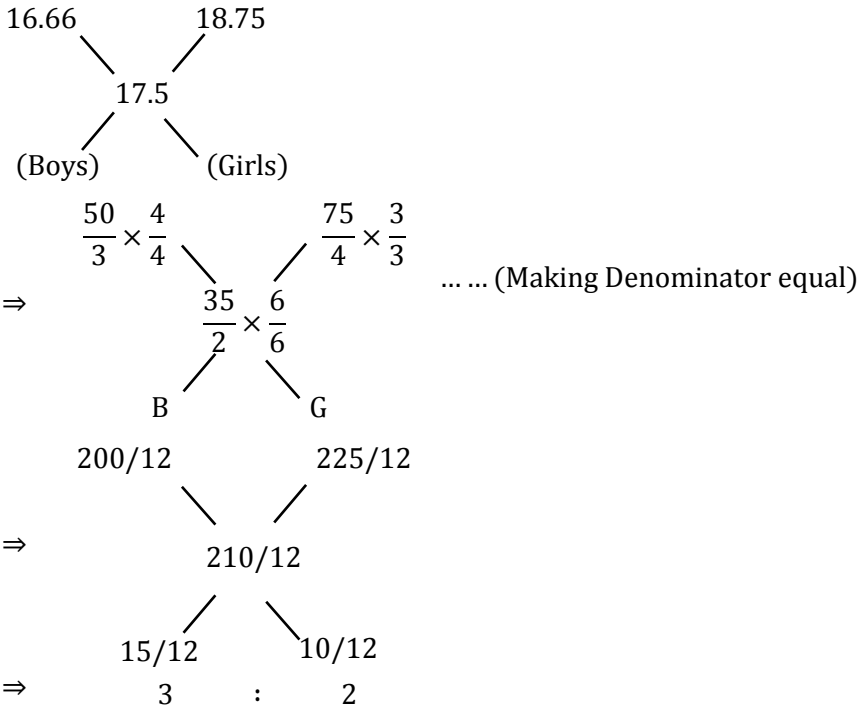
Unit digit $\underbrace{4 \times 9^2}_{4} \times \underbrace{4^3 \times 9^4}_{4} \times \underbrace{4^5 \times 9^6}_{4} \times \ldots . \underbrace{4^{99} \times 9^{100}}_{4}$

Again $4 \times 4 \times 4 \times 4 \ldots 4$(upto 50 times)

i.e., the unit digit of 4^{50}, which is 6

[Since unit digit of 4^{2n} is 6 for n = 1, 2, 3, ...etc]

8. [Ans. B]



… … (Making Denominator equal)

∴ Boys = 3x; Girls = 2x

Given 3x − 2x = 8

∴ x = 8

Thus the number of Girls = 16 and number of Boys = 24

9. [Ans. D]

Let there be x voters and k votes goes to loser then

$0.8x - 120 = k + (k + 200)$ … … . ①

Also, $k + 200 = 0.41x$ … … . ②

From equation ① and ②

$0.8x - 120 = 0.41x - 200 + 0.41x$

$0.02x = 80$

$x = 4000$

$\therefore k = 0.41 \times 4000 - 200$

$\Rightarrow k = 1440$

And $(k + 200) = 1640$

Number of voters voted = $x - 0.2x$

$0.8x = 0.8 \times 4000 = 3200$

Therefore, percentage of votes for defeated candidates $= \frac{1440}{3200} \times 100 = 45\%$

10. [Ans. *] Range: 40 to 40

Given

$W_2 = 1.5\ W_1$ ……. (50% Increase in walk)

$D_1 = D_2$

$\because \dfrac{M_1 \times D_1}{W_1} = \dfrac{M_2 \times D_2}{W_2}$

$\therefore M_2 = 1.5\ M_1$

$\therefore$ If the efficiency of M_1 and M_2 is same, then 50% more work force is required.

