

CUET PG 2026 B.Ed. Mathematics

Question Paper with Solutions

Conducted by National Testing Agency (NTA)



General Instructions

- (i) **Duration:** The total duration of the examination is 90 minutes.
- (ii) **Total Marks:** The complete paper carries a maximum of 300 marks.
- (iii) **Structure:** The paper consists of 1 Section:
 - **Section A:** 75 Questions (Mathematics)
- (iv) **Compulsory Questions:** All 75 questions are compulsory.
- (v) Each question has four options. Only **one** option is correct.
- (vi) **Right Answer:** Marks as per question scheme (Total 300 marks).
- (vii) **Incorrect Answer:** No negative marking.
- (viii) **Unanswered/Marked for Review:** 0 marks.

1. Which of the following represents the slope of the line passing through points $(3, -2)$ and $(3, 4)$?

- (A) 0
- (B) 1
- (C) $-\frac{3}{2}$
- (D) ∞

Correct Answer: (D) ∞

Solution:

Step 1: Identify the Given Information

We are given two points through which the line passes:

$$\text{Point 1: } P_1 = (x_1, y_1) = (3, -2)$$

$$\text{Point 2: } P_2 = (x_2, y_2) = (3, 4)$$

Step 2: Recall the Slope Formula The slope m of a line passing through any two points (x_1, y_1) and (x_2, y_2) is defined as the ratio of the vertical change (change in y) to the horizontal change (change in x):

$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

Step 3: Substitute the Coordinates into the Formula Substitute the values $x_1 = 3$, $y_1 = -2$, $x_2 = 3$, and $y_2 = 4$ into the slope formula:

$$m = \frac{4 - (-2)}{3 - 3}$$

Step 4: Simplify the Expression Evaluate the numerator and the denominator separately:

$$\text{Numerator: } \Delta y = 4 - (-2) = 4 + 2 = 6$$

$$\text{Denominator: } \Delta x = 3 - 3 = 0$$

Thus, the slope expression becomes:

$$m = \frac{6}{0}$$

Step 5: Interpret the Result Mathematically Division by zero is undefined in standard real arithmetic. Graphically:

- Since $x_1 = x_2 = 3$, the line is vertical (given by the equation $x = 3$).
- The horizontal run Δx is zero, meaning the line rises without any horizontal movement.
- A vertical line has an **undefined** or **infinite** slope ($m \rightarrow \infty$).

Conclusion Comparing our result with the given choices, the term ∞ corresponds to option (D).

Quick Tip: If two points have the same x -coordinate, the line is vertical and its slope is undefined. If two points have the same y -coordinate, the line is horizontal and its slope is 0.

2. Evaluate the determinant:

$$\begin{vmatrix} b+c & a-b & a \\ c+a & b-c & b \\ a+b & c-a & c \end{vmatrix}$$

(A) $3abc - a^3 - b^3 - c^3$

(B) $3abc + a^3 + b^3 + c^3$

(C) $3abc - a^3 + b^3 - c^3$

(D) $3abc + a^3 - b^3 - c^3$

Correct Answer: (A) $3abc - a^3 - b^3 - c^3$

Solution:

Concept:

To evaluate a determinant of order 3, we can expand it along any row or column. Here, we expand along the first row.

Step 1: Write the determinant.

$$\Delta = \begin{vmatrix} b+c & a-b & a \\ c+a & b-c & b \\ a+b & c-a & c \end{vmatrix}$$

Step 2: Expand along the first row.

$$\Delta = (b+c) \begin{vmatrix} b-c & b \\ c-a & c \end{vmatrix} - (a-b) \begin{vmatrix} c+a & b \\ a+b & c \end{vmatrix} + a \begin{vmatrix} c+a & b-c \\ a+b & c-a \end{vmatrix}$$

Step 3: Evaluate the minor determinants.

$$\begin{vmatrix} b-c & b \\ c-a & c \end{vmatrix} = (b-c)c - b(c-a)$$

$$= bc - c^2 - bc + ab$$

$$= ab - c^2$$

Similarly, after simplifying the complete expansion, we get:

$$\Delta = 3abc - a^3 - b^3 - c^3$$

Step 4: Final answer.

$$\therefore \Delta = 3abc - a^3 - b^3 - c^3$$

$\therefore$ Correct Answer is (A)

Quick Tip: For a 3×3 determinant, expand carefully along any row or column and simplify term by term. Always keep track of signs $+, -, +$.

3. If

$$x = e^{\tan^{-1}\left(\frac{y-x^2}{x}\right)}$$

then $\frac{dy}{dx} = ?$

- (A) $\sec^2(\log_e x) + \tan(\log_e x)$
- (B) $2x + \sec^2(\log_e x) + \tan(\log_e x)$
- (C) $-2x + \sec^2(\log_e x) + \tan(\log_e x)$
- (D) $2x + \sec(\log_e x) + \tan(\log_e x)$

Correct Answer: (B) $2x + \sec^2(\log_e x) + \tan(\log_e x)$

Solution:

Concept:

When a variable is given inside inverse trigonometric and exponential functions, first simplify the equation using logarithm and trigonometric inverse properties.

Step 1: Take natural logarithm on both sides.

$$x = e^{\tan^{-1}\left(\frac{y-x^2}{x}\right)}$$

Taking $\log_e$ on both sides:

$$\log_e x = \tan^{-1}\left(\frac{y-x^2}{x}\right)$$

Step 2: Apply tangent on both sides.

$$\tan(\log_e x) = \frac{y-x^2}{x}$$

Step 3: Solve for y .

$$x \tan(\log_e x) = y - x^2$$

$$y = x^2 + x \tan(\log_e x)$$

Step 4: Differentiate both sides with respect to x .

$$\frac{dy}{dx} = \frac{d}{dx}(x^2) + \frac{d}{dx}[x \tan(\log_e x)]$$

$$\frac{d}{dx}(x^2) = 2x$$

Now apply product rule:

$$\frac{d}{dx}[x \tan(\log_e x)] = x \cdot \frac{d}{dx}[\tan(\log_e x)] + \tan(\log_e x) \cdot \frac{d}{dx}(x)$$

$$= x \cdot \sec^2(\log_e x) \cdot \frac{1}{x} + \tan(\log_e x)$$

$$= \sec^2(\log_e x) + \tan(\log_e x)$$

Step 5: Combine the terms.

$$\frac{dy}{dx} = 2x + \sec^2(\log_e x) + \tan(\log_e x)$$

∴ Correct Answer is (B)

Quick Tip: For equations involving $e^{\tan^{-1}(\cdot)}$, first take $\log_e$ on both sides and then apply tangent to remove $\tan^{-1}$.

4. If $y = e^{m \sin^{-1} x}$ and y_n indicates n^{th} derivative of y with respect to x , then which of the following relation is true?

- (A) $(1 + x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 + m^2)y_n = 0$
(B) $(1 - x^2)y_{n+2} + (2n + 1)xy_{n+1} - (n^2 + m^2)y_n = 0$
(C) $(1 - x^2)y_{n+2} + (2n + 1)xy_{n+1} + (n^2 + m^2)y_n = 0$
(D) $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 + m^2)y_n = 0$

Correct Answer: (D) $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 + m^2)y_n = 0$

Solution:

Concept:

This question is based on successive differentiation. First we form a differential equation satisfied by y , and then differentiate it n times.

Step 1: Given function.

$$y = e^{m \sin^{-1} x}$$

Taking logarithm:

$$\log y = m \sin^{-1} x$$

Step 2: Differentiate once.

$$\frac{1}{y} \frac{dy}{dx} = \frac{m}{\sqrt{1-x^2}}$$

$$y' = \frac{my}{\sqrt{1-x^2}}$$

Step 3: Form the differential equation.

On differentiating again and simplifying, the standard differential equation obtained is:

$$(1 - x^2)y'' - xy' - m^2y = 0$$

Step 4: Differentiate n times.

$$D^n[(1 - x^2)y''] - D^n[xy'] - m^2D^n[y] = 0$$

Using Leibniz theorem:

$$D^n[(1 - x^2)y''] = (1 - x^2)y_{n+2} - 2nxy_{n+1} - n(n-1)y_n$$

Also,

$$D^n[xy'] = xy_{n+1} + ny_n$$

Step 5: Substitute these values.

$$(1 - x^2)y_{n+2} - 2nxy_{n+1} - n(n-1)y_n - xy_{n+1} - ny_n - m^2y_n = 0$$

$$(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 + m^2)y_n = 0$$

$\therefore$ Correct Answer is (D)

Quick Tip: For successive derivative questions, first form the differential equation satisfied by y , then apply Leibniz theorem to differentiate n times.

5. Which of the following is derivative of $\sqrt{a^{\sqrt{x}}}$ with respect to x ?

- (A) $\frac{\sqrt{a^{\sqrt{x}}}}{2\sqrt{x}}$
 (B) $\frac{\sqrt{a^{\sqrt{x}}} \log_e a}{2\sqrt{x}}$
 (C) $\frac{a^{\sqrt{x}} \sqrt{a^{\sqrt{x}}} \log_e a}{2\sqrt{x}}$

(D) $\frac{\sqrt{a^{\sqrt{x}}}}{4\sqrt{x} \log_a e}$

Correct Answer: (D) $\frac{\sqrt{a^{\sqrt{x}}}}{4\sqrt{x} \log_a e}$

Solution:

Concept:

To differentiate an exponential function of the form $a^{f(x)}$, we use:

$$\frac{d}{dx} (a^{f(x)}) = a^{f(x)} \log_e a \cdot f'(x)$$

Step 1: Write the given function.

$$y = \sqrt{a^{\sqrt{x}}}$$

This can be written as:

$$y = (a^{\sqrt{x}})^{\frac{1}{2}}$$

$$y = a^{\frac{\sqrt{x}}{2}}$$

Step 2: Differentiate using exponential rule.

$$\frac{dy}{dx} = a^{\frac{\sqrt{x}}{2}} \log_e a \cdot \frac{d}{dx} \left(\frac{\sqrt{x}}{2} \right)$$

Step 3: Differentiate the exponent.

$$\frac{d}{dx} \left(\frac{\sqrt{x}}{2} \right) = \frac{1}{2} \cdot \frac{1}{2\sqrt{x}}$$

$$= \frac{1}{4\sqrt{x}}$$

Step 4: Substitute.

$$\frac{dy}{dx} = a^{\frac{\sqrt{x}}{2}} \log_e a \cdot \frac{1}{4\sqrt{x}}$$

$$\frac{dy}{dx} = \frac{\sqrt{a^{\sqrt{x}}} \log_e a}{4\sqrt{x}}$$

Now,

$$\log_a e = \frac{1}{\log_e a}$$

Therefore,

$$\frac{\sqrt{a^{\sqrt{x}}} \log_e a}{4\sqrt{x}} = \frac{\sqrt{a^{\sqrt{x}}}}{4\sqrt{x} \log_a e}$$

$\therefore$ Correct Answer is (D)

Quick Tip: First convert $\sqrt{a^{\sqrt{x}}}$ into $a^{\frac{\sqrt{x}}{2}}$, then apply the differentiation formula of $a^{f(x)}$.

6. If a, b, c are in arithmetic progression, then find the value of

$$\begin{vmatrix} x+2 & x+3 & x+2a \\ x+3 & x+4 & x+2b \\ x+4 & x+5 & x+2c \end{vmatrix}.$$

- (A) $2x$
- (B) x
- (C) 1
- (D) 0

Correct Answer: (D) 0

Solution:

Concept:

If three elements a, b, c are in arithmetic progression, then:

$$2b = a + c$$

A determinant becomes zero if its rows or columns become linearly dependent.

Step 1: Given determinant.

$$\Delta = \begin{vmatrix} x+2 & x+3 & x+2a \\ x+3 & x+4 & x+2b \\ x+4 & x+5 & x+2c \end{vmatrix}$$

Step 2: Use the A.P. condition.

a, b, c are in A.P.

Therefore,

$$a + c = 2b$$

Step 3: Observe the pattern in rows.

The first two columns increase regularly from row to row. The third column also becomes linearly related because a, b, c are in arithmetic progression.

Step 4: Linear dependence.

Since the columns are linearly dependent, the determinant must be zero.

$$\Delta = 0$$

$\therefore$ Correct Answer is (D)

Quick Tip: Whenever entries in rows or columns follow an arithmetic progression, check for linear dependence. A determinant with linearly dependent rows or columns is always zero.

7. If each side of a rectangle is increased by 10%, then which of the following will represent the increased area of a rectangle?

- (A) 28%
- (B) 21%
- (C) 22%

(D) 25%

Correct Answer: (B) 21%

Solution:

Concept:

Area of a rectangle is:

$$A = l \times b$$

If both length and breadth are increased, the new area is found by multiplying the increased dimensions.

Step 1: Assume original length and breadth.

Let the original length be l and breadth be b .

Original area:

$$A = lb$$

Step 2: Increase each side by 10%.

