

Statistics And Probability JEE Main PYQ – 2

Total Time: 25 Minute

Total Marks: 40

Instructions

Instructions

1. Test will auto submit when the Time is up.
2. The Test comprises of multiple choice questions (MCQ) with one or more correct answers.
3. The clock in the top right corner will display the remaining time available for you to complete the examination.

Navigating & Answering a Question

1. The answer will be saved automatically upon clicking on an option amongst the given choices of answer.
2. To deselect your chosen answer, click on the clear response button.
3. The marking scheme will be displayed for each question on the top right corner of the test window.

Statistics And Probability

1. Consider the following statements : P : Ramu is intelligent Q : Ramu is rich R : Ramu is not honest The negation of the statement "Ramu is intelligent and honest if and only if Ramu is not rich" can be expressed as : (+4, -1)
[2021, 18 March Shift-11]
- a. $((P \wedge (\sim R)) \wedge Q) \wedge ((\sim Q) \wedge ((\sim P) \vee R))$
- b. $((P \wedge R) \wedge Q) \vee ((\sim Q) \wedge ((\sim P) \vee (\sim R)))$
- c. $((P \wedge R) \wedge Q) \wedge ((\sim Q) \wedge ((\sim P) \vee (\sim R)))$
- d. $((P \wedge (\sim R)) \wedge Q) \vee ((\sim Q) \wedge ((\sim P) \vee R))$
-
2. Consider the data: $x, y, 10, 12, 4, 6, 8, 12$. If mean is 9 and variance is 9.25, then the value of $3x-2y$ is $(x > y)$ (+4, -1)
[8-Apr-2023 shift 1]
- a. 25
- b. 1
- c. 24
- d. 13
-
3. The mean and variance of 15 observations is 20 and 64 respectively. If 55 is wrongly read as 40 as one of the observation, then the correct variance is: (+4, -1)
[1-Feb-2023 Shift 1]
- a. $\frac{247}{3}$
- b. $\frac{167}{2}$
- c. 118
- d. 96
-
4. Positive numbers a_1, a_2, \dots, a_5 are in geometric progression. Their mean and variance are $\frac{31}{10}$ and $\frac{m}{n}$ respectively. The mean of the reciprocals is $\frac{31}{40}$, then $m + n$ is? (+4, -1)

- a. 209
 - b. 211
 - c. 113
 - d. 429
-

5. In a given data set mean of 40 observations is 50 and standard deviation is 12. Two readings which were 20 and 25, were mistakenly taken as 40 and 45. Find correct variance of data set (+4, -1)

[10-Apr-2023 shift 1]

- a. 169
 - b. 150
 - c. 178
 - d. 180
-

6. Probability of four sons to a couple is (+4, -1)

[29-Jan-2024 Shift 1]

- a. $\frac{1}{4}$
 - b. $\frac{1}{8}$
 - c. $\frac{1}{16}$
 - d. $\frac{1}{32}$
-

7. Let A and B be two events such that $P(\overline{A \cup B}) = \frac{1}{6}$, $P(\overline{A \cap B}) = \frac{1}{4}$ and $P(\overline{A}) = \frac{1}{4}$ where \overline{A} stands for the complement of the event A . Then, the events A and B are (+4, -1)

[2014]

- a. independent but not equally likely
- b. independent and equally likely
- c. mutually exclusive and independent

d. equally likely but not independent

8. An unbiased coin is tossed eight times. The probability of obtaining at least one head and at least one tail is : (+4, -1)
[Online April 8, 2017]

a. $\frac{255}{256}$

b. $\frac{127}{128}$

c. $\frac{63}{64}$

d. $\frac{1}{2}$

9. A bag contains six balls of different colours. Two balls are drawn in succession with replacement. The probability that both the balls are of the same colour is p . Next four balls are drawn in succession with replacement and the probability that exactly three balls are of the same colour is q . If $p : q = m : n$, where m and n are coprime, then $m + n$ is equal to _____ (+4, -1)

10. 25% of the population are smokers. A smoker has 27 times more chances to develop lung cancer than a non-smoker. A person is diagnosed with lung cancer and the probability that this person is a smoker is $\frac{k}{10}$. Then the value of k is _____ (+4, -1)

[25-Jan-2023 Shift 2]

Answers

1. Answer: d

Explanation:

Negation of $(P \wedge \sim R) \leftrightarrow (\sim Q)$
 $\Rightarrow ((P \wedge \sim R) \wedge Q) \vee (\sim Q \wedge \sim (P \wedge \sim R))$
 $\Rightarrow ((P \wedge \sim R) \wedge Q) \vee (\sim Q \wedge (\sim P \vee R))$
Answer *D* is correct

Concepts:

1. Statistics:

[Statistics](#) is a field of mathematics concerned with the study of data collection, data analysis, data interpretation, data presentation, and data organization. Statistics is mainly used to acquire a better understanding of data and to focus on specific applications. Also, Statistics is the process of gathering, assessing, and summarising data in a mathematical form.