But it is given the productivity of new labour is 25% more (i.e., 5/4 times efficient)

$\therefore$ Actual % increase in work force required $= \dfrac{50\%}{5/4} = 40\%$

Technical:

1. **[Ans. D]**

$(P \leftrightarrow Q) \equiv (P \rightarrow Q) \wedge (Q \rightarrow P)$

$\equiv (\sim P \vee Q) \wedge (\sim Q \vee P)$

2. **[Ans. *] Range: 0.63 to 0.69**

Let A = Number is prime

B = number is odd

Given if the number is odd

Find the probability of prime

Conditional probability = $P(A/B)$ Where A is Unknown and B is known

$$P\left(\frac{A}{B}\right) = \frac{P(A \cap B)}{P(B)}$$

Sample space ⇒ {1,2,3,4,5,6}

odd ⇒ {1,3,5} odd ∩ prime ⇒ {3,5}

$$\text{So, } P(B) = \frac{3}{6} = \frac{1}{2} \quad P(A \cap B) = \frac{2}{6} = \frac{1}{3}$$

$$P\left(\frac{A}{B}\right) = \frac{1/3}{1/2} = \frac{2}{3} = 0.66667$$

3. **[Ans. *] Range: 6 to 6**

{1, 2, 3, 4, 5, 6} is a largest subset of graph that itself a complete graph of six vertex.

So, the clique number of a graph is 6.

4. **[Ans. *] Range: 3 to 3**

For maximum number of linearly independent vectors convert the matrix into row echelon form

$$\begin{bmatrix} 3 & 0 & 1 & 2 \\ 6 & 1 & 0 & 0 \\ 12 & 1 & 2 & 4 \\ 6 & 0 & 2 & 4 \\ 9 & 0 & 1 & 2 \end{bmatrix} \Rightarrow \begin{bmatrix} 3 & 0 & 1 & 2 \\ 0 & 1 & -2 & -4 \\ 0 & 1 & -2 & -4 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & -2 & -4 \end{bmatrix}$$

$$\Downarrow$$

$$\begin{bmatrix} 3 & 0 & 1 & 2 \\ 0 & 1 & -2 & -4 \\ 0 & 1 & -2 & -4 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Rank of the matrix=Number of non-zero rows in row echelon form = 3

This means that the maximum number of linearly independent vectors is 3.

5. **[Ans. *] Range: 2 to 2**

Rank (A^TA) = rank (A)

$$\begin{pmatrix} 1 & 3 & 1 & -4 \\ -1 & -3 & 1 & 0 \\ 2 & 6 & 2 & -8 \end{pmatrix} \begin{matrix} R_2 \to R_2 + R_1 \\ R_3 \to R_3 - 2R_1 \end{matrix}$$

$$\begin{pmatrix} 1 & 3 & 1 & -4 \\ 0 & 0 & 2 & -4 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

Rank (A) = 2

$\therefore$ Rank $(A^TA) = 2$

6. **[Ans. B]**

Writing characteristics equation for A

$$\begin{bmatrix} a-\lambda & 1 & 0 & 0 \\ 1 & a-\lambda & 0 & 0 \\ 0 & 0 & 1-\lambda & -1 \\ 0 & 0 & -1 & 1-\lambda \end{bmatrix} = (a-\lambda)\left((a-\lambda)\begin{vmatrix} 1-\lambda & -1 \\ -1 & 1-\lambda \end{vmatrix}\right) - 1\left(1.\begin{vmatrix} 1-\lambda & -1 \\ -1 & 1-\lambda \end{vmatrix}\right)$$

$$= ((a-\lambda)^2 - 1)\begin{vmatrix} 1-\lambda & -1 \\ -1 & 1-\lambda \end{vmatrix} ((a-\lambda)^2 - 1)(\lambda^2 - 2\lambda) = 0$$

Which can be expressed as?