New length:

$$l + \frac{10}{100}l = 1.1l$$

New breadth:

$$b + \frac{10}{100}b = 1.1b$$

Step 3: Find new area.

$$A' = 1.1l \times 1.1b$$

$$A' = 1.21lb$$

Step 4: Find percentage increase.

$$\text{Increase} = A' - A$$

$$= 1.21lb - lb$$

$$= 0.21lb$$

Percentage increase:

$$\frac{0.21lb}{lb} \times 100 = 21\%$$

$\therefore$ Correct Answer is (B)

Quick Tip: If both dimensions of a rectangle increase by 10%, area becomes $1.1 \times 1.1 = 1.21$, so area increases by 21%.

8. On adding any three consecutive even numbers, the summation result would always be divisible by which of the following?

- (A) 5
- (B) 7
- (C) 6
- (D) 11

Correct Answer: (C) 6

Solution:

Concept:

Consecutive even numbers differ by 2. We can represent any three consecutive even numbers algebraically.

Step 1: Let the three consecutive even numbers be:

$$2n, \quad 2n + 2, \quad 2n + 4$$

Step 2: Add the three numbers.

$$S = 2n + (2n + 2) + (2n + 4)$$

$$S = 6n + 6$$

$$S = 6(n + 1)$$

Step 3: Interpret the result.

Since the sum is:

$$6(n + 1)$$

it is always divisible by 6.

∴ Correct Answer is (C)

Quick Tip: The sum of any three consecutive even numbers is always divisible by 6.

9. Which of the following is equation of hyperbola with vertices $(\pm 2, 0)$ and foci $(\pm 3, 0)$?

- (A) $\frac{x^2}{4} - \frac{y^2}{9} = 1$
 (B) $\frac{x^2}{4} + \frac{y^2}{9} = 1$
 (C) $\frac{x^2}{4} - \frac{y^2}{5} = 1$
 (D) $\frac{x^2}{5} - \frac{y^2}{4} = 1$

Correct Answer: (C) $\frac{x^2}{4} - \frac{y^2}{5} = 1$

Solution:

Concept:

For a hyperbola with transverse axis along the x -axis, the standard equation is:

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

The vertices are:

$$(\pm a, 0)$$

and the foci are:

$$(\pm c, 0)$$

where:

$$c^2 = a^2 + b^2$$

Step 1: Use the vertices.

Given vertices are:

$$(\pm 2, 0)$$

Therefore,

$$a = 2$$

$$a^2 = 4$$

Step 2: Use the foci.

Given foci are:

$$(\pm 3, 0)$$

Therefore,

$$c = 3$$

$$c^2 = 9$$

Step 3: Find b^2 .

$$c^2 = a^2 + b^2$$

$$9 = 4 + b^2$$

$$b^2 = 5$$

Step 4: Write the equation.

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

$$\frac{x^2}{4} - \frac{y^2}{5} = 1$$

∴ Correct Answer is (C)

Quick Tip: For a hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, vertices give a , foci give c , and use $c^2 = a^2 + b^2$.

10. The normal at the point (1, 1) on the curve $2y + x^2 = 3$ is?

- (A) $x + y = 0$
- (B) $x - y = 0$
- (C) $x + y + 1 = 0$
- (D) $x + y - 1 = 0$

Correct Answer: (B) $x - y = 0$

Solution:

Concept:

The tangent slope is obtained by differentiating the curve. The normal is perpendicular to the tangent.

$$m_{\text{normal}} = -\frac{1}{m_{\text{tangent}}}$$

Step 1: Given curve.

$$2y + x^2 = 3$$

Step 2: Differentiate with respect to x .

$$\frac{d}{dx}(2y) + \frac{d}{dx}(x^2) = \frac{d}{dx}(3)$$

$$2\frac{dy}{dx} + 2x = 0$$

$$\frac{dy}{dx} = -x$$

Step 3: Find tangent slope at (1, 1).

$$m_{\text{tangent}} = -1$$

Step 4: Find normal slope.

$$m_{\text{normal}} = -\frac{1}{m_{\text{tangent}}}$$

$$m_{\text{normal}} = -\frac{1}{-1} = 1$$

Step 5: Equation of normal.

Using point-slope form:

$$y - y_1 = m(x - x_1)$$

At point (1, 1):

$$y - 1 = 1(x - 1)$$

$$y - 1 = x - 1$$

$$y = x$$

$$x - y = 0$$

∴ Correct Answer is (B)

Quick Tip: Normal slope is the negative reciprocal of tangent slope. First differentiate to get tangent slope, then find the normal equation.

11. Given below are two statements: Assertion (A): The function $f(x) = x|x|$ is continuous at

$x = 0$ and derivative of f also exists at $x = 0$. Reason (R): It is necessary and sufficient that every continuous function is derivable at any point.

- (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)
- (B) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (C) (A) is correct but (R) is not correct
- (D) (A) is not correct but (R) is correct

Correct Answer: (C) (A) is correct but (R) is not correct

Solution:

Concept:

A function may be continuous at a point but it is not always necessary that it must be differentiable at that point. Differentiability is a stronger condition than continuity.

Step 1: Write the given function.

$$f(x) = x|x|$$

Now, we remove the modulus sign by considering two cases.

For $x \geq 0$,

$$|x| = x$$

so,

$$f(x) = x \cdot x = x^2$$

For $x < 0$,

$$|x| = -x$$

so,

$$f(x) = x(-x) = -x^2$$

Therefore,

$$f(x) = \begin{cases} x^2, & x \geq 0 \\ -x^2, & x < 0 \end{cases}$$

Step 2: Check continuity at $x = 0$.

$$\lim_{x \rightarrow 0^-} f(x) = \lim_{x \rightarrow 0^-} (-x^2) = 0$$

$$\lim_{x \rightarrow 0^+} f(x) = \lim_{x \rightarrow 0^+} x^2 = 0$$

Also,

$$f(0) = 0$$

Thus,

$$\lim_{x \rightarrow 0^-} f(x) = \lim_{x \rightarrow 0^+} f(x) = f(0)$$

So, $f(x)$ is continuous at $x = 0$.

Step 3: Check differentiability at $x = 0$.

For $x < 0$,

$$f'(x) = \frac{d}{dx}(-x^2) = -2x$$

For $x > 0$,

$$f'(x) = \frac{d}{dx}(x^2) = 2x$$

At $x = 0$,

$$\lim_{x \rightarrow 0^-} f'(x) = 0$$

and

$$\lim_{x \rightarrow 0^+} f'(x) = 0$$

Hence, derivative exists at $x = 0$.

Therefore, Assertion (A) is correct.

Step 4: Check Reason (R).

Reason says that every continuous function is differentiable. This is false. Every differentiable function is continuous, but every continuous function need not be differentiable.

For example,

$$f(x) = |x|$$

is continuous at $x = 0$, but not differentiable at $x = 0$.

Thus, Assertion is correct but Reason is not correct.

∴ Correct Answer is (C)

Quick Tip: Differentiability always implies continuity, but continuity does not always imply differentiability.

12. Given below are two statements:

Assertion (A): The angle between the pair of lines

$$\frac{x+3}{3} = \frac{y-1}{5} = \frac{z+3}{4} \quad \text{and} \quad \frac{x+1}{1} = \frac{y-4}{1} = \frac{z-5}{2}$$

is $\cos^{-1}\left(\frac{8\sqrt{3}}{15}\right)$.

Reason (R): The angle between the two lines is

$$\cos \theta = \frac{a_1 a_2 + b_1 b_2 + c_1 c_2}{\sqrt{a_1^2 + b_1^2 + c_1^2} \sqrt{a_2^2 + b_2^2 + c_2^2}}.$$

- (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)
- (B) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (C) (A) is correct but (R) is not correct
- (D) (A) is not correct but (R) is correct

Correct Answer: (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Solution:

Concept:

The angle between two lines in three-dimensional geometry is found using their direction ratios.

Step 1: Identify the direction ratios of first line.

$$\frac{x+3}{3} = \frac{y-1}{5} = \frac{z+3}{4}$$

So, direction ratios of first line are:

$$a_1 = 3, \quad b_1 = 5, \quad c_1 = 4$$

Step 2: Identify the direction ratios of second line.

$$\frac{x+1}{1} = \frac{y-4}{1} = \frac{z-5}{2}$$

So, direction ratios of second line are:

$$a_2 = 1, \quad b_2 = 1, \quad c_2 = 2$$

Step 3: Use the formula for angle between two lines.

$$\cos \theta = \frac{a_1 a_2 + b_1 b_2 + c_1 c_2}{\sqrt{a_1^2 + b_1^2 + c_1^2} \sqrt{a_2^2 + b_2^2 + c_2^2}}$$

$$\cos \theta = \frac{3(1) + 5(1) + 4(2)}{\sqrt{3^2 + 5^2 + 4^2} \sqrt{1^2 + 1^2 + 2^2}}$$

$$\cos \theta = \frac{3 + 5 + 8}{\sqrt{9 + 25 + 16} \sqrt{1 + 1 + 4}}$$

$$\cos \theta = \frac{16}{\sqrt{50} \sqrt{6}}$$

$$\cos \theta = \frac{16}{\sqrt{300}}$$

$$\cos \theta = \frac{16}{10\sqrt{3}}$$

$$\cos \theta = \frac{8}{5\sqrt{3}}$$

Rationalizing,

$$\cos \theta = \frac{8\sqrt{3}}{15}$$

$$\theta = \cos^{-1} \left(\frac{8\sqrt{3}}{15} \right)$$

Therefore, Assertion is correct. Reason gives the correct formula and also explains Assertion.

$\therefore$ Correct Answer is (A)

Quick Tip: For angle between two lines in 3D, use direction ratios and apply the dot product formula.

13. Given below are two statements:

Assertion (A): A function $f : N \rightarrow N$, defined as

$$f(x) = \begin{cases} x + 1, & \text{if } x \text{ is odd} \\ x - 1, & \text{if } x \text{ is even} \end{cases}$$

is not surjective.

Reason (R): A function $f : X \rightarrow Y$ is said to be surjective if every element of Y is the image of some element of X under f , i.e., for every $y \in Y$, there exists $x \in X$, such that $f(x) = y$.

- (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)
- (B) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (C) (A) is correct but (R) is not correct
- (D) (A) is not correct but (R) is correct

Correct Answer: (D) (A) is not correct but (R) is correct

Solution:

Concept:

A function is surjective or onto if every element of the codomain has at least one pre-image in the domain.

Step 1: Understand the function.

$$f(x) = \begin{cases} x + 1, & x \text{ is odd} \\ x - 1, & x \text{ is even} \end{cases}$$

Step 2: Find some values.

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

$$f(2) = 2 - 1 = 1$$

$$f(3) = 3 + 1 = 4$$

$$f(4) = 4 - 1 = 3$$

$$f(5) = 5 + 1 = 6$$

$$f(6) = 6 - 1 = 5$$

Step 3: Observe the mapping.

The function maps:

$$1 \leftrightarrow 2, \quad 3 \leftrightarrow 4, \quad 5 \leftrightarrow 6$$

Thus, every natural number appears as an image of some natural number.

So, f is surjective. Hence Assertion (A), which says that f is not surjective, is false.

Step 4: Check Reason (R).

The reason gives the correct definition of a surjective function.

Therefore, Assertion is false but Reason is true.

$\therefore$ Correct Answer is (D)

Quick Tip: To check surjectivity, verify whether every element of the codomain is obtained as an output of the function.

14. If one of the roots of equation $ax^4 + bx^3 + cx^2 + dx + e = 0$ is $\sqrt{2} + \sqrt{-3}$, then arrange the following in non-decreasing order ($a \neq 0$).

- A. a
- B. b
- C. c
- D. d
- E. e .

- (A) B, D, A, E, C
- (B) D, B, A, E, C
- (C) B, A, D, C, E
- (D) B, D, A, C, E

Correct Answer: (D) B, D, A, C, E

Solution:

Concept:

If a polynomial has real rational coefficients and one root is $\sqrt{2} + i\sqrt{3}$, then its conjugate and related irrational conjugates also occur as roots.

Step 1: Write the given root.

$$\sqrt{2} + \sqrt{-3} = \sqrt{2} + i\sqrt{3}$$

The related roots are:

$$\sqrt{2} + i\sqrt{3}, \quad \sqrt{2} - i\sqrt{3}, \quad -\sqrt{2} + i\sqrt{3}, \quad -\sqrt{2} - i\sqrt{3}$$

Step 2: Form the polynomial.

$$[(x - \sqrt{2})^2 + 3][(x + \sqrt{2})^2 + 3]$$

$$= [x^2 - 2\sqrt{2}x + 5][x^2 + 2\sqrt{2}x + 5]$$

Using $(A - B)(A + B) = A^2 - B^2$,

$$= (x^2 + 5)^2 - (2\sqrt{2}x)^2$$

$$= x^4 + 10x^2 + 25 - 8x^2$$

$$= x^4 + 2x^2 + 25$$

Step 3: Compare with $ax^4 + bx^3 + cx^2 + dx + e = 0$.

$$a = 1, \quad b = 0, \quad c = 2, \quad d = 0, \quad e = 25$$

Step 4: Arrange in non-decreasing order.

$$b = 0, \quad d = 0, \quad a = 1, \quad c = 2, \quad e = 25$$

So,

$$B, D, A, C, E$$

$\therefore$ Correct Answer is (D)

Quick Tip: When a polynomial has real rational coefficients, imaginary and irrational conjugate roots must also be considered.