Mathematically there are two approaches for analyzing data in statistics that are widely used:

Descriptive Statistics -

Using measures of central tendency and measures of dispersion, the descriptive technique of statistics is utilized to describe the data collected and summarise the data and its attributes.

Inferential Statistics -

This statistical strategy is utilized to produce conclusions from data. Inferential statistics rely on statistical tests on samples to make inferences, and it does so by discovering variations between the two groups. The p-value is calculated and differentiated to the probability of chance $(\alpha) = 0.05$. If the p-value is less than or equivalent to, the p-value is considered statistically significant.

2. Answer: a

Explanation:

The correct option is (A): 25

Concepts:

1. Statistics:

[Statistics](#) is a field of mathematics concerned with the study of data collection, data analysis, data interpretation, data presentation, and data organization. Statistics is mainly used to acquire a better understanding of data and to focus on specific applications. Also, Statistics is the process of gathering, assessing, and summarising data in a mathematical form.

Mathematically there are two approaches for analyzing data in statistics that are widely used:

Descriptive Statistics -

Using measures of central tendency and measures of dispersion, the descriptive technique of statistics is utilized to describe the data collected and summarise the data and its attributes.

Inferential Statistics -

This statistical strategy is utilized to produce conclusions from data. Inferential statistics rely on statistical tests on samples to make inferences, and it does so by discovering variations between the two groups. The p-value is calculated and differentiated to the probability of chance $(\alpha) = 0.05$. If the p-value is less than or equivalent to, the p-value is considered statistically significant.

3. Answer: a

Explanation:

Correct answer is (A) : $\frac{247}{3}$

$$64 = \frac{\sum x_i^2}{15} - (20)^2$$

$$\Rightarrow \sum x_i^2 = 6950$$

$$\sigma^2 = \frac{6950 - 40^2 + 50^2}{15} - (21)^2$$

$$\frac{7850}{15} - 441$$

$$= \frac{1235}{15}$$

$$= \frac{247}{3}$$

Concepts:

1. Variance and Standard Deviation:

Variance:

According to layman's words, the [variance](#) is a measure of how far a set of data are dispersed out from their mean or average value. It is denoted as ' σ^2 '.

Variance Formula:

$$s = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}$$

Read More: [Difference Between Variance and Standard Deviation](#)

Standard Deviation:

The spread of statistical data is measured by the [standard deviation](#). Distribution measures the deviation of data from its mean or average position. The degree of dispersion is computed by the method of estimating the deviation of data points. It is denoted by the symbol, ' σ '.

Types of Standard Deviation:

- Standard Deviation for Discrete Frequency distribution
- Standard Deviation for Continuous Frequency distribution

Standard Deviation Formulas:

1. Population Standard Deviation

$$\sigma = \sqrt{\frac{\sum (x_i - \mu)^2}{N}}$$

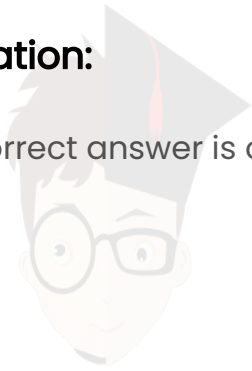
2. Sample Standard Deviation

$$s = \sqrt{\frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N-1}}$$

4. Answer: b

Explanation:

The correct answer is option (B) : 211



$$a \left(\frac{1}{r^2} + \frac{1}{r} + 1 + r + r^2 \right) = \frac{31}{2}$$

$$\frac{1}{a} \left(\frac{1}{r^2} + \frac{1}{r} + 1 + r + r^2 \right) = \frac{31}{8}$$

$$\Rightarrow a^2 = 4$$

$$\Rightarrow a = 2$$

$$\Rightarrow \frac{1}{r^2} + \frac{1}{r} + 1 + r + r^2 = \frac{31}{4}$$

$$\Rightarrow \left(r + \frac{1}{r} \right)^2 + \left(r + \frac{1}{r} \right) = \frac{31}{4} + 1 = \frac{35}{4}$$

$$4t^2 + 4t - 35 = 0$$

$$\Rightarrow t = \frac{5}{2}$$

$$\Rightarrow r = 2$$

$$\therefore \text{numbers are} = \frac{1}{2}, 1, 2, 4, 8$$

$$\therefore \sigma^2 = \frac{\frac{1}{4} + 1 + 4 + 16 + 64}{5} - \left(\frac{31}{10}\right)^2$$

$$= \frac{341}{20} - \frac{961}{100}$$

$$= \frac{1705 - 961}{100}$$

$$= \frac{744}{100} = \frac{186}{25}$$

$$\therefore m + n = 186 + 25$$

= 211

Concepts:

1. Statistics:

[Statistics](#) is a field of mathematics concerned with the study of data collection, data analysis, data interpretation, data presentation, and data organization. Statistics is mainly used to acquire a better understanding of data and to focus on specific applications. Also, Statistics is the process of gathering, assessing, and summarising data in a mathematical form.