$(a-\lambda^2) - 1 = 0$ or $\Rightarrow (a-\lambda) = \pm 1$

$(\lambda^2 - 2\lambda) = 0 \Rightarrow \lambda = a+1, \lambda = a-1$

$\Rightarrow \lambda(\lambda - 2) = 0$

$\lambda = 0, \lambda = 2$

So, $\lambda = a+1, \lambda = a-1, \lambda = 0, \lambda = 2$

Alternative Method:

Sum of Eigen values $= 2a + 2$

Only (B) satisfies

7. **[Ans. A]**

Considering the carry in function c, $c_1 = a_0b_0 + a_0c + b_0c$, but e is missing in all option and hence ignored

$c_1 = a_0b_0$

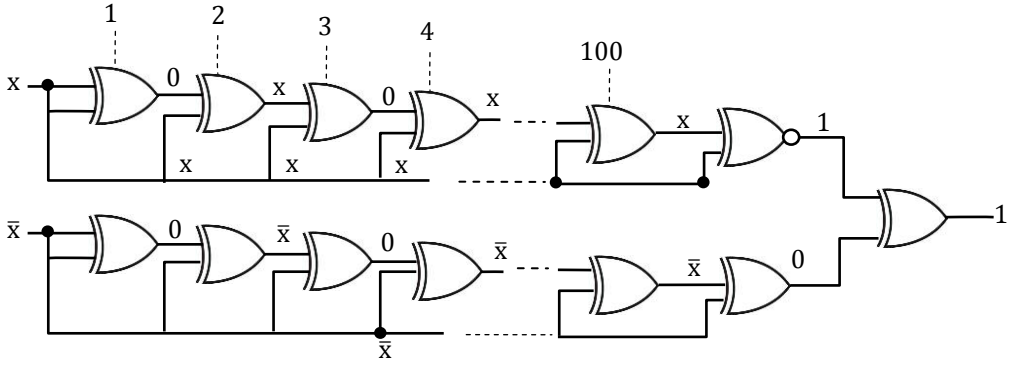
$c_2 = a_1b_1 + a_1c_1 + b_1c_1$

$c_3 = a_2b_2 + a_2c_2 + b_2c_2$

$= a_2b_2 + a_2(a_1b_1 + a_1a_0b_0 + b_1a_0b_0) + b_2(a_1b_1 + a_1a_0b_0 + b_1a_0b_0)$

$= a_2b_2 + a_2a_1b_1 + a_2a_1a_0b_0 + a_2a_0b_1b_0 + a_1b_2b_1 + a_1a_0b_2b_0 + a_0b_2b_1b_0$

8. **[Ans.*]Range: 0 to 0**



$y = 1 \Rightarrow \bar{y} = 0$

9. **[Ans. C]**

The condition for over flow to occur is $\bar{x}\,\bar{y}z + xy\,\bar{z}$

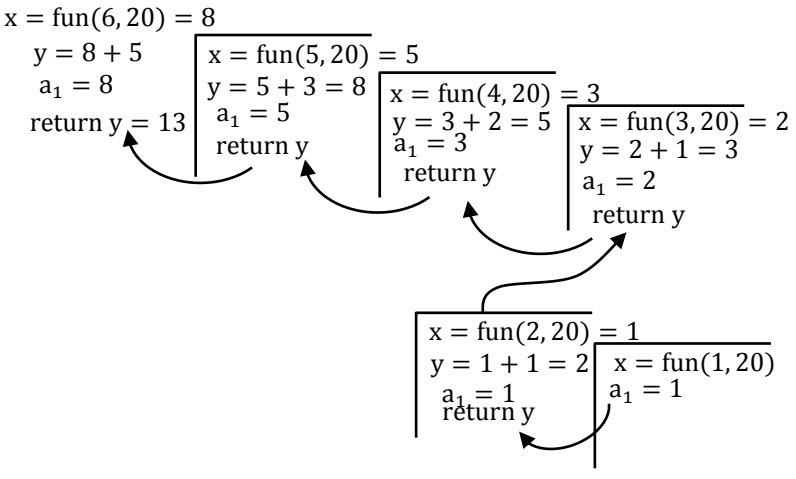
10. **[Ans. C]**

After implementing 250, 2 address instructions and 1530 1 -address instructions, number of 0-address instructions that can be implemented=6*256=1536

