SOLVED GATE (COMPUTER SCIENCE AND INFORMATION TECHNOLOGY) 2022

Engineering Mathematics and General Aptitude

ENGINEERING MATHEMATICS

Q. No. 1–4 Carry One Mark Each

1. Consider the following two statements with respect to the matrices $A_{m\times n}$, $B_{n\times m}$, $C_{n\times n}$ and $D_{n\times n}$.

Statement 1: $tr(AB) = tr(BA)$

Statement 2: $tr(CD) = tr(DC)$

where $tr()$ represents the trace of a matrix. Which one of the following holds?

(A) Statement 1 is correct and Statement 2 is wrong.
(B) Statement 1 is wrong and Statement 2 is correct.
(C) Both Statement 1 and Statement 2 are correct.
(D) Both Statement 1 and Statement 2 are wrong.

Solution: We know that,

$$tr\,(AB) = tr\,(BA)$$

where tr is trace of matrix, that is, sum of diagonal matrix.

Thus both statements are correct and hence option (C) is correct.

Ans. (C)

2. Which of the following statements is/are **true** for a group G?

(A) If for all $x, y \in G, (xy)^2 = x^2y^2$, then G is commutative.
(B) If for all $x \in G, x^2 = 1$, then G is commutative. Here, 1 is the identity element of G.
(C) If the order of G is 2, then G is commutative.
(D) If G is commutative, then a subgroup of G need not be commutative.

Solution:

Statement A: If for all $x, y \in G, (xy)^2 = x^2y^2$ then G is commutative,

$$(xy)^2 = x^2y^2$$

$$\Rightarrow \qquad xyxy = xxyy$$

Now, using cancellation laws

$$yx = xy$$

Therefore, G is commutative. So, statement (A) is correct.

Statement B: If for all $x \in G,\ x^2 = 1$, then G is commutative. Here, 1 is identity of G.

$$x^2 = 1 \Rightarrow xx = 1$$

Now, multiply by x^{-1} on left side

$$x^{-1}xx = x^{-1}$$

$$ex = x^{-1} \qquad (\text{Since, } x^{-1}x = e\,)$$

$$x = x^{-1} \qquad (\text{Since, } ex = x)$$

If in a group every element has its own inverse then group is commutative. So, statement B is correct.

Statement C: If the order of G is 2, then G is commutative.

By definition, every group of prime order is commutative. So, statement C is correct.

Statement D: If G is commutative, then a subgroup of G need not be commutative. This statement is false. If G is commutative, then a subgroup of G may also be commutative.

Let $x, y \in G$ and let $x, y \in H$ where H is subgroup of g then $xy = yx$

$\because\ x, y \in G$ and G is commutative

Therefore, H is also commutative. So, statement (D) is incorrect.

Ans. (A, B, C)

3. The number of arrangements of six identical balls in three identical bins is _____.

Solution: Possible arrangements of six identical balls in three identical bins are

(6, 0, 0), (5, 1, 0), (4, 2, 0), (3, 3, 0), (4, 1, 1), (3, 2, 1), (2, 2, 2)

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That is, these are 7 possible arrangements.

Ans. (7)

4. The value of the following limit is _____.

$$\lim_{x\to 0^+}\frac{\sqrt{x}}{1-e^{2\sqrt{x}}}$$

Solution: Given that,

$$\lim_{x\to 0^+}\frac{\sqrt{x}}{1-e^{2\sqrt{x}}}$$

Using L'Hospital's rule, we have

$$\lim_{x\to 0^+}\frac{f(x)}{g(x)}=\lim_{x\to 0^+}\frac{f'(x)}{g'(x)}$$

So, $$\lim_{x\to 0^+}\frac{\sqrt{x}}{1-e^{2\sqrt{x}}}=\lim_{x\to 0^+}\frac{\frac{1}{2\sqrt{x}}}{-2\frac{e^{-2\sqrt{x}}}{2\sqrt{x}}}$$

$$=\lim_{x\to 0^+}\frac{-1}{2e^{-2\sqrt{x}}}=\frac{-1}{2}=-0.5$$

Ans. (−0.5)

