CUET PG 2026 Statistics Question Paper with Solutions

Time Allowed :1 Hour 30 Minutes	Maximum Marks :300	Total Questions :75

General Instructions

Read the following instructions very carefully and strictly follow them:

- The Question Paper consists of 75 Multiple Choice Questions (MCQs).
- Total marks for the exam is 300.
- The total duration is 90 minutes; a, timer on the screen will display the remaining time, and the exam will automatically submit when the time reaches zero.
- For every correct answer, 4 marks (+4) will be awarded to the candidate, and a 1 mark (-1) will be deducted for every incorrect answer.
- Question papers are available in both English and Hindi.

1. If $P(A) = 0.4$, $P(B) = 0.5$, and A and B are independent events, what is the value of $P(A \cup B)$?
(A) 0.60
(B) 0.65
(C) 0.70
(D) 0.75

Correct Answer: (C) 0.70

Solution:

Step 1: Understanding the Question
The question asks for the probability of the union of two events, A and B, given their individual probabilities and the fact that they are independent.

Step 2: Key Formula or Approach
The formula for the probability of the union of two events is:

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

For independent events, the probability of their intersection is the product of their individual probabilities:

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

Step 3: Detailed Explanation
First, we calculate the probability of the intersection $P(A \cap B)$ using the independence property. Given $P(A) = 0.4$ and $P(B) = 0.5$:

$$P(A \cap B) = 0.4 \times 0.5 = 0.20$$

Next, we substitute this value into the union formula:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$
$$P(A \cup B) = 0.4 + 0.5 - 0.20$$
$$P(A \cup B) = 0.9 - 0.20 = 0.70$$

Step 4: Final Answer
The value of $P(A \cup B)$ is 0.70.

> Quick Tip
>
> For independent events, remember that the probability of both events occurring together is the product of their probabilities:
>
> $$P(A \cap B) = P(A)P(B)$$
>
> This simplifies many probability calculations.

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2. For a Poisson distribution where the mean is 4, what is the value of the third central moment?
(A) 4
(B) 8
(C) 16
(D) 64

Correct Answer: (A) 4

Solution:

Step 1: Understanding the Question
The question asks for the value of the third central moment (μ_3) for a Poisson distribution with a given mean.

Step 2: Key Formula or Approach
A key property of the Poisson distribution with parameter λ is that its mean, variance, and third central moment are all equal to λ.

- Mean $E(X) = \lambda$
- Variance $\text{Var}(X) = \mu_2 = \lambda$
- Third Central Moment $\mu_3 = \lambda$

Step 3: Detailed Explanation

The problem states that the mean of the Poisson distribution is 4.
From the properties of the Poisson distribution, we know that the mean is equal to the parameter λ.

$$\text{Mean} = \lambda = 4$$

The third central moment, μ_3, is also equal to λ.

$$\mu_3 = \lambda = 4$$

Step 4: Final Answer

The value of the third central moment is 4.

> Quick Tip
>
> For a Poisson distribution, several moments have simple forms:
>
> $$\text{Mean} = \text{Variance} = \text{Third central moment} = \lambda$$
>
> This property makes calculations involving Poisson moments very straightforward.

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3. Which property of an estimator is satisfied if its expected value equals the population parameter?

(A) Consistency
(B) Efficiency
(C) Unbiasedness
(D) Sufficiency

Correct Answer: (C) Unbiasedness

Solution:

Step 1: Understanding the Question

The question asks to identify the specific property of a statistical estimator where its average value (expected value) over all possible samples is equal to the true value of the population parameter it is trying to estimate.

Step 2: Detailed Explanation

Let's define the properties listed in the options:

- **Consistency:** An estimator is consistent if it converges in probability to the true parameter value as the sample size increases.

- **Efficiency:** This refers to the estimator having the smallest variance among all unbiased estimators. An efficient estimator is more precise.

- **Unbiasedness:** An estimator $\hat{\theta}$ is said to be unbiased for a parameter θ if its expected value is equal to the true parameter, i.e., $E(\hat{\theta}) = \theta$. This means the estimator does not systematically overestimate or underestimate the parameter.