11. **[Ans. D]**

12. **[Ans. A]**

a_1	x_1
15	20
20	200



13. **[Ans. C]**

Time complexity ≅

$O(n^2) + O(n^2) + \cdots\cdots$ n times

$= O(n^3)$

14. **[Ans. A]**

15. **[Ans. B]**

Let $x = \frac{\log n}{\log\log n} = \log(n - \log n)$

$x_1 = 2^x = n - \log n = O(n)$

$y = n^{\frac{1}{2}}\log n = \log n^{n^{\frac{1}{2}}}$

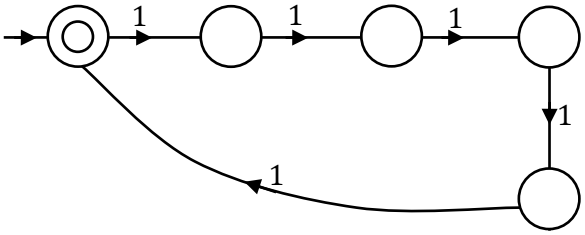
$2^y = n^{n^{1/2}} = O(n^{n^{1/2}})$

$z = \log n^{\log n}$

$2^z = n^{\log n} = O(n^{\log n})$

$2^y > 2^z > 2^x$

16. **[Ans. *]Range: 5 to 5**



Minimum DFA

17. **[Ans. B]**

$(0 + 1 + 11)^* \equiv (0 + 1 + 01)^* \equiv (0 + 1)^*$

So, expression is

$\Rightarrow (0 + 1)^*01(0 + 1)^*$

Generate set of all strings where 01 is Substring.

18. **[Ans. C]**

$(L_1 \cap L_2)'$is CSL

$(L_3 \cap L_4)'$may be REL iff L_4 is Recursive language.(Note: Every Recursive is Recursive Enumerable)

So, $((L_1 \cap L_2)' \cup (L_3 \cap L_4)')'$is may be Recursive Enumerable language.

19. **[Ans. *]Range: 6 to 6**

$A \rightarrow SS/a$

$S \rightarrow AA/b$

$\Rightarrow A \rightarrow AAS/bS/a$

$\Rightarrow S \rightarrow AA/b$

Resultant grammar contain 6 production rule

$A \rightarrow bSA'/aA'$

$A' \rightarrow ASA'/\epsilon$

$S \rightarrow AA/b$

20. **[Ans. *] Range : 4 to 4**

	10P	2V	6P	5P	3V
Counting Semaphore	+2	+4	−2	−7	−4

∴ Number of Blocked Process = 4

21. **[Ans. D]**

$n(V + P_b) + P_b <= (\text{size of a page})$
Since maximum capacity is allowed so
$n = \text{size of page} / V + P_b$
$= 1000/40 + 10 = 20$

22. **[Ans. D]**

23. **[Ans. B]**

$3^{16} \bmod 17$
$= ((3^2 \% 17)^8 \% 17)$
$= (9^8 \% 17)$
$= ((9^2 \% 17)^4 \% 17)$
$= (13^4 \% 17)$
$= ((13^2 \% 17)^2 \% 17)$
$= 16^2 \% 17$
$= 1$

24. **[Ans. A]**

The vulnerable time for pure and slotted aloha is $2T_{fr}$ and T_{fr} respectively so, statement S_1 and S_2 are true. In CSMA/CD, the minimum frame should emit NA for $2T_{fr}$ time otherwise collision detection is not possible so, the third statement is not always true

25. **[Ans. A]**

26. **[Ans. D]**

All are not exit
[I] Number of element P (A) is never null
[II] $\{\emptyset, \{\emptyset, \{\emptyset\}\}\}$ set has only two element $\emptyset$ and $\{\emptyset, \{\emptyset\}\}$
[III] P($\{\emptyset\}$ is $\{\emptyset, \{\emptyset\}\}$

27. **[Ans. B]**

The square of every negative integer is positive
$\forall x[(A(x) \wedge (x < 0)) \rightarrow (x^2 > 0)]$