Q. No. 5–11 Carry Two Marks Each

5. Which one of the following is the closed form for the generating function of the sequence $\{a_n\}_{n\geq 0}$ defined below?

$$a_n=\begin{cases}n+1, & n \text{ is odd}\\ 1, & \text{otherwise}\end{cases}$$

(A) $\frac{x(1+x^2)}{(1-x^2)^2}+\frac{1}{1-x}$ (B) $\frac{x(3-x^2)}{(1-x^2)^2}+\frac{1}{1-x}$

(C) $\frac{2x}{(1-x^2)^2}+\frac{1}{1-x}$ (D) $\frac{x}{(1-x^2)^2}+\frac{1}{1-x}$

Solution: We have,

$$a_n=\begin{cases}n+1, & n \text{ is odd}\\ 1, & \text{otherwise}\end{cases}$$

Generating function is

$$\sum_{\text{odd, } n} nx^n+\sum_{\text{odd } n} x^n+\sum_{\text{others}} x^n$$

$$=(x^2+3x^3+5x^5+\cdots)+(x^1+x^3+x^5+\cdots)$$
$$+(x^0+x^2+x^4+\cdots)$$
$$=(x^2+3x^3+5x^5+\cdots)+(x^0+x^1+x^2+x^3+\cdots)$$
$$=\frac{x(1+x^2)}{(1-x^2)^2}+\frac{1}{1-x}$$

Ans. (A)

6. Consider a simple undirected unweighted graph with at least three vertices. If A is the adjacency matrix of the graph, then the number of 3-cycles in the graph is given by the trace of

(A) A^3 (B) A^3 divided by 2

(C) A^3 divided by 3 (D) A^3 divided by 6

Solution: Let adjacency matrix of the graph be $A[\,][\,]$ then, $A^n[i][j]$ represents number of distinct walks between i and j vertex of the graph.

Therefore, $A^3[i][j]$ represents triangle that begins and ends at i vertex in graph, that is, 3-cycle in the graph.

$$A^3=A_{11}^3+A_{22}^2+\cdots A_{nn}^3$$

Since each vertex is distinct and counted separately, then number of 3-cycles $=\frac{A^3}{3}$

Moreover since the graph is undirected eliminating double counting we get number of 3-cycles

$$\frac{1}{2}\times\frac{A^3}{3}=\frac{A^3}{6}$$

Ans. (D)

7. Consider solving the following system of simultaneous equations using LU decomposition.

$$x_1+x_2-2x_3=4$$
$$x_1+3x_2-x_3=7$$
$$2x_1+x_2-5x_3=7$$

where L and U are denoted as

$$L=\begin{pmatrix}L_{11}&0&0\\L_{21}&L_{22}&0\\L_{31}&L_{32}&L_{33}\end{pmatrix},U=\begin{pmatrix}U_{11}&U_{12}&U_{13}\\0&U_{22}&U_{23}\\0&0&U_{33}\end{pmatrix}$$

Which one of the following is the correct combination of values for L_{32}, U_{33}, and x_1?

(A) $L_{32}=2, U_{33}=-\frac{1}{2}, x_1=-1$

(B) $L_{32}=2, U_{33}=2, x_1=-1$

(C) $L_{32}=-\frac{1}{2}, U_{33}=2, x_1=0$

(D) $L_{32}=-\frac{1}{2}, U_{33}=-\frac{1}{2}, x_1=0$

Solution: Writing the given equations in matrix form $AX=B$

$$\begin{bmatrix}1&1&-2\\1&3&-1\\2&1&-5\end{bmatrix}\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix}=\begin{bmatrix}4\\7\\7\end{bmatrix}$$