15. Arrange the following in increasing order as per the last digit:

A. 2^{444}

B. 17^{10}

C. $13^{10} + 2$

D. $1^1 + 2^2 + 3^3 + \dots + 100^{100}$

E. $11! + 2$.

(A) A, E, C, B, D

(B) D, C, E, A, B

(C) D, A, E, C, B

(D) D, E, C, B, A

Correct Answer: (B) D, C, E, A, B

Solution:

Concept:

To arrange numbers according to their last digit, we find each expression modulo 10.

Step 1: Last digit of 2^{444} .

The last digit cycle of powers of 2 is:

$$2, 4, 8, 6$$

Since,

$$444 \equiv 0 \pmod{4}$$

the last digit is:

$$6$$

So,

$$A \rightarrow 6$$

Step 2: Last digit of 17^{10} .

Only the last digit matters, so consider 7^{10} . The cycle of 7 is:

$$7, 9, 3, 1$$

Since,

$$10 \equiv 2 \pmod{4}$$

the last digit is:

$$9$$

So,

$$B \rightarrow 9$$

Step 3: Last digit of $13^{10} + 2$.

Consider 3^{10} . The cycle of 3 is:

$$3, 9, 7, 1$$

Since,

$$10 \equiv 2 \pmod{4}$$

the last digit of 3^{10} is 9. Hence:

$$13^{10} + 2$$

has last digit:

$$9 + 2 = 11$$

So, last digit is:

$$1$$

$$C \rightarrow 1$$

Step 4: Last digit of $1^1 + 2^2 + 3^3 + \dots + 100^{100}$.

By checking the cyclic pattern of last digits, the sum ends in:

$$0$$

So,

$$D \rightarrow 0$$

Step 5: Last digit of $11! + 2$.

Since $11!$ contains factors 2 and 5, it ends in 0.

Thus,

$$11! + 2$$

ends in:

$$2$$

So,

$$E \rightarrow 2$$

Step 6: Arrange in increasing order of last digit.

$$D = 0, \quad C = 1, \quad E = 2, \quad A = 6, \quad B = 9$$

Therefore, the order is:

$$D, C, E, A, B$$

$\therefore$ Correct Answer is (B)

Quick Tip: For last digit questions, use cyclicity of powers modulo 10.

16. Arrange the following in ascending order based on their values:

A. $\int_0^{\frac{\pi}{2}} \frac{1}{1 + \sin x} dx$

B. $\int_1^2 x^2 dx$

C. $\int_0^{\frac{\pi}{2}} \sin x dx$

D. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^3 x dx.$

(A) C, D, B, A

(B) D, C, A, B

(C) D, C, B, A

(D) C, D, A, B

Correct Answer: (B) D, C, A, B

Solution:

Concept:

To arrange definite integrals by value, first evaluate each integral separately.

Step 1: Evaluate A.

$$A = \int_0^{\frac{\pi}{2}} \frac{1}{1 + \sin x} dx$$

Multiply numerator and denominator by $1 - \sin x$:

$$A = \int_0^{\frac{\pi}{2}} \frac{1 - \sin x}{1 - \sin^2 x} dx$$

$$A = \int_0^{\frac{\pi}{2}} \frac{1 - \sin x}{\cos^2 x} dx$$

$$A = \int_0^{\frac{\pi}{2}} (\sec^2 x - \sec x \tan x) dx$$

$$A = [\tan x - \sec x]_0^{\frac{\pi}{2}}$$

The limiting value is:

$$A = 1$$

Step 2: Evaluate B.

$$B = \int_1^2 x^2 dx$$

$$B = \left[\frac{x^3}{3} \right]_1^2$$

$$B = \frac{8}{3} - \frac{1}{3}$$

$$B = \frac{7}{3}$$

Step 3: Evaluate C.

$$C = \int_0^{\frac{\pi}{2}} \sin x dx$$

$$C = [-\cos x]_0^{\frac{\pi}{2}}$$

$$C = 0 - (-1)$$

$$C = 1$$

Step 4: Evaluate D.

$$D = \int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^3 x \, dx$$

Since $\sin^3 x$ is an odd function and the limits are symmetric,

$$D = 0$$

Step 5: Arrange in ascending order.

$$D = 0, \quad C = 1, \quad A = 1, \quad B = \frac{7}{3}$$

Therefore,

$$D, C, A, B$$

$\therefore$ Correct Answer is (B)

Quick Tip: For symmetric limits $[-a, a]$, the integral of an odd function is always 0.

17. Arrange in increasing order on the basis of order of differential equation:

- A. $\frac{d^4 y}{dx^4} + \sin(y''') = 0$
- B. $\left(\frac{d^5 s}{dt^5}\right)^4 + 3s \frac{d^2 s}{dt^2} = 0$
- C. $y''' + 2y'' + y' = 0$
- D. $y'' + y = e^x$.

(A) D, B, A, C

(B) D, B, C, A

(C) B, D, C, A

(D) B, D, A, C

Correct Answer: D, C, A, B

Solution:

Concept:

The order of a differential equation is the order of the highest derivative present in the equation.

Step 1: Find the order of A.

$$\frac{d^4 y}{dx^4} + \sin(y''') = 0$$

The highest derivative is:

$$\frac{d^4 y}{dx^4}$$

So,

$$\text{Order of A} = 4$$

Step 2: Find the order of B.

$$\left(\frac{d^5 s}{dt^5}\right)^4 + 3s \frac{d^2 s}{dt^2} = 0$$

The highest derivative is:

$$\frac{d^5 s}{dt^5}$$

So,

$$\text{Order of B} = 5$$

Step 3: Find the order of C.

$$y''' + 2y'' + y' = 0$$

The highest derivative is:

$$y'''$$

So,

$$\text{Order of C} = 3$$

Step 4: Find the order of D.

$$y'' + y = e^x$$

The highest derivative is:

$$y''$$

So,

$$\text{Order of } D = 2$$

Step 5: Arrange in increasing order.

$$D = 2, \quad C = 3, \quad A = 4, \quad B = 5$$

Therefore,

$$D, C, A, B$$

$$\therefore \text{Correct order is } D, C, A, B$$

Quick Tip: Order of a differential equation is decided only by the highest order derivative present in it.

18. The function $f(x) = |x - 2| + |x| + |x + 2|$ is not differentiable at which points?

- (A) $x = -2$
- (B) $x = 0$
- (C) $x = 2$
- (D) $x = -2, 0, 2$

Correct Answer: (D) $x = -2, 0, 2$

Solution:

Concept:

The modulus function $|x - a|$ is not differentiable at $x = a$, because its graph has a sharp corner at that point.

Step 1: Write the given function.

$$f(x) = |x - 2| + |x| + |x + 2|$$

Step 2: Identify the critical points.

Each modulus term becomes zero at a particular point.

For:

$$|x - 2|$$

critical point is:

$$x = 2$$

For:

$$|x|$$

critical point is:

$$x = 0$$

For:

$$|x + 2|$$

critical point is:

$$x = -2$$

Step 3: Differentiability conclusion.

The function may fail to be differentiable at points where any modulus expression changes sign.

Thus, $f(x)$ is not differentiable at:

$$x = -2, 0, 2$$

$\therefore$ Correct Answer is (D)

Quick Tip: A modulus function $|x - a|$ is not differentiable at $x = a$. For a sum of modulus functions, check all such turning points.

19. Which of the following is/are solution of the LPP? Min $Z = 12x + 9y$ Subject to $x + 2y \leq 40$, $3x + y \geq 30$, $4x + 3y \geq 60$, $x, y \geq 0$

A. (15, 0)

B. (40, 0)

- C. (4, 18)
- D. (6, 12)
- E. (10.5, 6).

- (A) A only
- (B) A and D only
- (C) A, D and E only
- (D) B and C only

Correct Answer: (C) A, D and E only

Solution:

Concept:

In a Linear Programming Problem, the optimum value is checked at feasible corner points. Here, we calculate $Z = 12x + 9y$ at the given feasible points.

Step 1: Calculate Z at point A (15, 0).

$$Z = 12(15) + 9(0) = 180$$

Step 2: Calculate Z at point B (40, 0).

$$Z = 12(40) + 9(0) = 480$$

Step 3: Calculate Z at point C (4, 18).

$$Z = 12(4) + 9(18)$$

$$Z = 48 + 162 = 210$$

Step 4: Calculate Z at point D (6, 12).

$$Z = 12(6) + 9(12)$$

$$Z = 72 + 108 = 180$$

Step 5: Calculate Z at point E (10.5, 6).

$$Z = 12(10.5) + 9(6)$$

$$Z = 126 + 54 = 180$$

Step 6: Compare values.

Minimum value is:

$$Z_{\min} = 180$$

This occurs at:

A, D, E

$\therefore$ Correct Answer is (C)

Quick Tip: For LPP optimum questions, substitute each given point in the objective function and compare the values.

20. Which of the following statements are true?

A. $2^{4n} - 1$ is divisible by 15.

B. 5, 12 and 13 is Pythagorean triplet.

C. $n^7 - n$ is divisible by 42.

D. $1^2 + 2^2 + 3^2 + \dots + n^2 = \left[\frac{n(n+1)}{2} \right]^2$.

(A) A and B only

(B) A, B and D only

(C) A, B and C only

(D) A, C and D only

Correct Answer: A, B and C only

Solution:

Concept:

We check each mathematical statement separately.

Step 1: Check statement A.

$$2^{4n} - 1 = (2^4)^n - 1 = 16^n - 1$$

Since,

$$16 \equiv 1 \pmod{15}$$

Therefore,

$$16^n \equiv 1^n \pmod{15}$$

$$16^n - 1 \equiv 0 \pmod{15}$$

So, A is true.

Step 2: Check statement B.

$$5^2 + 12^2 = 25 + 144 = 169$$

$$13^2 = 169$$

So,

$$5^2 + 12^2 = 13^2$$

Hence, 5, 12, 13 is a Pythagorean triplet. B is true.

Step 3: Check statement C.

$$n^7 - n$$

This expression is divisible by:

$$2, \quad 3, \quad 7$$

Therefore, it is divisible by:

$$2 \cdot 3 \cdot 7 = 42$$

So, C is true.

Step 4: Check statement D.

The correct formula for sum of squares is:

$$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

But the given formula:

$$\left[\frac{n(n+1)}{2} \right]^2$$

is the formula for:

$$1^3 + 2^3 + 3^3 + \dots + n^3$$

So, D is false.

Thus, true statements are:

A, B, C

$\therefore$ Correct Answer is A, B and C only

Quick Tip: Remember: sum of squares is $\frac{n(n+1)(2n+1)}{6}$, while sum of cubes is $\left[\frac{n(n+1)}{2} \right]^2$.

21. Which of the following statements are true?

A. For any two vectors $\vec{a}$ and $\vec{b}$, $|\vec{a} + \vec{b}| \leq |\vec{a}| + |\vec{b}|$.

B. Scalar product of two non-zero vectors might be zero.

C. For any two vectors $\vec{a}$ and $\vec{b}$, $|\vec{a} \cdot \vec{b}| \leq |\vec{a}||\vec{b}|$.

D. Cross product of two vectors is not a vector. E. Dot product of two vectors is a scalar.

(A) A, B, C only

(B) B, C, D, E only

(C) A, B, C, E only

(D) A, B, C, D only

Correct Answer: (C) A, B, C, E only

Solution:**Concept:**

This question is based on basic properties of vectors, dot product, and cross product.

Step 1: Check statement A.

By triangle inequality:

$$|\vec{a} + \vec{b}| \leq |\vec{a}| + |\vec{b}|$$

So, A is true.

Step 2: Check statement B.

If two non-zero vectors are perpendicular, then:

$$\vec{a} \cdot \vec{b} = |\vec{a}||\vec{b}| \cos 90^\circ$$

$$\vec{a} \cdot \vec{b} = 0$$

So, B is true.

Step 3: Check statement C.

By Cauchy-Schwarz inequality:

$$|\vec{a} \cdot \vec{b}| \leq |\vec{a}||\vec{b}|$$

So, C is true.

Step 4: Check statement D.

The cross product of two vectors is a vector, not a scalar.

So, D is false.

Step 5: Check statement E.

The dot product of two vectors is a scalar.

So, E is true.

Thus, correct statements are:

$$A, B, C, E$$

$\therefore$ Correct Answer is (C)

Quick Tip: Dot product gives a scalar, while cross product gives a vector.