Mathematically there are two approaches for analyzing data in statistics that are widely used:

Descriptive Statistics -

Using measures of central tendency and measures of dispersion, the descriptive technique of statistics is utilized to describe the data collected and summarise the data and its attributes.

Inferential Statistics -

This statistical strategy is utilized to produce conclusions from data. Inferential statistics rely on statistical tests on samples to make inferences, and it does so by discovering variations between the two groups. The p-value is calculated and differentiated to the probability of chance (α) = 0.05. If the p-value is less than or equivalent to, the p-value is considered statistically significant.

5. Answer: c

Explanation:

The correct answer is option (C) : 178

$$\sum x_{i(\text{Correct})} = 40 \cdot 50 = 2000$$

$$= 1960$$

$$\bar{x}_{i(\text{Correct})} = 49$$

$$\frac{\sum x_{i(\text{Wrong})}^2}{40} - (50)^2 = 144$$

$$\sum x_{i(\text{Wrong})}^2 = 2644 \cdot 40$$

$$\sum x_{i(\text{Correct})}^2 = 40 \cdot 2644 - (2600)$$

Correct variance

$$40 \cdot 2644 - 2600 = 10560$$

$$\begin{aligned} &= \frac{70 \times 2077 - 2000}{40} - (49)^2 \\ &= 2644 - 65 - 2401 \\ &= 2644 - 2466 \\ &= 178 \end{aligned}$$

Concepts:

1. Statistics:

[Statistics](#) is a field of mathematics concerned with the study of data collection, data analysis, data interpretation, data presentation, and data organization. Statistics is mainly used to acquire a better understanding of data and to focus on specific applications. Also, Statistics is the process of gathering, assessing, and summarising data in a mathematical form.

Mathematically there are two approaches for analyzing data in statistics that are widely used:

Descriptive Statistics -

Using measures of central tendency and measures of dispersion, the descriptive technique of statistics is utilized to describe the data collected and summarise the data and its attributes.

Inferential Statistics -

This statistical strategy is utilized to produce conclusions from data. Inferential statistics rely on statistical tests on samples to make inferences, and it does so by discovering variations between the two groups. The p-value is calculated and

differentiated to the probability of chance() = 0.05. If the p-value is less than or equivalent to, the p-value is considered statistically significant.

6. Answer: c

Explanation:

44577

Concepts:

1. Probability:

Probability is defined as the extent to which an event is likely to happen. It is measured by the ratio of the favorable outcome to the total number of possible outcomes.

The definitions of some important terms related to probability are given below:

Sample space

The set of possible results or outcomes in a trial is referred to as the sample space. For instance, when we flip a coin, the possible outcomes are heads or tails. On the other hand, when we roll a single die, the possible outcomes are 1, 2, 3, 4, 5, 6.

Sample point

In a sample space, a sample point is one of the possible results. For instance, when using a deck of cards, as an outcome, a sample point would be the ace of spades or the queen of hearts.

Experiment

When the results of a series of actions are always uncertain, this is referred to as a trial or an experiment. For Instance, choosing a card from a deck, tossing a coin, or rolling a die, the results are uncertain.

Event

An event is a single outcome that happens as a result of a trial or experiment. For instance, getting a three on a die or an eight of clubs when selecting a card from a deck are happenings of certain events.

Outcome

A possible outcome of a trial or experiment is referred to as a result of an outcome. For instance, tossing a coin could result in heads or tails. Here the possible outcomes are heads or tails. While the possible outcomes of dice thrown are 1, 2, 3, 4, 5, or 6.

7. Answer: a

Explanation:

$$P(\overline{A \cup B}) = \frac{1}{6}$$

$$\Rightarrow P(A \cup B) = 1 - \frac{1}{6} = \frac{5}{6}$$

$$P(\bar{A}) = \frac{1}{4}$$

$$\Rightarrow P(A) = 1 - \frac{1}{4} = \frac{3}{4}$$

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

$$\frac{5}{6} = \frac{3}{4} + P(B) - \frac{1}{4}$$

$$P(B) = \frac{1}{3}$$

$\therefore P(A) \neq P(B)$ so they are not equally likely

$$\text{Also } P(A) \times P(B) = \frac{3}{4} \times \frac{1}{3} = \frac{1}{4}$$

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

$\therefore P(A \cap B) = P(A) \cdot P(B)$ so A & B are independent

Concepts:

1. Probability:

Probability is defined as the extent to which an event is likely to happen. It is measured by the ratio of the favorable outcome to the total number of possible outcomes.