Here $$A=\begin{bmatrix}1&1&-2\\1&3&-1\\2&1&-5\end{bmatrix}$$

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Now using elementary row transformation $R_2 \rightarrow R_2 \rightarrow R_1$, we get

$$A = \begin{bmatrix} 1 & 1 & -2 \\ 0 & 2 & 1 \\ 2 & 1 & -5 \end{bmatrix}$$

Now $R_3 \rightarrow R_3 - 2R_1$, we get

$$A = \begin{bmatrix} 1 & 1 & -2 \\ 0 & 2 & 1 \\ 0 & -1 & -1 \end{bmatrix}$$

Now $R_3 \rightarrow R_3 - \left(\frac{-R_2}{2}\right)$, we get

$$A = U = \begin{bmatrix} 1 & 1 & -2 \\ 0 & 2 & 1 \\ 0 & 0 & -1/2 \end{bmatrix}$$

Similarly, $$I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Now $R_2 \rightarrow R_2 - R_1$, we get

$$I = \begin{bmatrix} 1 & 0 & 0 \\ -1 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Now $R_3 \rightarrow R_3 - 2R_1$, we get

$$I = \begin{bmatrix} 1 & 0 & 0 \\ -1 & 1 & 0 \\ -2 & 0 & 1 \end{bmatrix}$$

Now $R_3 \rightarrow R_3 - \left(\frac{+R_2}{2}\right)$, we get

$$I = L = \begin{bmatrix} 1 & 0 & 0 \\ -1 & 1 & 0 \\ -3/2 & -1/2 & 1 \end{bmatrix}$$

Therefore, $L_{33} = -1/2$, $U_{33} = -1/2$ and $x_1 = 0$.

Ans. (D)

8. Consider the following recurrence:

$f(1) = 1;$
$f(2n) = 2f(n) - 1,$ for $n \geq 1;$
$f(2n+1) = 2f(n) + 1,$ for $n \geq 1.$

Then, which of the following statements is/are **true**?

(A) $f(2^n - 1) = 2^n - 1$ (B) $f(2^n) = 1$

(C) $f(5 \cdot 2^n) = 2^{n+1} + 1$ (D) $f(2^n + 1) = 2^n + 1$

Solution: We have

$$f(1) = 1;\ f(2n) = 2f(n) - 1,$$

and $$f(2n+1) = 2f(n) + 1$$

For $n = 2$, $f(2) = 2f(1) - 1 = 2 - 1 = 1$

For $n = 3$, $f(3) = f(2 \times 1 + 1) = 2f(1) + 1 = 2 + 1 = 3$

For $n = 4$, $f(4) = f(2 \times 2) = 2f(2) - 1 = 2 \times 1 - 1 = 1$

For $n = 5$, $f(5) = f(2 \times 2 + 1) = 2f(2) + 1 = 2 \times 1 + 1 = 3$

For $n = 6$, $f(6) = f(2 \times 3) = 2f(3) - 1 = 2 \times 3 - 1 = 5$

For $n = 7$, $f(7) = f(2 \times 3 + 1) = 2f(3) + 1 = 2 \times 3 + 1 = 7$

For $n = 8$, $f(8) = f(2 \times 4) = 2f(4) - 1 = 2 \times 1 - 1 = 1$

For $n = 9$, $f(9) = f(2 \times 4 + 1) = 2f(4) + 1 = 2 \times 1 + 1 = 3$

For $n = 10$, $f(10) = f(2 \times 5) = 2f(5) - 1 = 2 \times 3 - 1 = 5$

Using the analysis we conclude that

$$f(2^n) = 1,\ f(2^n + 1) = 3,\ f(2^n - 1) = 2^n - 1,$$

$$f(5 \cdot 2^n) = (2^{n+1} + 1)$$

Therefore, $f(2^n + 1) \neq 2^n + 1$

So, option (A), (B) and (C) are correct and option (D) is false.

Ans. (A, B, C)

9. Which of the properties hold for the adjacency matrix A of a simple undirected unweighted graph having n vertices?

(A) The diagonal entries of A^2 are the degrees of the vertices of the graph.

(B) If the graph is connected, then none of the entries of $A^{n-1} + I_n$ can be zero.

(C) If the sum of all the elements of A is at most $2(n - 1)$, then the graph must be acyclic.