28. **[Ans. *] Range: 7776 to 7776**

Complement of a is $= \{b, c, d, e, f, g\}$

Complement of b is $= \{e, d, h, g, f\}$

$x = 6, y = 5$

$x^y = 6^5 \Rightarrow 7776$

29. **[Ans. *]Range: 9.42 to 9.43**

By Stoke theorem

$$\oint_c \vec{F} \cdot \overrightarrow{dr} = \iint_S (\nabla \times F) \cdot N \, ds$$

Where N is Normal vector to the surface

Given, $\vec{F} = -y^3\hat{i} + x^3\hat{j}$

$$\nabla \times \vec{F} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ -y^3 & x^3 & 0 \end{vmatrix}$$

$= i(0-0) - j(0-0) + k(3x^2 + 3y^2)$

$= 3(x^2 + y^2)k$

$\nabla \times \vec{F} = 3k \ (\because x^2 + y^2 \leq 1)$

$N = k \ (\because z = 0)$

$$\oint_c \vec{F} \cdot \overrightarrow{dr} = \iint_S (\nabla \times F).N \, ds$$

$$= \iint_s 3k \,.\, k \, ds$$

$$= 3 \iint_S ds$$

$= 3\,\pi\,(1)^2$

$= 3\pi = 9.4284$

30. **[Ans. *] Range: 27 to 27**

Set A consists 3 elements

The number of asymmetric and reflexive relations is $3^{n(n-1)/2}$

$\Rightarrow 3^{3(3-1)/2} = 27$

31. **[Ans. *] Range: 1044 to 1044**

$R_1 \leftarrow R_1 + 1 = 1$

$R_2 \leftarrow R_2 + M[100 + R_1]$

$= 1000 + M[101] = 1002$

Final Value after $8-$ iterations $= 1002 + 3 + 4 + 5 + 6 + 7 + 8 + 9 = 1044$

32. **[Ans. *] Range: 16 to 16**

$12 - 2 = \log_2\left(\frac{16384}{N_s}\right)$ Where N_s = Number of sets

$\therefore N_s = 16$

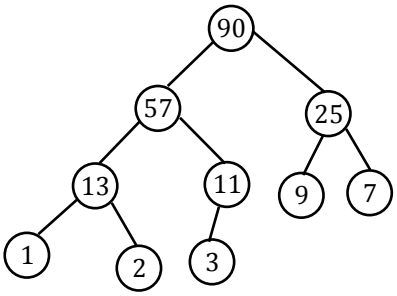
$N_s = \frac{256}{x} \therefore x = 16$

33. **[Ans. A]**

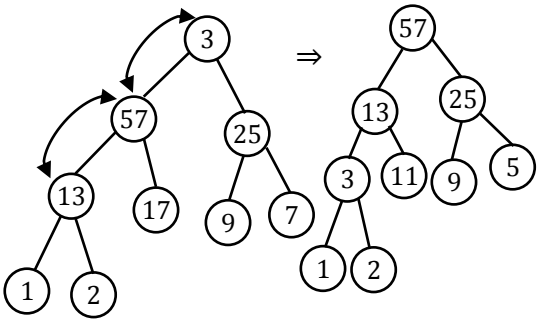
$$\text{Speedup} = \frac{2+2+5+11+4}{\max(2,2,5,11,4)+1} = \frac{24}{12} = 2$$

34. **[Ans. *]Range: 2 to 2**

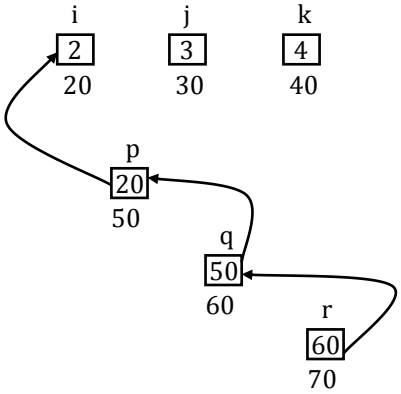
Max heap



After deleting 90, 3 will become root



35. **[Ans. B]**



Function (20, 50, 60)