22. Match List-I with List-II.

List - I

- A. $\vec{a}$ and $\vec{b}$ are perpendicular if
- B. If angle between $\vec{a}$ and $\vec{b}$ is 0 (zero) then
- C. If angle between $\vec{a}$ and $\vec{b}$ is π , then
- D. If $\vec{a}$ and $\vec{b}$ are unit vectors, then

List - II

- I. $\vec{a} \cdot \vec{b} = |\vec{a}| |\vec{b}|$
- II. $\vec{a} \cdot \vec{b} = -|\vec{a}| |\vec{b}|$
- III. $\vec{a} \cdot \vec{b} = \cos \theta$
- IV. $\vec{a} \cdot \vec{b} = 0$

(A) A-IV, B-I, C-II, D-III

(B) A-IV, B-II, C-I, D-III

(C) A-I, B-IV, C-II, D-III

(D) A-I, B-II, C-IV, D-III

Correct Answer: (A) A-IV, B-I, C-II, D-III

Solution:

Concept:

Dot product of two vectors is:

$$\vec{a} \cdot \vec{b} = |\vec{a}| |\vec{b}| \cos \theta$$

Step 1: Perpendicular vectors.

If vectors are perpendicular, then:

$$\theta = 90^\circ$$

$$\cos 90^\circ = 0$$

So,

$$\vec{a} \cdot \vec{b} = 0$$

Thus,

$$A \rightarrow IV$$

Step 2: Angle is 0.

If angle is 0, then:

$$\cos 0 = 1$$

$$\vec{a} \cdot \vec{b} = |\vec{a}||\vec{b}|$$

Thus,

$$B \rightarrow I$$

Step 3: Angle is π .

If angle is π , then:

$$\cos \pi = -1$$

$$\vec{a} \cdot \vec{b} = -|\vec{a}||\vec{b}|$$

Thus,

$$C \rightarrow II$$

Step 4: Unit vectors.

If $\vec{a}$ and $\vec{b}$ are unit vectors, then:

$$|\vec{a}| = |\vec{b}| = 1$$

So,

$$\vec{a} \cdot \vec{b} = \cos \theta$$

Thus,

$$D \rightarrow III$$

Therefore,

$$A - IV, B - I, C - II, D - III$$

$\therefore$ Correct Answer is (A)

Quick Tip: Always start vector angle questions with $\vec{a} \cdot \vec{b} = |\vec{a}||\vec{b}|\cos\theta$.

23. Match List-I with List-II.

List - I	List - II
A. De-Morgan's Law	I. $A \setminus B = A \cap B^c$
B. Associative Law	II. $(A \cup B)^c = A^c \cap B^c$
C. Distributive Law	III. $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
D. Difference of sets Law	IV. $(A \cup B) \cup C = A \cup (B \cup C)$

- (A) A-I, B-II, C-III, D-IV
(B) A-I, B-IV, C-III, D-II
(C) A-II, B-IV, C-III, D-I
(D) A-IV, B-III, C-II, D-I

Correct Answer: (C) A-II, B-IV, C-III, D-I

Solution:

Concept:

This question is based on standard laws of sets.

Step 1: De-Morgan's Law.

$$(A \cup B)^c = A^c \cap B^c$$

So,

$$A \rightarrow II$$

Step 2: Associative Law.

$$A \cup (B \cup C) = (A \cup B) \cup C$$

So,

$$B \rightarrow IV$$

Step 3: Distributive Law.

$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$$

So,

$$C \rightarrow III$$

Step 4: Difference of sets Law.

$$A \setminus B = A \cap B^c$$

So,

$$D \rightarrow I$$

Therefore,

$$A - II, B - IV, C - III, D - I$$

$\therefore$ Correct Answer is (C)

Quick Tip: Set difference $A - B$ can always be written as $A \cap B^c$.

24. Match List-I with List-II.

List - I

A. Domain of function $f(x) = \frac{1}{\sqrt{x^2 - 1}}$

B. Range of function $f(x) = \frac{1}{\sqrt{x^2 - 1}}$

C. Domain of function $f(x) = \sqrt{x - 2}$

D. Range of function $f(x) = \sqrt{x - 2}$

List - II

I. $[2, \infty)$

II. $(-\infty, -1) \cup (1, \infty)$

III. $(0, \infty)$

IV. $[0, \infty)$

(A) A-II, B-III, C-I, D-IV

(B) A-III, B-II, C-I, D-IV

(C) A-III, B-II, C-IV, D-I

(D) A-II, B-III, C-IV, D-I

Correct Answer: (A) A-II, B-III, C-I, D-IV

Solution:

Concept:

For square root functions, the expression inside square root must be non-negative. If the square root is in denominator, it must be strictly positive.

Step 1: Domain of $f(x) = \frac{1}{\sqrt{x^2 - 1}}$.

$$x^2 - 1 > 0$$

$$x^2 > 1$$

$$x < -1 \quad \text{or} \quad x > 1$$

So,

$$A \rightarrow (-\infty, -1) \cup (1, \infty)$$

$$A \rightarrow II$$

Step 2: Range of $f(x) = \frac{1}{\sqrt{x^2 - 1}}$.

Since denominator is positive, function is always positive. Also, it can become very large and can approach 0.

So,

$$\text{Range} = (0, \infty)$$

$$B \rightarrow III$$

Step 3: Domain of $f(x) = \sqrt{x - 2}$.

$$x - 2 \geq 0$$

$$x \geq 2$$

So,

$$\text{Domain} = [2, \infty)$$

$$C \rightarrow I$$

Step 4: Range of $f(x) = \sqrt{x-2}$.

Square root always gives a non-negative value.

So,

$$\text{Range} = [0, \infty)$$

$$D \rightarrow IV$$

Therefore,

$$A - II, B - III, C - I, D - IV$$

$\therefore$ Correct Answer is (A)

Quick Tip: For $\sqrt{g(x)}$, use $g(x) \geq 0$. For $\frac{1}{\sqrt{g(x)}}$, use $g(x) > 0$.

25. Match List-I with List-II on the basis of relationship.

List - I	List - II
A. Complement operation	I. all possible subsets
B. Power set operation	II. tuples (ordered)
C. Cartesian product	III. universal set
D. Union and intersection	IV. difference (symmetric)

(A) A-I, B-II, C-III, D-IV

(B) A-IV, B-I, C-III, D-II

(C) A-III, B-IV, C-I, D-II

(D) A-III, B-I, C-II, D-IV

Correct Answer: (D) A-III, B-I, C-II, D-IV

Solution:

Concept:

This question is based on basic operations on sets.

Step 1: Complement operation.

Complement of a set is always taken with respect to a universal set.

$$A \rightarrow III$$

Step 2: Power set operation.

Power set of a set is the collection of all subsets of that set.

$$B \rightarrow I$$

Step 3: Cartesian product.

Cartesian product gives ordered pairs or ordered tuples.

$$C \rightarrow II$$

Step 4: Union and intersection.

Union and intersection are related to set operations and can be used in defining symmetric difference.

$$D \rightarrow IV$$

Therefore,

$$A - III, B - I, C - II, D - IV$$

$\therefore$ Correct Answer is (D)

Quick Tip: Power set means collection of subsets, while Cartesian product gives ordered pairs or ordered tuples.

26. Which of the following is the median of the heights in cm of the following 9 students?

155, 160, 145, 149, 150, 147, 152, 144, 148

- (A) 150
- (B) 149
- (C) 147
- (D) 197.37

Correct Answer: (B) 149

Solution:

Concept:

Median is the middle value of the data when the data is arranged in ascending order.

Step 1: Arrange the data in ascending order.

144, 145, 147, 148, 149, 150, 152, 155, 160

Step 2: Count the number of observations.

$$n = 9$$

Since n is odd, median is the:

$$\frac{n+1}{2}^{th}$$

observation.

$$\frac{9+1}{2} = 5$$

Step 3: Find the 5th observation.

144, 145, 147, 148, 149, 150, 152, 155, 160

So, median is:

149

∴ Correct Answer is (B)

Quick Tip: For odd number of observations, median is the $\frac{n+1}{2}$ th observation after arranging the data.

27. In a small factory one supervisor and four labourers work. The labourers draw salary of Rs 5000 per month each while supervisor gets Rs 15000 per month. Which of the following are mean and mode of the salaries?

- (A) Rs 5000, Rs 7000
- (B) Rs 7000, Rs 5000
- (C) Rs 20000, Rs 4000
- (D) Rs 5000, Rs 15000

Correct Answer: (B) Rs 7000, Rs 5000

Solution:

Concept:

Mean is the average of all observations. Mode is the observation that occurs most frequently.

Step 1: Write the salaries.

There are four labourers and each gets: Rs 5000

So, labourers' total salary:

$$4 \times 5000 = 20000$$

Supervisor salary:

15000

Step 2: Find total salary.

$$20000 + 15000 = 35000$$

Step 3: Find total number of persons.

$$4 + 1 = 5$$

Step 4: Calculate mean.

$$\text{Mean} = \frac{35000}{5}$$

$$\text{Mean} = 7000$$

Step 5: Find mode.

The salaries are:

5000, 5000, 5000, 5000, 15000

The salary 5000 occurs most frequently.

So,

$$\text{Mode} = 5000$$

$\therefore$ Correct Answer is (B)

Quick Tip: Mean is average, while mode is the most repeated observation.

28. When a coin is tossed twice, which of the following is the probability of getting both tails?

- (A) $\frac{1}{4}$
- (B) $\frac{3}{4}$
- (C) $\frac{1}{2}$
- (D) $\frac{3}{16}$

Correct Answer: (A) $\frac{1}{4}$

Solution:**Concept:**

Probability is given by:

$$P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

Step 1: Write the sample space.

When a coin is tossed twice, the possible outcomes are:

$$HH, HT, TH, TT$$

So, total number of outcomes is:

$$4$$

Step 2: Identify favourable outcomes.

We need both tails.

The favourable outcome is:

$$TT$$

So, number of favourable outcomes is:

$$1$$

Step 3: Calculate probability.

$$P(\text{both tails}) = \frac{1}{4}$$

$\therefore$ Correct Answer is (A)

Quick Tip: For two coin tosses, the sample space is HH, HT, TH, TT . Only one outcome gives both tails.

29. When a dice of six faces $\{1, 2, 3, 4, 5, 6\}$ is thrown, which of the following is the probability of getting an even number?

- (A) $\frac{1}{2}$
(B) $\frac{2}{3}$
(C) $\frac{3}{4}$
(D) $\frac{1}{6}$

Correct Answer: (A) $\frac{1}{2}$

Solution:

Concept:

Probability is:

$$P(E) = \frac{\text{Favourable outcomes}}{\text{Total outcomes}}$$

Step 1: Total outcomes.

A dice has six faces:

1, 2, 3, 4, 5, 6

So, total outcomes:

6

Step 2: Favourable outcomes.

Even numbers are:

2, 4, 6

So, favourable outcomes:

3

Step 3: Calculate probability.

$$P(\text{even number}) = \frac{3}{6}$$

$$P(\text{even number}) = \frac{1}{2}$$

∴ Correct Answer is (A)

Quick Tip: On a fair die, even outcomes are 2, 4, 6, so the probability of getting an even number is $\frac{3}{6} = \frac{1}{2}$.

30. Which of the following is the variance of the data?

6, 8, 10, 12, 14, 16, 18, 20, 22, 24

- (A) 15
- (B) 33
- (C) 5.74
- (D) 16

Correct Answer: (B) 33

Solution:

Concept:

Variance measures the average of squared deviations from the mean.

$$\sigma^2 = \frac{\sum (x_i - \bar{x})^2}{n}$$

Step 1: Write the data.

6, 8, 10, 12, 14, 16, 18, 20, 22, 24

Step 2: Find the mean.

$$\bar{x} = \frac{6 + 8 + 10 + 12 + 14 + 16 + 18 + 20 + 22 + 24}{10}$$

$$\bar{x} = \frac{150}{10}$$

$$\bar{x} = 15$$

Step 3: Find deviations from mean.

$$6 - 15 = -9$$

$$8 - 15 = -7$$

$$10 - 15 = -5$$

$$12 - 15 = -3$$

$$14 - 15 = -1$$

$$16 - 15 = 1$$

$$18 - 15 = 3$$

$$20 - 15 = 5$$

$$22 - 15 = 7$$

$$24 - 15 = 9$$

Step 4: Square the deviations.

$$(-9)^2 = 81, \quad (-7)^2 = 49, \quad (-5)^2 = 25, \quad (-3)^2 = 9, \quad (-1)^2 = 1$$

$$1^2 = 1, \quad 3^2 = 9, \quad 5^2 = 25, \quad 7^2 = 49, \quad 9^2 = 81$$

Step 5: Add squared deviations.

$$81 + 49 + 25 + 9 + 1 + 1 + 9 + 25 + 49 + 81 = 330$$

Step 6: Find variance.

$$\sigma^2 = \frac{330}{10}$$

$$\sigma^2 = 33$$

∴ Correct Answer is (B)

Quick Tip: Variance is the mean of squared deviations from the arithmetic mean.