(D) If there is at least a 1 in each of A's rows and columns, then the graph must be connected.

Solution: For an adjacency matrix A of a simple undirected unweighted graph having n vertices, the diagonal entries of A^2 are the degrees of the vertices of the graph.

Ans. (A)

10. Which of the following is/are the eigenvector(s) for the matrix given below?

$$\begin{pmatrix} -9 & -6 & -2 & -4 \\ -8 & -6 & -3 & -1 \\ 20 & 15 & 8 & 5 \\ 32 & 21 & 7 & 12 \end{pmatrix}$$

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(A) $\begin{pmatrix}-1\\1\\0\\1\end{pmatrix}$ (B) $\begin{pmatrix}1\\0\\-1\\0\end{pmatrix}$

(C) $\begin{pmatrix}-1\\0\\2\\2\end{pmatrix}$ (D) $\begin{pmatrix}0\\1\\-3\\0\end{pmatrix}$

Solution: We know that,

$$AX = \lambda X$$

where λ is eigen values of matrix A.
Consider option (A), we have

$$X = \begin{bmatrix}-1\\1\\0\\1\end{bmatrix}$$

Then, $AX = \begin{bmatrix}-9 & -6 & -2 & -4\\-8 & -6 & -3 & -1\\20 & 15 & 8 & 5\\32 & 21 & 7 & 12\end{bmatrix}\begin{bmatrix}-1\\1\\0\\1\end{bmatrix}$

$$= \begin{bmatrix}9-6-4\\+8-6-1\\-20+15+5\\-32+21+12\end{bmatrix} = \begin{bmatrix}-1\\1\\0\\1\end{bmatrix}$$

So, $AX = 1X$with $\lambda = 1$. Therefore, $\begin{bmatrix}-1\\0\\0\\1\end{bmatrix}$ is an eigen vector.
Consider option (B), we have

$$X = \begin{bmatrix}1\\0\\-1\\0\end{bmatrix}$$

Then, $AX = \begin{bmatrix}-9 & -6 & -2 & -4\\-8 & -6 & -3 & -1\\20 & 15 & 8 & 5\\32 & 21 & 7 & 12\end{bmatrix}\begin{bmatrix}1\\0\\-1\\0\end{bmatrix}$

$$= \begin{bmatrix}-9+2\\-8+3\\20-8\\32-7\end{bmatrix} = \begin{bmatrix}-7\\-5\\12\\25\end{bmatrix}$$

Therefore, $AX \neq \lambda X$ so $\begin{bmatrix}1\\0\\-1\\0\end{bmatrix}$ is not an eigen vector.

Consider option (C), we have

$$X = \begin{bmatrix}-1\\0\\2\\2\end{bmatrix}$$

Then, $AX = \begin{bmatrix}-9 & -6 & -2 & -4\\-8 & -6 & -3 & -1\\20 & 15 & 8 & 5\\32 & 21 & 7 & 12\end{bmatrix}\begin{bmatrix}-1\\0\\2\\2\end{bmatrix}$

$$= \begin{bmatrix}9-4-8\\8-6-2\\-20+16+10\\-32+14+24\end{bmatrix} = \begin{bmatrix}-3\\0\\6\\6\end{bmatrix} = 3\begin{bmatrix}-1\\0\\2\\2\end{bmatrix}$$

Therefore, $AX = 3X$ with $\lambda = 3$ so $\begin{bmatrix}-1\\0\\2\\2\end{bmatrix}$ is an eigen vector.
Consider option D, we have

$$X = \begin{bmatrix}0\\1\\-3\\0\end{bmatrix}$$

Then, $AX = \begin{bmatrix}-9 & -6 & -2 & -4\\-8 & -6 & -3 & -1\\20 & 15 & 8 & 5\\32 & 21 & 7 & 12\end{bmatrix}\begin{bmatrix}0\\1\\-3\\0\end{bmatrix}$

$$= \begin{bmatrix}-6+6\\-6+9\\15-24\\21-21\end{bmatrix} = \begin{bmatrix}0\\3\\-9\\0\end{bmatrix} = 3\begin{bmatrix}0\\1\\-3\\0\end{bmatrix}$$

Therefore, $AX = 3X$ with $\lambda = 3$ so $\begin{bmatrix}0\\1\\-3\\0\end{bmatrix}$ is an eigen vector.