- **Sufficiency:** A sufficient statistic is one that captures all the information in the sample about the population parameter.

The condition given in the question, "its expected value equals the population parameter," directly matches the definition of unbiasedness.

Step 3: Final Answer

The property of an estimator that is satisfied if its expected value equals the population parameter is **Unbiasedness**.

Quick Tip

An estimator is **unbiased** if:

$$E(\hat{\theta}) = \theta$$

This means the estimator gives the correct value of the parameter on average over many samples.

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4. If a matrix A has eigenvalues 2 and 3, what are the eigenvalues of the matrix A^2?

(A) $2, 3$

(B) $4, 9$

(C) $5, 6$

(D) $8, 27$

Correct Answer: (B) 4, 9

Solution:

Step 1: Understanding the Question

The question provides the eigenvalues of a matrix A and asks for the eigenvalues of the matrix A^2.

Step 2: Key Formula or Approach

There is a fundamental property of eigenvalues: If λ is an eigenvalue of a matrix A, then λ^k is an eigenvalue of the matrix A^k for any positive integer k.

For this question, $k = 2$. So, if λ is an eigenvalue of A, then λ^2 is an eigenvalue of A^2.

Step 3: Detailed Explanation

The given eigenvalues of matrix A are $\lambda_1 = 2$ and $\lambda_2 = 3$.
To find the eigenvalues of A^2, we need to square each eigenvalue of A.
The first eigenvalue of A^2 is:

$$(\lambda_1)^2 = 2^2 = 4$$

The second eigenvalue of A^2 is:

$$(\lambda_2)^2 = 3^2 = 9$$

Step 4: Final Answer

The eigenvalues of the matrix A^2 are 4 and 9.

Quick Tip

If λ is an eigenvalue of A, then for any positive integer k:

$$\text{Eigenvalues of } A^k = \lambda^k$$

Thus, simply raise each eigenvalue of A to the power k.

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5. In a Normal distribution, what percentage of data falls within two standard deviations of the mean?

(A) 68%
(B) 95%
(C) 99.7%
(D) 90%

Correct Answer: (B) 95%

Solution:

Step 1: Understanding the Question

The question asks for the proportion of data in a Normal distribution that lies in the interval from two standard deviations below the mean to two standard deviations above the mean, i.e., $(\mu - 2\sigma, \mu + 2\sigma)$.

Step 2: Key Formula or Approach

This question relates to the Empirical Rule, also known as the 68–95–99.7 rule, which is a key property of the Normal distribution.

Step 3: Detailed Explanation

The Empirical Rule states the approximate percentage of data within certain ranges around the mean (μ) for a Normal distribution with standard deviation (σ):

- Approximately **68%** of the data falls within one standard deviation of the mean ($\mu \pm \sigma$).
- Approximately **95%** of the data falls within two standard deviations of the mean ($\mu \pm 2\sigma$).
- Approximately **99.7%** of the data falls within three standard deviations of the mean ($\mu \pm 3\sigma$).

The question specifically asks for the percentage within two standard deviations.

Step 4: Final Answer
According to the Empirical Rule, approximately 95% of the data falls within two standard deviations of the mean.

> Quick Tip
>
> Remember the **68–95–99.7 rule** for Normal distribution:
>
> $$1\sigma \to 68\%, \qquad 2\sigma \to 95\%, \qquad 3\sigma \to 99.7\%$$
>
> It is frequently used in statistics and data analysis.

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6. What is the rank of a 3×3 identity matrix added to a 3×3 null matrix?
(A) 0
(B) 1
(C) 2
(D) 3

Correct Answer: (D) 3

Solution:

Step 1: Understanding the Question
We need to first perform the matrix addition of a 3×3 identity matrix and a 3×3 null (zero) matrix, and then find the rank of the resulting matrix.

Step 2: Key Formula or Approach
Key matrix properties needed:

- **Identity Matrix (I)**: A square matrix with 1s on the main diagonal and 0s elsewhere.

- **Null Matrix (O)**: A matrix where all elements are 0.