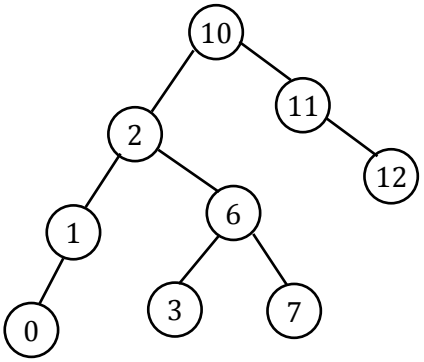
1. $*p = **q + 4$

$*p = 2 + 4 = 6 \Rightarrow i = 6$

2. $**q = ****r + 6$
   $6 + 6 = 12 \Rightarrow i = 12$
3. $***r = *p - 3$
   $12 - 3 = 9 \Rightarrow i = 9$

print → 11 9 9
if (***r<=10)
9<=10
Fun (20, 50, 60)
$*p = **q + 4 = 9 + 4 = 13 \Rightarrow i = 13$
$**q = ***r + 6 = 13 + 6 = 19 \Rightarrow i = 19$
$***r = *p - 3 = 19 - 3 = 16 \Rightarrow i = 16$
printf → 18,16,16
If (***r<=10)
16<=10
printf →$*p + 4$,$**q + 4$,$***r + 10$
20, 20, 26
Solution: 11, 99,18,16,16,20,20,26

36. **[Ans. B]**
The resulting AVL tree is



37. **[Ans. C]**
$= (3, x \gg 5 - 4)\ [*arr]$
$= (3, 5 \gg 1)\ [*arr]$ (−has higher precedence than ≫)
$= (3, 2)\ [*arr]$
↓
2
$= 2[*ar]$
$= *(2 + *arr)$
$= *arr\ [2]$
$= *(\&c) = c$
Print c data i.e.,
SUCCESS 35

38. **[Ans. D]**

39. **[Ans. *]Range: 3 to 3**

$$|x| = \begin{vmatrix} \alpha & \beta & y \\ \beta & y & \alpha \\ \beta & \alpha & y \end{vmatrix}$$

$= \alpha(y^2 - \alpha^2) - \beta(\beta y - \alpha\beta) + y(\beta\alpha - \beta y)$

$= \alpha y^2 - \alpha^3 - \beta^2 y + \beta^2\alpha + \alpha\beta y - y^2\beta$

$= \beta^2(\alpha - y) + y^2(\alpha - \beta) + \alpha(\beta y - \alpha^2)$

$\neq 0$

$|x| \neq 0$

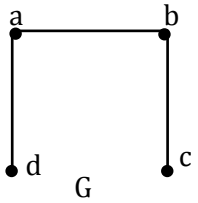
All three row/columns of matrix are independent

$\therefore$ So rank $= 3$

40. **[Ans. A]**

For a binary tree having three vertices the pre-order, post order, and in-order can never be same to the matrix formed from these traversal cannot have rank 1

41. **[Ans. C]**



G and $\overline{G}$ are isomorphic

42. **[Ans. *]Range: 4 to 4**

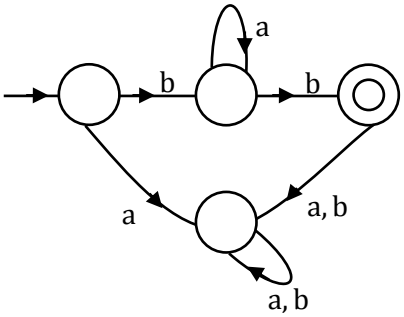
Language L_1 is λ

L_2 is ba^*b

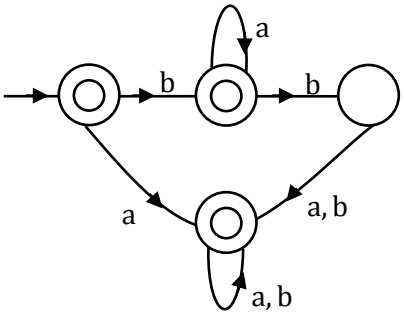
$L_1 \cdot L_2$ is $\lambda \cdot ba^*b$

So, $[L_1 \cdot L_2 = ba^*b]$

Minimum automata for $L_1 \cdot L_2$ is



Complement of $L_1 \cdot L_2$ is



Minimum States $\Rightarrow$ 4

43. **[Ans: *]Range: 3 to 3**

S_1 is false.