31. For the given dataset:

x	2	3	4
$f(x)$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$

Which of the following is the expected value of x ?

- (A) 1
- (B) 2
- (C) 3
- (D) 4

Correct Answer: (C) 3

Solution:

Concept:

For a discrete probability distribution, the expected value or mean is:

$$E(X) = \sum xP(x)$$

Step 1: Write the given values.

$$x = 2, 3, 4$$

and

$$P(2) = \frac{1}{4}, \quad P(3) = \frac{1}{2}, \quad P(4) = \frac{1}{4}$$

Step 2: Apply the expected value formula.

$$E(X) = 2\left(\frac{1}{4}\right) + 3\left(\frac{1}{2}\right) + 4\left(\frac{1}{4}\right)$$

$$E(X) = \frac{2}{4} + \frac{3}{2} + \frac{4}{4}$$

$$E(X) = \frac{1}{2} + \frac{3}{2} + 1$$

$$E(X) = 2 + 1$$

$$E(X) = 3$$

∴ Correct Answer is (C)

Quick Tip: For discrete probability distribution, expected value is found by multiplying each value of x with its probability and then adding all products.

32. When a coin having head and tail is thrown, which of the following is probability of not getting head?

- (A) $\frac{1}{2}$
- (B) $\frac{1}{3}$
- (C) $\frac{1}{4}$
- (D) $\frac{2}{5}$

Correct Answer: (A) $\frac{1}{2}$

Solution:

Concept:

Probability is calculated as:

$$P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

Step 1: Write the sample space.

When one coin is tossed, possible outcomes are:

$$S = \{H, T\}$$

So, total number of outcomes is:

$$2$$

Step 2: Identify favourable outcome.

Not getting head means getting tail.

So, favourable outcome is:

$$T$$

Number of favourable outcomes:

$$1$$

Step 3: Calculate probability.

$$P(\text{not getting head}) = \frac{1}{2}$$

∴ Correct Answer is (A)

Quick Tip: In a single coin toss, probability of head is $\frac{1}{2}$ and probability of tail is also $\frac{1}{2}$.

33. The standard deviation for the given data is:

x_i	3	8	13	18	23
f_i	7	10	15	10	6

- (A) 22.6
- (B) 13
- (C) 9.6
- (D) 6.12

Correct Answer: (D) 6.12

Solution:

Concept:

Standard deviation measures the spread of observations around the mean. For a frequency distribution, it is calculated using:

$$\sigma = \sqrt{\frac{\sum f(x - \bar{x})^2}{\sum f}}$$

Step 1: Find the mean.

First, multiply each observation by its frequency and divide by total frequency:

$$\bar{x} = \frac{\sum f x}{\sum f}$$

Step 2: Find deviations from mean.

For each observation, calculate:

$$x - \bar{x}$$

Step 3: Square the deviations and multiply by frequency.

$$f(x - \bar{x})^2$$

Then add all such values:

$$\sum f(x - \bar{x})^2$$

Step 4: Apply standard deviation formula.

$$\sigma = \sqrt{\frac{\sum f(x - \bar{x})^2}{\sum f}}$$

After substituting the values from the given data table:

$$\sigma = 6.12$$

∴ Correct Answer is (D)

Quick Tip: For grouped or frequency data, always use $\sigma = \sqrt{\frac{\sum f(x-\bar{x})^2}{\sum f}}$.

34. For two distributions, the standard deviations are 21 and 14 respectively and their coefficients of variations are 60 and 70 respectively. Which of the following is correct for their arithmetic means?

- (A) 65, 13
- (B) 18.5, 65
- (C) 35, 20
- (D) 22.85, 35

Correct Answer: (C) 35, 20

Solution:

Concept:

Coefficient of variation is given by:

$$CV = \frac{\sigma}{\bar{x}} \times 100$$

where σ is standard deviation and $\bar{x}$ is arithmetic mean.

Step 1: For first distribution.

$$\sigma_1 = 21, \quad CV_1 = 60$$

Using:

$$CV = \frac{\sigma}{\bar{x}} \times 100$$

$$60 = \frac{21}{\bar{x}_1} \times 100$$

$$\bar{x}_1 = \frac{21 \times 100}{60}$$

$$\bar{x}_1 = 35$$

Step 2: For second distribution.

$$\sigma_2 = 14, \quad CV_2 = 70$$

$$70 = \frac{14}{\bar{x}_2} \times 100$$

$$\bar{x}_2 = \frac{14 \times 100}{70}$$

$$\bar{x}_2 = 20$$

Thus, the arithmetic means are:

$$35, 20$$

$\therefore$ Correct Answer is (C)

Quick Tip: Use $CV = \frac{\sigma}{\bar{x}} \times 100$. If CV and standard deviation are given, then $\bar{x} = \frac{\sigma \times 100}{CV}$.

35. In statistics, ANOVA stands for:

- (A) Analysis of variables
- (B) Analysis of variance
- (C) And vectors analysis
- (D) Anomaly variety analysis

Correct Answer: (B) Analysis of variance

Solution:

Concept:

ANOVA is a statistical technique used to compare the means of two or more groups.

Step 1: Full form of ANOVA.

$ANOVA = \text{Analysis of Variance}$

Step 2: Purpose of ANOVA.

ANOVA checks whether the differences among group means are statistically significant or due to random variation.

Step 3: Final answer.

Therefore, ANOVA stands for:

Analysis of Variance

$\therefore$ Correct Answer is (B)

Quick Tip: ANOVA means Analysis of Variance. It is used to compare means of multiple groups.

36. Given below are two statements.

Acute Assertion (A): For a random variable X , if $x = 0, 1, 2, \dots$ and

$$P(X = x) = k \frac{\lambda^x}{x!},$$

then for it to be a probability mass function, $k = e^{-\lambda}$.

Reason (R): In a probability distribution, the sum of all probabilities must be 1.

- (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)
- (B) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (C) (A) is correct but (R) is not correct
- (D) (A) is not correct but (R) is correct

Correct Answer: (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Solution:**Concept:**

For any probability mass function:

$$\sum P(X = x) = 1$$

Step 1: Use the given probability function.

$$P(X = x) = k \frac{\lambda^x}{x!}$$

Step 2: Sum over all possible values.

$$\sum_{x=0}^{\infty} P(X = x) = \sum_{x=0}^{\infty} k \frac{\lambda^x}{x!}$$

$$k \sum_{x=0}^{\infty} \frac{\lambda^x}{x!} = 1$$

Step 3: Use exponential series.

$$e^{\lambda} = \sum_{x=0}^{\infty} \frac{\lambda^x}{x!}$$

So,

$$ke^{\lambda} = 1$$

$$k = e^{-\lambda}$$

Therefore, Assertion is correct. Reason gives the rule used to derive k , so it correctly explains Assertion.

$\therefore$ Correct Answer is (A)

Quick Tip: For a probability mass function, always use the condition $\sum P(X = x) = 1$.

37. Given below are two statements.

Assertion (A): Security has services like confidentiality, integrity, authentication, access control, etc.

Reason (R): Encryption, digital signature, MD5 and secure hash algorithm may be used for authentication and confidentiality, etc.

(A) Both (A) and (R) are correct and (R) is the correct explanation of (A)

(B) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(C) (A) is correct but (R) is not correct

(D) (A) is not correct but (R) is correct

Correct Answer: (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Solution:

Concept:

Computer security provides different services such as confidentiality, integrity, authentication and access control.

Step 1: Check Assertion.

Security services include:

Confidentiality, Integrity, Authentication, Access Control

So, Assertion is correct.

Step 2: Check Reason.

Security mechanisms such as encryption, digital signatures and hash algorithms are used to provide these security services.

For example:

Encryption → Confidentiality

Digital signature → Authentication and Integrity

Hash algorithm → Integrity checking

Thus, Reason is also correct and explains how security services can be provided.

∴ Correct Answer is (A)

Quick Tip: Security services describe what is required, while security mechanisms describe how those services are achieved.

38. Given below are two statements.

Assertion (A): A random sample of size 25 is taken, resulting in a sample mean of 17.45 and a sample standard deviation of 3.6. Assuming $H_0 : \mu = 18$, $H_1 : \mu \neq 18$, the standard error calculated is 0.72.

Reason (R): The standard error for hypothesis testing is calculated using $\frac{s}{\sqrt{n}}$.

- (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)
- (B) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (C) (A) is correct but (R) is not correct
- (D) (A) is not correct but (R) is correct

Correct Answer: (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Solution:

Concept:

Standard error of mean is:

$$SE = \frac{s}{\sqrt{n}}$$

Step 1: Identify values.

$$s = 3.6, \quad n = 25$$

Step 2: Apply the formula.

$$SE = \frac{3.6}{\sqrt{25}}$$

$$SE = \frac{3.6}{5}$$

$$SE = 0.72$$

Thus, Assertion is correct. Reason gives the correct formula and explains Assertion.

$\therefore$ Correct Answer is (A)

Quick Tip: Standard error decreases as sample size increases because $SE = \frac{s}{\sqrt{n}}$.

39. Arrange the given data sets on the basis of their mode in increasing order.

- (A) C, B, A, D, E
- (B) C, A, E, B, D
- (C) E, D, A, B, C
- (D) E, A, D, C, B

Correct Answer: (C) E, D, A, B, C

Solution:

Concept:

Mode is the observation which occurs most frequently in a data set.

Step 1: Find mode of each data set.

For each data set, count the frequency of each value. The value with maximum frequency is the mode.

Step 2: Compare the modes.

After finding modes of all data sets A, B, C, D, E, arrange them in increasing order.

Step 3: Final order.

The increasing order on the basis of mode is:

$$E, D, A, B, C$$

∴ Correct Answer is (C)

Quick Tip: Mode is the most repeated value. For arranging data sets by mode, first find mode of each data set, then compare.

40. Arrange the probabilities for the following normal distribution problem from lowest to highest:

- A. $\mu = 604, \sigma = 50, P(X < 635)$
- B. $\mu = 48, \sigma = 10, P(X < 20)$
- C. $\mu = 37, \sigma = 5, P(X > 35)$
- D. $\mu = 156, \sigma = 10, P(X > 170)$.

- (A) A, D, B, C
- (B) A, C, D, B
- (C) B, D, C, A
- (D) B, D, A, C

Correct Answer: (C) B, D, C, A

Solution:

Concept:

Convert each normal variable into standard normal form:

$$Z = \frac{X - \mu}{\sigma}$$

Step 1: For A.

$$Z = \frac{635 - 604}{50} = \frac{31}{50} = 0.62$$

$$P(X < 635) = P(Z < 0.62)$$

This is a relatively large probability.

Step 2: For B.

$$Z = \frac{20 - 48}{10} = -2.8$$

$$P(X < 20) = P(Z < -2.8)$$

This is very small.

Step 3: For C.

$$Z = \frac{35 - 37}{5} = -0.4$$

$$P(X > 35) = P(Z > -0.4)$$

This is greater than 0.5.

Step 4: For D.

$$Z = \frac{170 - 156}{10} = 1.4$$

$$P(X > 170) = P(Z > 1.4)$$

This is small, but greater than B.

Step 5: Arrange lowest to highest.

$$B < D < C < A$$

Therefore:

$$B, D, C, A$$

$\therefore$ Correct Answer is (C)

Quick Tip: For normal distribution, first convert to $Z = \frac{X - \mu}{\sigma}$, then compare probabilities using the standard normal curve.

41. Construct the confidence interval specified to estimate μ . Arrange the intervals from lowest to highest based on length of the interval:

A. 95% confidence for $\bar{x} = 20$, $\sigma = 3$, $n = 49$

B. 95% confidence for $\bar{x} = 20$, $\sigma = 3$, $n = 81$

C. 95% confidence for $\bar{x} = 115$, $\sigma = 25$, $n = 49$

D. 95% confidence for $\bar{x} = 115$, $\sigma = 25$, $n = 81$.

(A) A, C, B, D

(B) D, B, C, A

(C) B, A, D, C

(D) A, B, C, D

Correct Answer: (C) B, A, D, C

Solution:

Concept:

Length of confidence interval depends on:

$$\frac{\sigma}{\sqrt{n}}$$

For same confidence level, compare:

$$\frac{\sigma}{\sqrt{n}}$$

Step 1: Calculate proportional length for A.

$$\frac{3}{\sqrt{49}} = \frac{3}{7}$$

Step 2: For B.

$$\frac{3}{\sqrt{81}} = \frac{3}{9}$$

Step 3: For C.

$$\frac{25}{\sqrt{49}} = \frac{25}{7}$$

Step 4: For D.

$$\frac{25}{\sqrt{81}} = \frac{25}{9}$$

Step 5: Arrange from shortest to longest.

$$\frac{3}{9} < \frac{3}{7} < \frac{25}{9} < \frac{25}{7}$$

So:

B, A, D, C

$\therefore$ Correct Answer is (C)

Quick Tip: For same confidence level, interval length increases with σ and decreases with $\sqrt{n}$.