- **Matrix Addition Property**: For any matrix A, $A + O = A$.

- **Rank of a Matrix**: The number of linearly independent rows (or columns) in the matrix. The rank of an $n \times n$ identity matrix, I_n, is n.

Step 3: Detailed Explanation
First, let's write the matrices:
The 3×3 identity matrix is:

$$I_3 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

The 3×3 null matrix is:

$$O = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

Now, add the two matrices:

$$I_3 + O = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} + \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} = I_3$$

The resulting matrix is the identity matrix I_3. The rank of I_3 is the number of its linearly independent rows, which is 3.

Step 4: Final Answer
The rank of the resulting matrix is 3.

> **Quick Tip**
>
> The rank of an identity matrix I_n is always n, because all rows and columns are linearly independent.

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7. In Simple Random Sampling Without Replacement (SRSWOR), what is the probability of selecting a specific unit at the second draw?

(A) $\dfrac{1}{N}$

(B) $\dfrac{1}{N-1}$

(C) $\dfrac{2}{N}$

(D) $\dfrac{1}{N^2}$

Correct Answer: (A) $\dfrac{1}{N}$

Solution:

Step 1: Understanding the Question

The question asks for the probability that a specific, pre-determined unit from a population of size N is selected at the second draw, given the sampling method is Simple Random Sampling Without Replacement (SRSWOR).

Step 2: Key Formula or Approach

In SRSWOR, the probability of any specific unit being selected is the same for every draw. We can prove this using conditional probability. For a specific unit to be selected at the second draw, it must not have been selected at the first draw.

$$P(\text{Unit selected at 2nd draw})$$
$$= P(\text{Unit not selected at 1st draw}) \times P(\text{Unit selected at 2nd draw}|\text{Not selected at 1st})$$

Step 3: Detailed Explanation

Let the population size be N. We want to find the probability of selecting a specific unit, say unit U_i, at the second draw.

- The probability of **not** selecting unit U_i in the first draw is $\frac{N-1}{N}$, since there are $N-1$ other units that could be chosen out of N.

- After the first draw (where U_i was not selected), there are $N-1$ units remaining in the population.

- The probability of selecting unit U_i in the second draw, given it was not selected in the first, is $\frac{1}{N-1}$.

Combining these, the overall probability is:

$$P(\text{select } U_i \text{ at 2nd draw}) = \left(\frac{N-1}{N}\right) \times \left(\frac{1}{N-1}\right) = \frac{N-1}{N(N-1)} = \frac{1}{N}$$

Step 4: Final Answer

The probability of selecting a specific unit at the second draw in SRSWOR is $\frac{1}{N}$.

Quick Tip

In SRSWOR, every unit has an equal chance of appearing in any position of the sample.
Thus, the probability that a specific unit appears in the k^{th} draw is always:

$$\frac{1}{N}$$

where N is the population size.

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8. If the correlation coefficient between X and Y is 0.8, what is the coefficient of determination?
(A) 0.64
(B) 0.80
(C) 0.16
(D) 1.60

Correct Answer: (A) 0.64

Solution:

Step 1: Understanding the Question
The question provides the correlation coefficient (r) between two variables and asks for the coefficient of determination (R^2).

Step 2: Key Formula or Approach
The coefficient of determination, denoted as R^2, is defined as the square of the correlation coefficient, r.

$$R^2 = r^2$$

It represents the proportion of the variance in the dependent variable that is predictable from the independent variable(s).

Step 3: Detailed Explanation
We are given the correlation coefficient:

$$r = 0.8$$

To find the coefficient of determination, we square this value:

$$R^2 = (0.8)^2 = 0.8 \times 0.8 = 0.64$$

Step 4: Final Answer
The coefficient of determination is 0.64. This means that 64% of the variation in one variable can be explained by the variation in the other variable.

Quick Tip

The coefficient of determination is simply the square of the correlation coefficient:

$$R^2 = r^2$$

It indicates the proportion of variation in one variable explained by the other.

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9. A bag contains 5 red and 7 blue balls. If two balls are drawn at random, what is the probability that both are red?