S_2, S_3, S_4 are true.

44. **[Ans. C]**

(1) L_3 Generate strings start with b but not accepted by the given pda.

(2) L_4 Generate strings start with b but not accepted by the given pda.

45. **[Ans. A]**

S_1 and S_2 are true; S_3 and S_4 are false.

46. **[Ans. B]**

L_1 is DCFL

L_2 is not CFL

L_3 is DCFL

L_4 is NCFL

$L_1 - L_3 \Rightarrow (L_1 \cap L_3)' \Rightarrow L_3'$ because L_1 is Superset.

So, $L_3' \Rightarrow (\text{DCFL})'$

So, it is DCFL [Note: Make DPDA of L_3 and change final to non-final and non-final to final]

47. **[Ans. *] Range: 88562 to 88562**

Total CPU burst time $= \frac{3^{11} - 3^0}{2} = 88573$

When P_0 completes, only 1 unit of $P_1, P_2 \ldots . P_{10}$ is left

$\therefore$ Completion Time $(P_0) = 88573 - 10 = 88563$

Waiting Time $(P_0) = 88563 - 1 = 88562$

48. **[Ans. *] Range: 20 to 20**

Fork ( ) –on success, returns PID of Child to parent 0 is returned to child.

Using above concept "Forked" will be printed 5 times on executing

fork ( ) && fork ( ) || fork( )

There are 2 more fork ( )'s which will print "forked" $5 * 2^2 = 20$ times

49. **[Ans. D]**

P (T) at Y and T=1, S=0 will start the strict alteration to print the mentioned string.

50. **[Ans. B]**

Seek time $= \frac{1}{2} \times 512 \times 1$ ms

$= 256$ ms

Rotational Latency $= \frac{1}{2} \times \frac{60 * 1000}{x}$ ms

Data transfer time $= \frac{60 * 1000}{x} . \frac{32 \text{ kB}}{256 \times 128} = \frac{60 * 1000}{x}$ ms

Total time $= 256 + \frac{1}{2} \frac{60 * 1000}{x} + \frac{60 * 1000}{x}$

$\therefore 331 = 256 + \frac{3}{2} . \frac{60 * 1000}{x}$

$x = 1200$ RPM

51. **[Ans. A]**

52. **[Ans. A]**

53. **[Ans. A]**

Propagation delay $(T_P) = 25.6\mu s$

$\therefore$ The minimum frame transmission time should be $2T_P$

$= (2 * 25.6)\mu s$

$= 51.2\mu s$

$\therefore$ The mi ni mum frame size should be

$= (51.2\mu s * 10\text{Mbps})$

$= 512\text{byts}$

$= 64$ byte

54. **[Ans. B]**

The amount of original data= $(4000 - 20)$ byte $= 3980$ byte

∴The first fragment data =1480 byte

The first fragment header =20 byte

∴The second fragment data =1480 byte

The second fragment header=20 byte

∴ The third fragment data=1020 byte

The third fragment header=20 byte

55. **[Ans. A]**

$T_P = \frac{8 * 10^3 * 10^3}{4 * 10^6} = 2$ sec

$T_{fr} = \frac{10^7}{500 * 10^6} = \frac{1}{50}$ sec

As, the channel will be used in it's full capacity so, efficiency $(\eta) = 1$

$\therefore \ \eta = \frac{N\ T_{fr}}{2T_P + T_{fr}}$, where N is the number of frames in a window

$1 = \frac{N * \frac{1}{50}}{(2 * 2) + \frac{1}{50}}$

$\Rightarrow N = 201$

As in selective repeat ARQ the window size remain half so, the original window size $= 2 * 201$

$= 402$

∴ Number of bits required to respresent the 402 length window is $[\log_2 402] = 9$