Ans. (A, C, D)

11. Let $G(V, E)$ be a directed graph, where $V = \{1, 2, 3, 4, 5\}$ is the set of vertices and E is the set of directed edges, as defined by the following adjacency matrix A.

$$A[i][j] = \begin{cases}1, & 1 \le j \le i \le 5\\0, & \text{otherwise}\end{cases}$$

$A[i][j] = 1$ indicates a directed edge from node i to node j. A *directed spanning tree* of G, rooted at $r \in V$, is defined as a subgraph T of G such that the undirected version of T is a tree, and T contains a directed path from r to every other vertex in V. The number of such directed spanning trees rooted at vertex 5 is _____.

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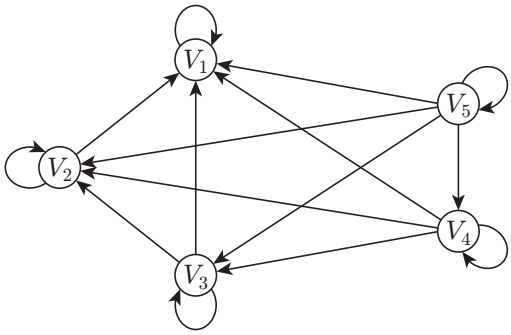
Solution: Given that, $V = \{1, 2, 3, 4, 5\}$ and

$$A[i][j] = \begin{cases} 1 & 1 \le j \le i \le 5 \\ 0 & \text{otherwise} \end{cases}$$

So, the adjacency matrix is

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

Graph of this matrix is



Therefore, number of direct spanning trees rooted at vertex $5 = 4 \times 3 \times 2 \times 1 = 24$

Ans. (24)

GENERAL APTITUDE

Q. No. 1–5 Carry One Mark Each

1. The _____ is too high for it to be considered _____.
(A) fair / fare (B) faer / fair
(C) fare / fare (D) fare / fair

Solution: The fare is too high for it to be considered fair.

Ans. (D)

2. A function $y(x)$ is defined in the interval [0, 1] on the x-axis as

$$y(x) = \begin{cases} 2 & \text{if} \quad 0 \le x < \dfrac{1}{3} \\ 3 & \text{if} \quad \dfrac{1}{3} \le x < \dfrac{3}{4} \\ 1 & \text{if} \quad \dfrac{3}{4} \le x \le 1 \end{cases}$$

Which one of the following is the area under the curve for the interval [0, 1] on the x-axis?

(A) $\dfrac{5}{6}$ (B) $\dfrac{6}{5}$
(C) $\dfrac{13}{6}$ (D) $\dfrac{6}{13}$

Solution: Given function:

$$y(x) = \begin{cases} 2 & \text{if} \quad 0 \le x < \dfrac{1}{3} \\ 3 & \text{if} \quad \dfrac{1}{3} \le x < \dfrac{3}{4} \\ 1 & \text{if} \quad \dfrac{3}{4} \le x \le 1 \end{cases}$$

Area under the curve for the interval [0, 1] on the x-axis is given by

$$A = \int_0^1 y(x)dx = \int_0^{1/3} 2dx + \int_{1/3}^{3/4} 3dx + \int_{3/4}^{1} 1dx$$

$$= (2x)\Big|_0^{1/3} + (3x)\Big|_3^{3/4} + (x)\Big|_{3/4}^{1}$$

$$= \left[2 \times \left(\frac{1}{3}\right)\right] + \left[3 \times \left(\frac{3}{4} - \frac{1}{3}\right)\right] + \left[1 \times \left(1 - \frac{3}{4}\right)\right]$$

$$= \left(2 \times \frac{1}{3}\right) + \left(3 \times \frac{5}{12}\right) + \left(1 \times \frac{1}{4}\right) = \frac{2}{3} + \frac{5}{4} + \frac{1}{4}$$

$$= \frac{8 + 15 + 3}{3 \times 4} = \frac{26}{3 \times 4} = \frac{13}{6}$$

Ans. (C)