(A) $\frac{5}{66}$
(B) $\frac{10}{66}$
(C) $\frac{5}{33}$
(D) $\frac{25}{66}$

Correct Answer: (B) $\frac{10}{66}$

Solution:

Step 1: Understanding the Question
We need to calculate the probability of drawing two red balls in succession, without replacement, from a bag containing 5 red and 7 blue balls.

Step 2: Key Formula or Approach
We can solve this using the multiplication rule for dependent events:

$$P(\text{Event 1 and Event 2}) = P(\text{Event 1}) \times P(\text{Event 2}|\text{Event 1 has occurred})$$

Alternatively, we can use combinations:

$$P(\text{Both red}) = \frac{\text{Number of ways to choose 2 red balls}}{\text{Total number of ways to choose 2 balls}} = \frac{\binom{5}{2}}{\binom{12}{2}}$$

Step 3: Detailed Explanation (Using Multiplication Rule)
First, determine the total number of balls:
Total balls = 5 Red + 7 Blue = 12 balls.
The probability that the first ball drawn is red is:

$$P(\text{1st is Red}) = \frac{\text{Number of red balls}}{\text{Total number of balls}} = \frac{5}{12}$$

After drawing one red ball, there are 4 red balls left and a total of 11 balls remaining.
The probability that the second ball drawn is also red, given the first was red, is:

$$P(\text{2nd is Red}|\text{1st is Red}) = \frac{\text{Remaining red balls}}{\text{Remaining total balls}} = \frac{4}{11}$$

Now, we multiply these probabilities to get the probability of both events happening:

$$P(\text{Both are Red}) = P(\text{1st is Red}) \times P(\text{2nd is Red}|\text{1st is Red}) = \frac{5}{12} \times \frac{4}{11} = \frac{20}{132}$$

Simplifying the fraction gives:

$$\frac{20}{132} = \frac{10}{66}$$

Step 4: Final Answer

The probability that both balls drawn are red is $\frac{10}{66}$.

Quick Tip

For drawing without replacement:

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

Alternatively, use combinations:

$$P(\text{both red}) = \frac{\binom{5}{2}}{\binom{12}{2}} = \frac{10}{66}$$

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10. Which test is most appropriate for testing the significance of the difference between two small sample means?

(A) Z-test

(B) t-test

(C) Chi-square test

(D) F-test

Correct Answer: (B) t-test

Solution:

Step 1: Understanding the Question

The question asks to identify the correct statistical test for comparing the means of two groups when the sample sizes are small.

Step 2: Detailed Explanation

Let's analyze the purpose of each test listed:

- **Z-test:** This test is used to compare means when the sample sizes are large (typically $n > 30$) or when the population variances are known. The large sample size allows us to rely on the Central Limit Theorem.

- **t-test (Student's t-test):** This test is specifically designed for situations where the sample sizes are small (typically $n < 30$) and the population variances are unknown. It is the standard method for comparing the means of two small samples.

- **Chi-square (χ^2) test:** This test is used for analyzing categorical data. It is used for goodness-of-fit tests or tests of independence between two categorical variables, not for comparing means.

- **F-test:** This test is primarily used to compare the variances of two populations. It is also the underlying test in Analysis of Variance (ANOVA), which compares the means of three or more groups.

The key phrase in the question is "two small sample means." This directly points to the t-test as the most appropriate choice.

Step 3: Final Answer
The most appropriate test for testing the significance of the difference between two small sample means is the **t-test**.

> Quick Tip
>
> Use the **t-test** when:
>
> - Sample size is small ($n < 30$)
> - Population variance is unknown
>
> It is commonly used to test the significance of the difference between two sample means.

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11. If the null hypothesis H_0 is rejected when it is actually true, what type of error has been committed?
(A) Type I Error
(B) Type II Error
(C) Sampling Error
(D) Standard Error

Correct Answer: (A) Type I Error

Solution:

Step 1: Understanding the Question
The question describes a scenario in hypothesis testing where a decision is made to reject the null hypothesis (H_0), but in reality, the null hypothesis was true. We need to identify the name

for this specific type of mistake.