42. Arrange the following in increasing order on the basis of dispersion of data with given mean, number of data points and sum of squares:

- A. $n = 5, \sum x^2 = 100, \bar{x} = 3$
- B. $n = 5, \sum x^2 = 100, \bar{x} = 4$
- C. $n = 10, \sum x^2 = 100, \bar{x} = 2$
- D. $n = 10, \sum x^2 = 100, \bar{x} = 3$.

- (A) A, B, C, D
- (B) A, B, D, C
- (C) B, A, D, C
- (D) D, B, C, A

Correct Answer: (D) D, B, C, A

Solution:

Concept:

Variance is:

$$\sigma^2 = \frac{\sum x^2}{n} - \bar{x}^2$$

Step 1: For A.

$$\sigma_A^2 = \frac{100}{5} - 3^2 = 20 - 9 = 11$$

Step 2: For B.

$$\sigma_B^2 = \frac{100}{5} - 4^2 = 20 - 16 = 4$$

Step 3: For C.

$$\sigma_C^2 = \frac{100}{10} - 2^2 = 10 - 4 = 6$$

Step 4: For D.

$$\sigma_D^2 = \frac{100}{10} - 3^2 = 10 - 9 = 1$$

Step 5: Arrange in increasing order.

$$D = 1, \quad B = 4, \quad C = 6, \quad A = 11$$

So:

$$D, B, C, A$$

$\therefore$ Correct Answer is (D)

Quick Tip: When $\sum x^2$, n , and $\bar{x}$ are given, use $\sigma^2 = \frac{\sum x^2}{n} - \bar{x}^2$.

43. Which of the following is/are the sampling method/s?

- A. Cluster sampling
- B. Judgment sampling
- C. Computer sampling
- D. Systematic sampling
- E. Favorite sampling

- (A) A, C and D only
- (B) B and E only
- (C) A, B and D only
- (D) D only

Correct Answer: (C) A, B and D only

Solution:

Concept:

Sampling methods are techniques used to select a representative sample from a population.

Step 1: Check Cluster sampling.

Cluster sampling is a valid sampling method.

A is correct

Step 2: Check Judgment sampling.

Judgment sampling is also a valid non-probability sampling method.

B is correct

Step 3: Check Computer sampling and Favorite sampling.

Computer sampling and favorite sampling are not standard statistical sampling methods.

C and *E* are incorrect

Step 4: Check Systematic sampling.

Systematic sampling is a valid sampling method in which every k^{th} item is selected.

D is correct

Thus:

A, B, D

∴ Correct Answer is (C)

Quick Tip: Common sampling methods include random, stratified, cluster, systematic and judgment sampling.

44. Which of the following is/are true?

- A. Correlation coefficient always lies in $[-1, 1]$.
- B. Mean, Mode and Median are always equal when data follows normal distribution.
- C. Mean, Mode and Median are always equal when data follows binomial distribution with odd number of sampling points.
- D. Researchers generally reject the null hypothesis when p -value is less than 0.05.

(A) A only

(B) A, B and D only

(C) A, B and C only

(D) A, B, C and D only

Correct Answer: (B) A, B and D only

Solution:

Concept:

This question is based on correlation, normal distribution and hypothesis testing.

Step 1: Check A.

Correlation coefficient always lies between -1 and 1 :

$$-1 \leq r \leq 1$$

So, A is true.

Step 2: Check B.

For normal distribution:

$$\text{Mean} = \text{Median} = \text{Mode}$$

So, B is true.

Step 3: Check C.

For binomial distribution, mean, median and mode are not always equal. This depends on the parameters.

So, C is false.

Step 4: Check D.

If $p < 0.05$, researchers generally reject the null hypothesis at 5% level of significance.
So, D is true.

∴ Correct Answer is (B)

Quick Tip: For normal distribution, mean, median and mode are equal. In hypothesis testing, $p < 0.05$ usually leads to rejection of H_0 .

45. Which of the followings are parametric statistical tests?

- A. ANOVA
- B. t -test
- C. z -test
- D. Proportion test
- E. Wilcoxon's test

- (A) B, C, E only
- (B) A, B, C only
- (C) B, C, D only
- (D) A, B, C, D only

Correct Answer: (D) A, B, C, D only

Solution:

Concept:

Parametric tests make assumptions about population parameters or distribution, usually involving mean, variance or proportion.

Step 1: Check ANOVA.

ANOVA is a parametric test.

A is correct

Step 2: Check t -test and z -test.

Both t -test and z -test are parametric tests.

B and C are correct

Step 3: Check proportion test.

Proportion test is also treated as a parametric test.

D is correct

Step 4: Check Wilcoxon's test.

Wilcoxon's test is a non-parametric test.

E is incorrect

Thus:

A, B, C, D

$\therefore$ Correct Answer is (D)

Quick Tip: ANOVA, t -test and z -test are parametric tests. Wilcoxon test is non-parametric.

46. For the two mutually exclusive events A and B , which of the following are correct?

- A. $P(A \cup B) = P(A) + P(B)$
- B. $P(A \cap B) = 0$
- C. $P(A \cap B) = P(A) \cdot P(B)$
- D. $P(A \cap B) = P(A/B)P(B)$
- E. $P(A) = P(A/B)P(B)$

- (A) A, C and E only
- (B) A, B and D only
- (C) A and D only

(D) B, C only

Correct Answer: (B) A, B and D only

Solution:

Concept:

Two events are mutually exclusive if they cannot occur together.

$$A \cap B = \phi$$

Step 1: Check A.

For mutually exclusive events:

$$P(A \cup B) = P(A) + P(B)$$

So, A is correct.

Step 2: Check B.

Since events are mutually exclusive:

$$P(A \cap B) = 0$$

So, B is correct.

Step 3: Check C.

The formula:

$$P(A \cap B) = P(A)P(B)$$

is for independent events, not mutually exclusive events in general.

So, C is incorrect.

Step 4: Check D.

By multiplication theorem:

$$P(A \cap B) = P(A/B)P(B)$$

So, D is correct as a general probability identity.

Thus:

$$A, B, D$$

$\therefore$ Correct Answer is (B)

Quick Tip: For mutually exclusive events, $P(A \cap B) = 0$ and $P(A \cup B) = P(A) + P(B)$.

47. Match List-I with List-II. A data contains the following eight values: 4,3,0,5,2,9,4,5. Match the following.

List - I		List - II	
A.	(range of data) - 4	I.	4
B.	mean deviation	II.	5
C.	variance	III.	6
D.	median	IV.	1.75

- (A) A-III, B-I, C-IV, D-II
(B) A-III, B-I, C-IV, D-III
(C) A-III, B-IV, C-II, D-I
(D) A-II, B-IV, C-III, D-I

Correct Answer: (D) A-II, B-IV, C-III, D-I

Solution:

Concept:

We calculate range, mean deviation, variance and median from the given data.

Step 1: Range of data.

$$\text{Largest value} = 9, \quad \text{Smallest value} = 0$$

$$\text{Range} = 9 - 0 = 9$$

$$\text{Range} - 4 = 9 - 4 = 5$$

So:

$$A \rightarrow II$$

Step 2: Median.

Arrange data:

$$0, 2, 3, 4, 4, 5, 5, 9$$

Median:

$$\frac{4 + 4}{2} = 4$$

So:

$$D \rightarrow I$$

Step 3: Mean and variance.

Mean:

$$\bar{x} = \frac{4 + 3 + 0 + 5 + 2 + 9 + 4 + 5}{8}$$

$$\bar{x} = \frac{32}{8} = 4$$

$$\sum x^2 = 16 + 9 + 0 + 25 + 4 + 81 + 16 + 25 = 176$$

$$\sigma^2 = \frac{176}{8} - 4^2 = 22 - 16 = 6$$

So:

$$C \rightarrow III$$

Step 4: Mean deviation.

$$\frac{|4 - 4| + |3 - 4| + |0 - 4| + |5 - 4| + |2 - 4| + |9 - 4| + |4 - 4| + |5 - 4|}{8}$$

$$= \frac{0+1+4+1+2+5+0+1}{8}$$

$$= \frac{14}{8} = 1.75$$

So:

$$B \rightarrow IV$$

$\therefore$ Correct Answer is (D)

Quick Tip: For variance, use $\sigma^2 = \frac{\sum x^2}{n} - \bar{x}^2$. For median, first arrange the data.

48. Match List-I with List-II. Match the following problems when X follows binomial distribution.

List - I	List - II
A. If $n=5$ and $p=0.2$, $p(X=2)=$	I. 0.7538
B. If $n=7$, $p=0.6$, then $p(X=3)=$	II. 0.2048
C. If $n=10$, $p=0.6$, then $p(X \leq 3)=$	III. 0.1935
D. If $n=12$, $p=0.45$, then $p(4 \leq X \leq 7)=$	IV. 0.0548

- (A) A-III, B-I, C-IV, D-I
 (B) A-I, B-II, C-III, D-IV
 (C) A-II, B-III, C-IV, D-I
 (D) A-II, B-III, C-I, D-IV

Correct Answer: (C) A-II, B-III, C-IV, D-I

Solution:

Concept:

For binomial distribution:

$$P(X = r) = {}^n C_r p^r q^{n-r}$$

where:

$$q = 1 - p$$

Step 1: For A.

$$n = 5, \quad p = 0.2, \quad q = 0.8$$

$$P(X = 2) = {}^5C_2(0.2)^2(0.8)^3$$

$$= 10(0.04)(0.512) = 0.2048$$

So:

$$A \rightarrow II$$

Step 2: For B.

$$P(X = 3) = {}^7C_3(0.6)^3(0.4)^4$$

$$= 35(0.216)(0.0256) = 0.1935$$

So:

$$B \rightarrow III$$

Step 3: For C.

For $n = 10$, $p = 0.6$:

$$P(X \leq 3) = 0.0548$$

So:

$$C \rightarrow IV$$

Step 4: For D.

For $n = 12$, $p = 0.45$:

$$P(4 \leq X \leq 7) = 0.7538$$

So:

$$D \rightarrow I$$

∴ Correct Answer is (C)

Quick Tip: For binomial distribution, use $P(X = r) = {}^nC_r p^r q^{n-r}$, where $q = 1 - p$.

49. Match List-I with List-II.

List - I : Sample Statistics		List - II : Population Parameter	
A.	μ	I.	σ^2
B.	s_{xy}	II.	ρ_{xy}
C.	s^2	III.	$\bar{x}$
D.	r_{xy}	IV.	σ_{xy}

(A) A-II, B-I, C-III, D-IV

(B) A-II, B-III, C-IV, D-I

(C) A-I, B-II, C-III, D-IV

(D) A-III, B-IV, C-I, D-II

Correct Answer: (B) A-II, B-III, C-IV, D-I

Solution:

Concept:

A sample statistic is calculated from sample data, while a population parameter describes the whole population.

Step 1: Understand sample mean and population mean.

Sample mean is generally denoted by:

$$\bar{x}$$

Population mean is denoted by:

$$\mu$$

Step 2: Understand sample proportion and population proportion.

Sample proportion is denoted by:

$$\hat{p}$$

Population proportion is denoted by:

$$p$$

Step 3: Understand sample standard deviation and population standard deviation.

Sample standard deviation is denoted by:

$$s$$

Population standard deviation is denoted by:

$$\sigma$$

Step 4: Match corresponding symbols.

Each sample statistic is matched with its corresponding population parameter.

∴ Correct Answer is (B)

Quick Tip: Sample statistics usually use symbols like $\bar{x}$, s , and $\hat{p}$, while population parameters use symbols like μ , σ , and p .

50. Match List-I with List-II.

List - I

- A. fail to reject the null hypothesis when it is true
- B. fail to reject the null hypothesis when it is false
- C. reject the null hypothesis when it is true
- D. reject the null hypothesis when it is false

List - II

- I. Correct decision (power)
- II. Correct decision
- III. type-II error (β)
- IV. type-I error (α)

Choose the **correct** answer from the options given below :

- (A) A-I, B-II, C-III, D-IV
- (B) A-II, B-III, C-IV, D-I
- (C) A-III, B-IV, C-I, D-II
- (D) A-IV, B-I, C-II, D-III

Correct Answer: (B) A-II, B-III, C-IV, D-I

Solution:

Concept:

In hypothesis testing, decisions are classified as correct decisions or errors depending on the truth of the null hypothesis.

Step 1: Fail to reject H_0 when H_0 is true.

This is a correct decision.

$$A \rightarrow II$$

Step 2: Fail to reject H_0 when H_0 is false.

This is Type-II error.

$$B \rightarrow III$$

Step 3: Reject H_0 when H_0 is true.