3. Let r be a root of the equation $x^2 + 2x + 6 = 0$. Then the value of the expression $(r + 2)(r + 3)(r + 4)(r + 5)$ is
(A) 51 (B) −51
(C) 126 (D) −126

Solution: Given quadratic equation

$$x^2 + 2x + 6 = 0$$

This quadratic equation has root r. So,

$$r^2 + 2r + 6 = 0 \qquad (1)$$

Now, $(r + 2)(r + 3)(r + 4)(r + 5)$

$$= (r^2 + 2r + 3r + 6)(r^2 + 4r + 5r + 20)$$

$$= ((r^2 + 2r + 6) + 3r)(r^2 + 9r + 20)$$

From Eq. (1), we get

$$(r+2)(r+3)(r+4)(r+5) = (0 + 3r)(r^2 + 9r + 20)$$

$$= 3r(r^2 + 2r + 7r + 6 + 14)$$

$$= 3r(r^2 + 2r + 6 + 7r + 14)$$

$$= 3r(0 + 7r + 14) = 21r^2 + 42r = 21(r^2 + 2r)$$

From Eq. (1), we have

$$r^2 + 2r = -6$$

So,

$$(r + 2)\ (r + 3)\ (r + 4)\ (r + 5) = 21 \times (-6)$$

$$= -126$$

Ans. (D)

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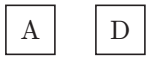
4. Given below are four statements.
Statement 1: All students are inquisitive.
Statement 2: Some students are inquisitive.
Statement 3: No student is inquisitive.
Statement 4: Some students are not inquisitive.
From the given four statements, find the two statements that **cannot be true** simultaneously, assuming that there is at least one student in the class.
(A) Statement 1 and Statement 3
(B) Statement 1 and Statement 2
(C) Statement 2 and Statement 4
(D) Statement 3 and Statement 4

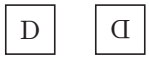
Solution: Statement 1: all students are inquisitive; Statement 3: No student is inquisitive. These statements can not be true simultaneously.

Ans. (A)

5. A palindrome is a word that reads the same forwards and backwards. In a game of words, a player has the following two plates painted with letters.



From the additional plates given in the options, which one of the combinations of additional plates would allow the player to construct a five-letter palindrome. The player should use all the five plates exactly once. The plates can be rotated in their plane.

(A) 

(B)

(C)

(D)

Solution: RADAR is a five — letter palindrome that can be formed using RAR after rotating last two plates.

Ans. (B)

Q. No. 6–10 Carry Two Marks Each

6. Some people believe that "what gets measured, improves". Some others believe that "what gets measured, gets gamed". One possible reason for the difference in the beliefs is the work culture in organizations. In organizations with good work culture, metrics help improve outcomes. However, the same metrics are counterproductive in organizations with poor work culture.
Which one of the following is the **correct** logical inference based on the information in the above passage?
(A) Metrics are useful in organizations with poor work culture
(B) Metrics are useful in organizations with good work culture
(C) Metrics are always counterproductive in organizations with good work culture
(D) Metrics are never useful in organizations with good work culture

Solution: Based on the information in above passage, correct logical inference is "metrics are useful in organization with good work culture".

Ans. (B)

7. In a recently conducted national entrance test, boys constituted 65% of those who appeared for the test. Girls constituted the remaining candidates and they accounted for 60% of the qualified candidates.
Which one of the following is the correct logical inference based on the information provided in the above passage?
(A) Equal number of boys and girls qualified
(B) Equal number of boys and girls appeared for the test
(C) The number of boys who appeared for the test is less than the number of girls who appeared
(D) The number of boys who qualified the test is less than the number of girls who qualified

Solution: From the given data, we have 65% boys appeared for the test, 35% girls appeared for the test and 60% girls qualified the test based on the given information, correct logical inference is that the number of boys who qualified the test is less than the number of girls who qualified.