Step 2: Detailed Explanation

In hypothesis testing, there are four possible outcomes based on our decision and the true state of nature:

Decision	H_0 is True	H_0 is False
Fail to Reject H_0	Correct Decision	Type II Error (β)
Reject H_0	Type I Error (α)	Correct Decision

- **Type I Error:** Rejecting a true null hypothesis. The probability of this error is denoted by α, the significance level.

- **Type II Error:** Failing to reject a false null hypothesis. The probability of this error is denoted by β.

The scenario described—rejecting H_0 when it is actually true—is the exact definition of a Type I Error.

Step 3: Final Answer

The error committed is a **Type I Error**.

Quick Tip

Remember the two main hypothesis testing errors:

$$\text{Type I Error: Reject } H_0 \text{ when it is true}$$
$$\text{Type II Error: Fail to reject } H_0 \text{ when it is false}$$

Type I error probability is the **significance level** α.

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12. What is the value of the integral $\int_{-\infty}^{\infty} e^{-x^2}\,dx$?

(A) $\sqrt{\pi}$
(B) π
(C) 1
(D) $\frac{\sqrt{\pi}}{2}$

Correct Answer: (A) $\sqrt{\pi}$

Solution:

Step 1: Understanding the Question

The question asks for the evaluation of the definite integral of the function e^{-x^2} from $-\infty$ to ∞. This is a famous integral known as the Gaussian integral.

Step 2: Key Formula or Approach

This is a standard result in calculus and probability theory. The value is:

$$\int_{-\infty}^{\infty} e^{-x^2}\,dx = \sqrt{\pi}$$

While memorizing the result is fastest, it can be derived by squaring the integral and converting to polar coordinates.

Step 3: Detailed Explanation (Derivation)

Let the integral be I:

$$I = \int_{-\infty}^{\infty} e^{-x^2}\,dx$$

We can also write I using a different variable, say y:

$$I = \int_{-\infty}^{\infty} e^{-y^2}\,dy$$

Now, let's calculate I^2:

$$I^2 = \left(\int_{-\infty}^{\infty} e^{-x^2}\,dx\right)\left(\int_{-\infty}^{\infty} e^{-y^2}\,dy\right) = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{-(x^2+y^2)}\,dx\,dy$$

Convert this double integral to polar coordinates by setting $x = r\cos\theta$, $y = r\sin\theta$, which gives $x^2 + y^2 = r^2$ and $dx\,dy = r\,dr\,d\theta$. The limits for r are from 0 to ∞, and for θ from 0 to 2π.

$$I^2 = \int_0^{2\pi}\int_0^{\infty} e^{-r^2}\,r\,dr\,d\theta$$

First, solve the inner integral $\int_0^{\infty} e^{-r^2}\,r\,dr$. Let $u = r^2$, so $du = 2r\,dr$.

$$\int e^{-r^2}\,r\,dr = \frac{1}{2}\int e^{-u}\,du = -\frac{1}{2}e^{-u} = -\frac{1}{2}e^{-r^2}$$

Evaluating the definite integral:

$$\int_0^{\infty} e^{-r^2}\,r\,dr = \left[-\frac{1}{2}e^{-r^2}\right]_0^{\infty} = \left(-\frac{1}{2}e^{-\infty}\right) - \left(-\frac{1}{2}e^{0}\right) = 0 - (-\frac{1}{2}) = \frac{1}{2}$$

Now substitute this back into the expression for I^2:

$$I^2 = \int_0^{2\pi} \frac{1}{2}\,d\theta = \frac{1}{2}[\theta]_0^{2\pi} = \frac{1}{2}(2\pi - 0) = \pi$$

Since $I^2 = \pi$, and the integrand e^{-x^2} is always positive, I must be positive.

$$I = \sqrt{\pi}$$

Step 4: Final Answer
The value of the integral is $\sqrt{\pi}$.

> 💡 Quick Tip
>
> The Gaussian integral is a standard result in calculus and statistics:
>
> $$\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$$
>
> It is closely related to the Normal distribution.