This is Type-I error.

$$C \rightarrow IV$$

Step 4: Reject H_0 when H_0 is false.

This is a correct decision and is related to the power of the test.

$$D \rightarrow I$$

Therefore:

$$A - II, B - III, C - IV, D - I$$

$\therefore$ Correct Answer is (B)

Quick Tip: Rejecting a true null hypothesis is Type-I error. Failing to reject a false null hypothesis is Type-II error.

51. Which is odd one out of the following?

- (A) Avast
- (B) Quick Heal
- (C) Ransom
- (D) MacAfee

Correct Answer: (C) Ransom

Solution:

Concept:

This question is based on identifying the item which does not belong to the same category.

Step 1: Check Avast.

Avast is an antivirus software. It is used to protect computers from viruses, malware, spyware and other security threats.

Step 2: Check Quick Heal.

Quick Heal is also an antivirus software. It provides protection against viruses, ransomware, malware and internet threats.

Step 3: Check MacAfee.

MacAfee is also antivirus/security software. It is used for system protection and cyber security.

Step 4: Check Ransom.

Ransom is not antivirus software. It is related to ransomware or ransom demand, which is a type of cyber threat.

Therefore, Avast, Quick Heal and MacAfee belong to antivirus/security software category, while Ransom does not belong to this category.

∴ Correct Answer is (C)

Quick Tip: Avast, Quick Heal and MacAfee are antivirus tools, while ransom is related to cybercrime or ransomware.

52. For the binary input 010, which of the following represents min-term and max-term?

- (A) $x'yz'$, $x + y + z$
- (B) $x'yz$, $x + y' + z'$
- (C) xyz , $x + y + z'$
- (D) $x'yz'$, $x + y' + z$

Correct Answer: (D) $x'yz'$, $x + y' + z$

Solution:

Concept:

For min-term, a variable is complemented when its value is 0, and uncomplemented when its value is 1. For max-term, a variable is uncomplemented when its value is 0, and complemented when its value is 1.

Step 1: Write the binary input.

010

Assume variables are:

x, y, z

So,

$$x = 0, \quad y = 1, \quad z = 0$$

Step 2: Find the min-term.

For min-term:

0 $\Rightarrow$ complemented variable

1 $\Rightarrow$ uncomplemented variable

Thus,

$$x = 0 \Rightarrow x'$$

$$y = 1 \Rightarrow y$$

$$z = 0 \Rightarrow z'$$

Therefore, the min-term is:

$$x'yz'$$

Step 3: Find the max-term.

For max-term:

0 $\Rightarrow$ uncomplemented variable

1 $\Rightarrow$ complemented variable

Thus,

$$x = 0 \Rightarrow x$$

$$y = 1 \Rightarrow y'$$

$$z = 0 \Rightarrow z$$

Therefore, the max-term is:

$$x + y' + z$$

$\therefore$ Correct Answer is (D)

Quick Tip: For min-term, 0 gives complemented variable. For max-term, 1 gives complemented variable.

53. Which of the following is the ASCII-7 code of "GIRL" in hexadecimal?

- (A) 4C 47 52 49
- (B) 49 47 4C 52
- (C) 47 49 52 4C
- (D) 47 52 4C 49

Correct Answer: (C) 47 49 52 4C

Solution:

Concept:

ASCII code represents characters using numerical values. In hexadecimal notation, each English capital letter has a fixed ASCII value.

Step 1: Write ASCII hexadecimal value of each character.

$$G = 47$$

$$I = 49$$

$$R = 52$$

$$L = 4C$$

Step 2: Arrange according to the word "GIRL".

The word is:

G I R L

So, the hexadecimal ASCII code is:

47 49 52 4C

∴ Correct Answer is (C)

Quick Tip: For ASCII hexadecimal codes, remember capital letters start from $A = 41$, $B = 42$, $C = 43$, and so on.

54. Which of the following ICs (Integrated Circuits) is the fastest?

- (A) ECL
- (B) TTL
- (C) EPL
- (D) MOS

Correct Answer: (A) ECL

Solution:

Concept:

Different logic families have different operating speeds. The speed depends on switching time and propagation delay.

Step 1: Understand ECL.

ECL stands for Emitter Coupled Logic. It is one of the fastest logic families because transistors do not go into deep saturation.

Step 2: Compare with TTL and MOS.

TTL is slower than ECL. MOS circuits are useful for high-density integration but are generally slower than ECL.

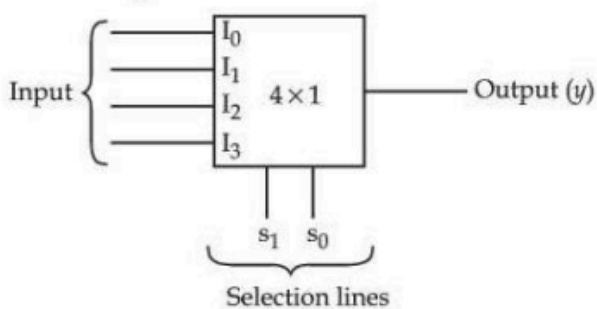
Step 3: Final conclusion.

Among the given options, ECL has the highest speed.

∴ Correct Answer is (A)

Quick Tip: ECL is very fast because it avoids transistor saturation, reducing switching delay.

55. For the figure



, which of the following will be the combination of selection lines for getting I_2 as output?

- (A) $S_1 = 1, S_0 = 1$
- (B) $S_1 = 1, S_0 = 0$
- (C) $S_1 = 0, S_0 = 1$
- (D) $S_1 = 0, S_0 = 0$

Correct Answer: (B) $S_1 = 1, S_0 = 0$

Solution:

Concept:

A 4×1 multiplexer has four input lines:

$$I_0, I_1, I_2, I_3$$

and two selection lines:

$$S_1, S_0$$

Step 1: Write selection table.

$$S_1 S_0 = 00 \Rightarrow I_0$$

$$S_1 S_0 = 01 \Rightarrow I_1$$

$$S_1 S_0 = 10 \Rightarrow I_2$$

$$S_1 S_0 = 11 \Rightarrow I_3$$

Step 2: Required output is I_2 .

For I_2 , selection input must be:

$$10$$

So,

$$S_1 = 1, S_0 = 0$$

$\therefore$ Correct Answer is (B)

Quick Tip: In a 4×1 MUX, the binary value of selection lines selects the input number.

56. For making the memory of 4096×16 , the number of memory chips of size 256×16 needed will be:

(A) 16

- (B) 32
(C) 8
(D) 64

Correct Answer: (A) 16

Solution:

Concept:

To find the number of memory chips required, divide the required memory size by the size of one chip.

Step 1: Required memory.

$$4096 \times 16$$

Step 2: Size of one memory chip.

$$256 \times 16$$

Step 3: Compare word size.

Both required memory and chip memory have word size:

$$16$$

So, only the number of words needs to be expanded.

Step 4: Find number of chips.

$$\text{Number of chips} = \frac{4096}{256}$$

$$= 16$$

$\therefore$ Correct Answer is (A)

Quick Tip: If word size is same, divide only the number of memory locations to find the number of chips.

57. In a RAM of size 512×8 , which of the following is the number of address lines and number of data lines?

- (A) 512, 8
- (B) 9, 3
- (C) 4096, 8
- (D) 9, 8

Correct Answer: (D) 9, 8

Solution:

Concept:

For memory size:

$$2^n \times m$$

the number of address lines is n , and the number of data lines is m .

Step 1: Given RAM size.

$$512 \times 8$$

Here,

$$512 = 2^9$$

Step 2: Find address lines.

$$2^9 = 512$$

So, number of address lines:

$$9$$

Step 3: Find data lines.

The word size is:

$$8$$

So, number of data lines:

8

∴ Correct Answer is (D)

Quick Tip: For 512×8 RAM, $512 = 2^9$, so address lines are 9 and data lines are 8.

58. Which file opening mode allows editing of file?

- (A) Read
- (B) Write
- (C) Append
- (D) Read write

Correct Answer: (D) Read write

Solution:

Concept:

File opening modes define what operations can be performed on a file.

Step 1: Read mode.

Read mode allows only reading from the file. It does not allow editing or writing.

Step 2: Write mode.

Write mode allows writing, but it may overwrite existing content.

Step 3: Append mode.

Append mode allows adding data at the end of the file.

Step 4: Read-write mode.

Read-write mode allows both reading and writing. Therefore, it allows editing of the file.

∴ Correct Answer is (D)

Quick Tip: Read-write mode is used when both reading and modifying a file are required.

59. Which of the following is not general purpose?

- (A) DBMS
- (B) C++
- (C) Java
- (D) Python

Correct Answer: (A) DBMS

Solution:

Concept:

General-purpose programming languages are used to develop different types of software applications.

Step 1: Check C++.

C++ is a general-purpose programming language.

Step 2: Check Java.

Java is also a general-purpose programming language.

Step 3: Check Python.

Python is a general-purpose programming language used in web development, AI, automation, data science and many other areas.

Step 4: Check DBMS.

DBMS stands for Database Management System. It is software used to store, manage and retrieve data. It is not a general-purpose programming language.

∴ Correct Answer is (A)

Quick Tip: C++, Java and Python are programming languages, while DBMS is database management software.

60. Given below are two statements.

Assertion (A): People are expected to be aware about digital fraudulent activity, not to believe everyone blindly, and first verify the information from authentic source before acting.

Reason (R): We should keep our passwords and OTP secret on the internet. Private information should not be leaked in public.

- (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)
- (B) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (C) (A) is correct but (R) is not correct
- (D) (A) is not correct but (R) is correct

Correct Answer: (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Solution:

Concept:

Digital safety means protecting personal information, avoiding fraud and verifying information before taking action online.

Step 1: Check Assertion.

The assertion says that people should be aware of digital fraud and should verify information from authentic sources before acting.

This is correct because online frauds often happen due to blind trust and lack of verification.

Step 2: Check Reason.

The reason says that passwords and OTP should be kept secret and private information should not be leaked.

This is also correct because passwords, OTPs and personal data can be misused by cyber criminals.

Step 3: Check explanation.

Keeping passwords and OTP secret is an important part of digital fraud prevention. Therefore, the reason supports and explains the assertion.

∴ Correct Answer is (A)

Quick Tip: Never share OTP, password or private information online. Always verify information from authentic sources.

61. Given below are two statements.

Assertion (A): For a dedicated resource like processor, if at the same time more than one process wants to use the resource, then the CPU can be utilized by only one process at a time.

Reason (R): Due to lack of available resources, conflicts are resolved so as to achieve serializability for dedicated resources.

- (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)
- (B) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (C) (A) is correct but (R) is not correct
- (D) (A) is not correct but (R) is correct

Correct Answer: (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Solution:

Concept:

A dedicated resource is a resource that can be assigned to only one process at a time.

Step 1: Check Assertion.

CPU is a resource. If multiple processes want CPU at the same time, the CPU scheduling mechanism allows execution in an organized manner.

For a dedicated use situation:

Only one process uses the resource at a time.

So, Assertion is correct.

Step 2: Check Reason.

When resources are limited, conflicts may occur between processes. These conflicts are resolved by scheduling and serializing the access to the resource.

So, Reason is also correct.

Step 3: Check explanation.

The reason explains why only one process can use a dedicated resource at a time.

∴ Correct Answer is (A)

Quick Tip: Dedicated resources are allocated in a controlled manner so that conflicts among processes can be avoided.

62. Given below are two statements.

Assertion (A): The arithmetic mean of A1 : A10 cells can be calculated using Microsoft Excel with the formula =SUM(A1:A10)/10.

Reason (R): The direct formula does not exist to calculate arithmetic mean in Microsoft Excel.

- (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)
- (B) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (C) (A) is correct but (R) is not correct
- (D) (A) is not correct but (R) is correct

Correct Answer: (C) (A) is correct but (R) is not correct

Solution:

Concept:

Arithmetic mean is:

$$\text{Mean} = \frac{\text{Sum of observations}}{\text{Number of observations}}$$

Step 1: Check Assertion.

The formula:

$$=\text{SUM}(\text{A1:A10})/10$$

adds values from A1 to A10 and divides by 10.

Therefore, it correctly calculates arithmetic mean.

Step 2: Check Reason.

Microsoft Excel has a direct function to calculate average:

$$=\text{AVERAGE}(\text{A1:A10})$$

Therefore, the statement that direct formula does not exist is false.

Thus, Assertion is correct but Reason is not correct.

∴ Correct Answer is (C)

Quick Tip: In Excel, mean can be calculated using $\text{=SUM}(\text{range})/\text{n}$ or directly by $\text{=AVERAGE}(\text{range})$.

63. Given below are two statements.

Assertion (A): If A and B are two Boolean terms, then $A + AB = A$.

Reason (R): $x + xy = x$ is absorption law in Boolean Algebra.