Ans. (D)

8. A box contains five balls of same size and shape. Three of them are green coloured balls and two of them are orange coloured balls. Balls are drawn from the box one at a time. If a green ball is drawn, it is not replaced. If an orange ball is drawn, it is replaced with another orange ball. First ball is drawn. What is the probability of getting an orange ball in the next draw?
(A) $\frac{1}{2}$ (B) $\frac{8}{25}$
(C) $\frac{19}{50}$ (D) $\frac{23}{50}$

Solution: Given that, total balls = 5, green balls = 3 and orange balls = 2
If green ball is drawn, it is not replaced with other balls. If orange ball is draw, it is replaced with another orange ball.

When, first ball is drawn:

$$\text{Probability of getting green ball} = \frac{3}{5}$$

$$\text{Probability of getting orange ball} = \frac{2}{5}$$

If first ball drawn was green remaining balls in bag = 4. So,

$$\text{Number of green balls} = 2$$

$$\text{Number of orange balls} = 2$$

$$\text{Then, Probability of getting orange ball} = \frac{2}{4} = \frac{1}{2}$$

If first balls was orange remaining balls in bag = 5. So,

$$\text{Number of green balls} = 3$$
$$\text{Number of orange balls} = 2$$

$$\text{Then, Probability of getting orange ball} = \frac{2}{5}$$

So, probability that next draw is an orange ball is

$$\frac{3}{5}\times\frac{1}{2}+\frac{2}{5}\times\frac{2}{5}=\frac{3}{10}+\frac{4}{25}=\frac{23}{50}$$

Ans. (D)

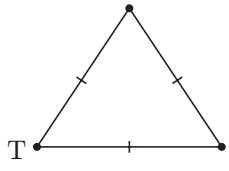
9. The corners and mid-points of the sides of a triangle are named using the distinct letters P, Q, R, S, T and U, but not necessarily in the same order. Consider the following statements:

- The line joining P and R is parallel to the line joining Q and S.
- P is placed on the side opposite to the corner T.
- S and U cannot be placed on the same side.

Which one of the following statements is correct based on the above information?

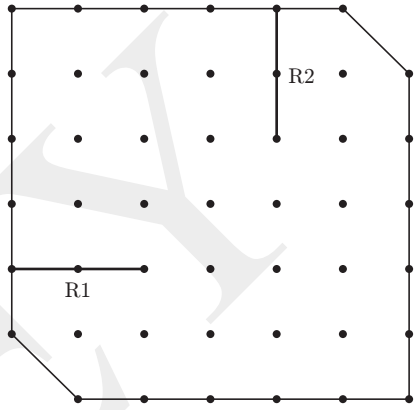
(A) P cannot be placed at a corner
(B) S cannot be placed at a corner
(C) U cannot be placed at a mid-point
(D) R cannot be placed at a corner

Solution: Based on the information given,
P can be placed at a corner of side opposite to T.



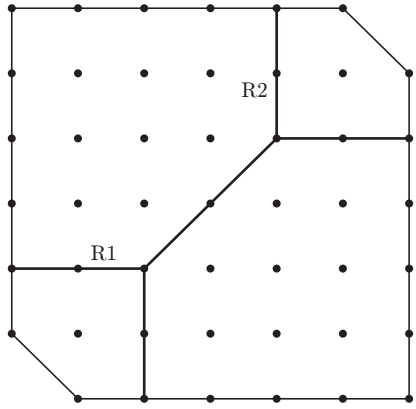
Ans. (A)

10. A plot of land must be divided between four families. They want their individual plots to be similar in shape, not necessarily equal in area. The land has equally spaced poles, marked as dots in the below figure. Two ropes, R1 and R2, are already present and cannot be moved.
What is the least number of **additional** straight ropes needed to create the desired plots? A single rope can pass through three poles that are aligned in a straight line.



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

Solution: 3 additional ropes are required to divide the plot into similar shape.



Ans. (D)

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