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13. In a negatively skewed distribution, what is the correct relationship between the Mean, Median, and Mode?
(A) Mean > Median > Mode
(B) Mean < Median < Mode
(C) Mean = Median = Mode
(D) Mode < Median < Mean

Correct Answer: (B) Mean < Median < Mode

Solution:

Step 1: Understanding the Question
The question asks for the ordering of the three main measures of central tendency (mean, median, mode) for a negatively skewed (or left-skewed) distribution.

Step 2: Detailed Explanation
Let's understand the concepts:

- **Mode:** The value that occurs most frequently. It corresponds to the peak of the distribution.

- **Median:** The middle value that divides the data into two equal halves. It is less affected by extreme values (outliers).

- **Mean:** The arithmetic average. It is sensitive to extreme values.

In a **negatively skewed distribution**, the tail of the distribution is longer on the left side. This means there are some extremely low values.

- These low values pull the **mean** to the left, making it the smallest of the three measures.

- The **median** is also pulled to the left but not as much as the mean.
- The **mode** remains at the peak of the distribution, which is to the right of the median and mean.

Therefore, the order from smallest to largest is Mean, then Median, then Mode.

Step 3: Final Answer
The correct relationship in a negatively skewed distribution is **Mean** $<$ **Median** $<$ **Mode**.

Quick Tip

Remember the order of central tendencies:

$$\text{Negatively skewed: Mean} < \text{Median} < \text{Mode}$$
$$\text{Positively skewed: Mean} > \text{Median} > \text{Mode}$$
$$\text{Symmetrical distribution: Mean} = \text{Median} = \text{Mode}$$

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14. Find the limit of $\left(1+\frac{1}{n}\right)^n$ as $n \to \infty$.
(A) 1
(B) e
(C) 0
(D) 2

Correct Answer: (B) e

Solution:

Step 1: Understanding the Question
The question asks for the value of the limit of the expression $\left(1+\frac{1}{n}\right)^n$ as the variable n approaches infinity.

Step 2: Key Formula or Approach
This limit is one of the fundamental definitions of the mathematical constant e, the base of the natural logarithm.

$$e = \lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$$

Step 3: Detailed Explanation
The expression is a standard form in calculus. As n becomes very large, the term $\frac{1}{n}$ approaches 0. This creates an indeterminate form of the type 1^∞. The resolution of this specific indeterminate form is the definition of e. The value of e is an irrational number approximately equal to 2.71828.

For competitive exams, this is a standard result that should be memorized.

Step 4: Final Answer
The limit of $\left(1 + \frac{1}{n}\right)^n$ as $n \to \infty$ is e.

Quick Tip

A very important limit in calculus is:

$$\lim_{n\to\infty} \left(1 + \frac{1}{n}\right)^n = e$$

This limit is used in compound interest, exponential growth, and many areas of mathematics.

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15. What is the degree of freedom for a Chi-square test used in a 3×4 contingency table?
(A) 6
(B) 8
(C) 9
(D) 12

Correct Answer: (A) 6

Solution:

Step 1: Understanding the Question
The question asks for the calculation of the degrees of freedom (df) for a Chi-square test of independence when applied to a contingency table with 3 rows and 4 columns.

Step 2: Key Formula or Approach
The formula for calculating the degrees of freedom for a Chi-square test on a contingency table is:

$$df = (r - 1)(c - 1)$$

where r is the number of rows and c is the number of columns in the table.

Step 3: Detailed Explanation
The dimensions of the contingency table are given as 3×4.
This means:

- Number of rows, $r = 3$
- Number of columns, $c = 4$

Now, we substitute these values into the formula for degrees of freedom:

$$df = (3 - 1) \times (4 - 1)$$

$$df = 2 \times 3$$

$$df = 6$$

Step 4: Final Answer

The degree of freedom for the Chi-square test is 6.

Quick Tip

For a Chi-square test using a contingency table:

$$df = (r - 1)(c - 1)$$

where r is the number of rows and c is the number of columns.