- (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)
- (B) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (C) (A) is correct but (R) is not correct
- (D) (A) is not correct but (R) is correct

Correct Answer: (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Solution:

Concept:

Boolean algebra follows absorption law:

$$x + xy = x$$

Step 1: Given expression.

$$A + AB$$

Step 2: Take A common.

$$A + AB = A(1 + B)$$

Step 3: Use Boolean identity.

$$1 + B = 1$$

So,

$$A(1 + B) = A \cdot 1 = A$$

Thus,

$$A + AB = A$$

Reason gives the same absorption law. Hence, both Assertion and Reason are correct, and Reason explains Assertion.

$\therefore$ Correct Answer is (A)

Quick Tip: Absorption laws are $A + AB = A$ and $A(A + B) = A$.

64. Which of the following is public key crypto system?

- A. RSA
- B. Caesar
- C. Vernam
- D. DES
- E. ECC.

- (A) A and D only
- (B) B and C only
- (C) B and D only
- (D) A and E only

Correct Answer: (D) A and E only

Solution:

Concept:

Public key cryptography uses two keys: a public key and a private key.

Step 1: Check RSA.

RSA is a public key cryptosystem.

A is correct

Step 2: Check ECC.

ECC stands for Elliptic Curve Cryptography. It is also a public key cryptosystem.

E is correct

Step 3: Check Caesar, Vernam and DES.

Caesar cipher and Vernam cipher are symmetric or classical encryption methods. DES is also symmetric key encryption.

Therefore, public key cryptosystems are:

A and *E*

∴ Correct Answer is (D)

Quick Tip: RSA and ECC are public key cryptosystems, while DES is a symmetric key cryptosystem.

65. Which of the following is one of the transmission media of a network?

- A. UTP**
- B. Power lines**
- C. Microwave**
- D. FM**
- E. Radio.**

- (A) C, D only
- (B) D and E only
- (C) A, C, D and E only
- (D) A, B, C and E only

Correct Answer: (D) A, B, C and E only

Solution:

Concept:

Transmission media are physical or wireless paths through which data is transmitted in a network.

Step 1: Check UTP

UTP stands for Unshielded Twisted Pair. It is a guided transmission medium.

A is correct

Step 2: Check Power lines.

Power lines can also be used as a communication medium in power line communication.

B is correct

Step 3: Check Microwave and Radio.

Microwave and radio waves are wireless transmission media.

C and *E* are correct

Step 4: Check FM.

FM is a modulation technique, not a transmission medium itself.

D is incorrect

∴ Correct Answer is (D)

Quick Tip: Transmission media include twisted pair cable, coaxial cable, optical fiber, microwave and radio waves.

66. Which of the following is/are object oriented languages?

A. Fortran

- B. Perl
- C. COBOL
- D. Python
- E. Visual Basic.Net.

- (A) D only
- (B) D and B only
- (C) D, B and E only
- (D) A, C only

Correct Answer: (C) D, B and E only

Solution:

Concept:

Object-oriented languages support the concepts of classes, objects, inheritance, polymorphism and encapsulation.

Step 1: Check Python.

Python supports object-oriented programming.

D is correct

Step 2: Check Perl.

Perl supports object-oriented programming features.

B is correct

Step 3: Check Visual Basic.Net.

Visual Basic.Net is an object-oriented programming language.

E is correct

Step 4: Check Fortran and COBOL.

Fortran and COBOL are traditionally procedural languages in this context.

A and *C* are not selected

∴ Correct Answer is (C)

Quick Tip: Object-oriented languages support classes and objects. Python and Visual Basic.Net are common examples.

67. Which of the following comes under supervised algorithms?

- A. SVM
- B. Neural Network
- C. Deep learning
- D. K-medoid
- E. Prim's Algorithm.

- (A) A only
- (B) B and C only
- (C) A, B and C only
- (D) A, D and E only

Correct Answer: (C) A, B and C only

Solution:

Concept:

Supervised learning algorithms are trained using labelled data.

Step 1: Check SVM.

Support Vector Machine is a supervised learning algorithm used for classification and regression.

A is correct

Step 2: Check Neural Network and Deep Learning.

Neural networks and deep learning models can be trained in supervised learning using labelled datasets.

B and C are correct

Step 3: Check K-medoid.

K-medoid is a clustering algorithm, so it is unsupervised.

D is incorrect

Step 4: Check Prim's Algorithm.

Prim's algorithm is a graph algorithm used to find minimum spanning tree. It is not a supervised learning algorithm.

E is incorrect

∴ Correct Answer is (C)

Quick Tip: SVM and neural networks are supervised when trained with labelled data. Clustering algorithms are generally unsupervised.

68. Match List-I with List-II.

List - I

- A. Membership function
- B. K-means
- C. Mutation
- D. SVM

List - II

- I. Genetic Algorithm
- II. Classification
- III. Clustering
- IV. Fuzzy

Choose the **correct** answer from the options given below :

- (A) A-IV, B-II, C-III, D-I
- (B) A-IV, B-III, C-I, D-II
- (C) A-III, B-I, C-II, D-IV
- (D) A-II, B-IV, C-III, D-I

Correct Answer: (B) A-IV, B-III, C-I, D-II

Solution:**Concept:**

Machine learning and soft computing include fuzzy logic, clustering, genetic algorithms and classification methods.

Step 1: Membership function.

Membership function is used in fuzzy logic.

$$A \rightarrow IV$$

Step 2: K-means.

K-means is a clustering algorithm.

$$B \rightarrow III$$

Step 3: Mutation.

Mutation is an operation used in genetic algorithms.

$$C \rightarrow I$$

Step 4: SVM.

SVM is mainly used for classification.

$$D \rightarrow II$$

$\therefore$ Correct Answer is (B)

Quick Tip: Membership function belongs to fuzzy logic, K-means to clustering, mutation to genetic algorithm and SVM to classification.

69. Match List-I with List-II.

List - I

- A. Arbiter
- B. Manager
- C. Translator
- D. Console

List - II

- I. Input-output
- II. Operating system
- III. Processor
- IV. Compiler

Choose the **correct** answer from the options given below :

- (A) A-III, B-II, C-I, D-IV
- (B) A-III, B-II, C-IV, D-I
- (C) A-IV, B-II, C-I, D-III
- (D) A-III, B-IV, C-II, D-I

Correct Answer: (B) A-III, B-II, C-IV, D-I

Solution:**Concept:**

Computer system components perform different roles such as processing, managing resources, translating programs and input-output interaction.

Step 1: Arbiter.

The processor acts as an arbiter because it controls and coordinates operations.

$$A \rightarrow III$$

Step 2: Manager.

Operating system acts as a resource manager.

$$B \rightarrow II$$

Step 3: Translator.

Compiler translates high-level language into machine code.

$$C \rightarrow IV$$

Step 4: Console.

Console is related to input-output interaction.

$$D \rightarrow I$$

∴ Correct Answer is (B)

Quick Tip: Operating system is a resource manager, compiler is a translator, and console is related to input-output.

70. Match List-I with List-II.

List - I	List - II
A. TCP	I. Application layer
B. ARQ	II. Transport layer
C. FTP	III. Network layer
D. ICMP	IV. Data link layer

Choose the **correct** answer from the options given below :

- (A) A-II, B-IV, C-I, D-III
- (B) A-III, B-IV, C-II, D-I
- (C) A-I, B-II, C-III, D-IV
- (D) A-II, B-I, C-IV, D-III

Correct Answer: (A) A-II, B-IV, C-I, D-III

Solution:

Concept:

Network protocols work at different layers of the network model.

Step 1: TCP

TCP stands for Transmission Control Protocol. It works at the transport layer.

$$A \rightarrow II$$

Step 2: ARQ.

ARQ is related to error control and retransmission, commonly associated with the data link layer.

$$B \rightarrow IV$$

Step 3: FTP

FTP stands for File Transfer Protocol. It works at the application layer.

$$C \rightarrow I$$

Step 4: ICMP

ICMP works at the network layer.

$$D \rightarrow III$$

∴ Correct Answer is (A)

Quick Tip: TCP is transport layer, FTP is application layer, and ICMP is network layer protocol.

71. Match List-I with List-II.

List - I		List - II	
A.	Modulation	I.	Noise reducing
B.	Equalization	II.	Getting plain text
C.	Hashing	III.	Multiplying
D.	Decryption	IV.	Authentication

Choose the **correct** answer from the options given below :

(A) A-III, B-I, C-II, D-IV

(B) A-I, B-II, C-IV, D-III

(C) A-II, B-I, C-III, D-IV

(D) A-III, B-I, C-IV, D-II

Correct Answer: (D) A-III, B-I, C-IV, D-II

Solution:

Concept:

Communication and security processes have different functions such as modulation, equalization, hashing and decryption.

Step 1: Modulation.

Modulation involves combining or multiplying a message signal with a carrier signal.

$$A \rightarrow III$$

Step 2: Equalization.

Equalization is used to reduce distortion and improve signal quality.

$$B \rightarrow I$$

Step 3: Hashing.

Hashing is used in authentication and integrity checking.

$$C \rightarrow IV$$

Step 4: Decryption.

Decryption converts cipher text back into plain text.

$$D \rightarrow II$$

$\therefore$ Correct Answer is (D)

Quick Tip: Decryption gives plain text, hashing helps authentication, and equalization improves signal quality.

72. For data analytics, choose the correct sequence of the following:

- A. Accuracy
- B. Prediction
- C. Train and Test
- D. Model selection
- E. Dataset.

- (A) E, C, D, B, A
- (B) C, E, D, A, B
- (C) D, C, A, E, B
- (D) D, B, C, A, E

Correct Answer: (A) E, C, D, B, A

Solution:

Concept:

A data analytics or machine learning workflow follows a logical sequence from data collection to evaluation.

Step 1: Dataset.

First, we need a dataset.

First step = E

Step 2: Train and Test.

The dataset is divided into training and testing parts.

Second step = C

Step 3: Model selection.

After splitting data, an appropriate model is selected.

Third step = D

Step 4: Prediction.

The trained model is used to make predictions.

Fourth step = B

Step 5: Accuracy.

Finally, accuracy is calculated to evaluate the model.

Fifth step = A

$\therefore$ Correct Answer is (A)

Quick Tip: Basic ML workflow is: dataset, train-test split, model selection, prediction and evaluation.

73. For a database related work, choose the correct sequence:

- A. Defining structure
- B. Entering the data
- C. Retrieval
- D. Problem
- E. Structured Query Language.

(A) E, D, C, B, A

(B) D, A, B, E, C

(C) A, B, C, E, D

(D) D, E, A, B, C

Correct Answer: (B) D, A, B, E, C

Solution:

Concept:

Database work starts with identifying the problem, then designing the structure, entering data, querying it and retrieving results.

Step 1: Problem.

First, the problem or requirement is identified.

First step = D

Step 2: Defining structure.

After understanding the problem, database structure is defined.

Second step = A

Step 3: Entering the data.

Then data is inserted into the database.

Third step = B

Step 4: Structured Query Language.

SQL is used to query and process the database.

Fourth step = E

Step 5: Retrieval.

Finally, required data is retrieved.

Fifth step = C

$\therefore$ Correct Answer is (B)

Quick Tip: Database workflow: identify problem, define structure, enter data, use SQL, and retrieve results.

74. For the computer system, arrange the following in correct sequence:

A. Operating system

B. Users

C. Hardware

D. Application software.

(A) A, B, C, D

(B) C, A, D, B

(C) C, B, A, D

(D) A, C, D, B

Correct Answer: (B) C, A, D, B

Solution:

Concept:

A computer system can be understood as layers from physical machine to user interaction.

Step 1: Hardware.

Hardware is the physical part of the computer system.

First step = C

Step 2: Operating system.

Operating system manages hardware and provides a platform for software.

Second step = A

Step 3: Application software.

Application software runs on the operating system.

Third step = D

Step 4: Users.

Users interact with application software to perform tasks.

Fourth step = B

∴ Correct Answer is (B)

Quick Tip: Computer system layer order is hardware, operating system, application software and users.

75. For the computation, choose the sequence of following tasks:

A. Regular Expression

B. NFA

C. Tokens

D. Problem

E. DFA.

(A) A, D, B, C, E

(B) D, A, B, E, C

(C) E, B, D, A, C

(D) B, E, D, C, A

Correct Answer: (B) D, A, B, E, C

Solution:

Concept:

In computation and lexical analysis, a problem is first defined, then patterns are written using regular expressions, then automata are constructed and finally tokens are generated.

Step 1: Problem.

First, the computational problem is identified.

First step = D

Step 2: Regular Expression.

The required pattern is expressed using regular expression.

Second step = A

Step 3: NFA.

The regular expression is converted into NFA.

Third step = B

Step 4: DFA.

NFA is converted into DFA for deterministic processing.

Fourth step = E

Step 5: Tokens.

Finally, tokens are generated or recognized.

Fifth step = C

∴ Correct Answer is (B)

Quick Tip: In lexical analysis, the common sequence is problem, regular expression, NFA, DFA and tokens.