The definitions of some important terms related to probability are given below:

Sample space

The set of possible results or outcomes in a trial is referred to as the sample space. For instance, when we flip a coin, the possible outcomes are heads or tails. On the other hand, when we roll a single die, the possible outcomes are 1, 2, 3, 4, 5, 6.

Sample point

In a sample space, a sample point is one of the possible results. For instance, when using a deck of cards, as an outcome, a sample point would be the ace of spades or the queen of hearts.

Experiment

When the results of a series of actions are always uncertain, this is referred to as a trial or an experiment. For instance, choosing a card from a deck, tossing a coin, or rolling a die, the results are uncertain.

Event

An event is a single outcome that happens as a result of a trial or experiment. For instance, getting a three on a die or an eight of clubs when selecting a card from a deck are happenings of certain events.

Outcome

A possible outcome of a trial or experiment is referred to as a result of an outcome. For instance, tossing a coin could result in heads or tails. Here the possible outcomes are heads or tails. While the possible outcomes of dice thrown are 1, 2, 3, 4, 5, or 6.

8. Answer: b

Explanation:

$$\begin{aligned} & 1 - \int P(\text{All Head}) + P(\text{AllTail}) \\ & 1 - \left\{ \frac{1}{2^8} + \frac{1}{2^8} \right\} \\ & = 1 - \frac{1}{2^7} \\ & = 1 - \frac{1}{128} = \frac{127}{128} \end{aligned}$$

Concepts:

1. Probability:

Probability is defined as the extent to which an event is likely to happen. It is measured by the ratio of the favorable outcome to the total number of possible outcomes.

The definitions of some important terms related to probability are given below:

Sample space

The set of possible results or outcomes in a trial is referred to as the sample space. For instance, when we flip a coin, the possible outcomes are heads or tails. On the other hand, when we roll a single die, the possible outcomes are 1, 2, 3, 4, 5, 6.

Sample point

In a sample space, a sample point is one of the possible results. For instance, when using a deck of cards, as an outcome, a sample point would be the ace of spades or the queen of hearts.

Experiment

When the results of a series of actions are always uncertain, this is referred to as a trial or an experiment. For Instance, choosing a card from a deck, tossing a coin, or rolling a die, the results are uncertain.

Event

An event is a single outcome that happens as a result of a trial or experiment. For instance, getting a three on a die or an eight of clubs when selecting a card from a deck are happenings of certain events.

Outcome

A possible outcome of a trial or experiment is referred to as a result of an outcome. For instance, tossing a coin could result in heads or tails. Here the possible outcomes are heads or tails. While the possible outcomes of dice thrown are 1, 2, 3, 4, 5, or 6.

9. Answer: 14 – 14

Explanation:

$$p = \frac{{}^6C_1}{6 \times 6} = \frac{1}{6}$$

$$q = \frac{{}^6C_1 \times {}^5C_1 \times 4}{6 \times 6 \times 6 \times 6} = \frac{5}{54}$$

$$\therefore p : q = 9 : 5$$

$$\Rightarrow m + n = 14$$

So, the correct answer is 14.

Concepts:

1. Probability:

Probability is defined as the extent to which an event is likely to happen. It is measured by the ratio of the favorable outcome to the total number of possible outcomes.

The definitions of some important terms related to probability are given below:

Sample space

The set of possible results or outcomes in a trial is referred to as the sample space. For instance, when we flip a coin, the possible outcomes are heads or tails. On the other hand, when we roll a single die, the possible outcomes are 1, 2, 3, 4, 5, 6.

Sample point

In a sample space, a sample point is one of the possible results. For instance, when using a deck of cards, as an outcome, a sample point would be the ace of spades or the queen of hearts.

Experiment

When the results of a series of actions are always uncertain, this is referred to as a trial or an experiment. For instance, choosing a card from a deck, tossing a coin, or rolling a die, the results are uncertain.

Event

An event is a single outcome that happens as a result of a trial or experiment. For instance, getting a three on a die or an eight of clubs when selecting a card from a deck are happenings of certain events.

Outcome

A possible outcome of a trial or experiment is referred to as a result of an outcome. For instance, tossing a coin could result in heads or tails. Here the possible outcomes are heads or tails. While the possible outcomes of dice thrown are 1, 2, 3, 4, 5, or 6.

10. Answer: 9 – 9

Explanation:

The correct answer is 9.

E_1 : Smokers

$$P(E_1) = \frac{1}{4}$$

E_2 : non-smokers

$$P(E_2) = \frac{3}{4}$$

E : diagnosed with lung cancer

$$P(E/E_1) = \frac{27}{28}$$

$$P(E/E_2) = \frac{1}{28}$$

$$P(E_1/E) = \frac{P(E_1)P(E/E_1)}{P(E)}$$

$$= \frac{\frac{1}{4} \times \frac{27}{28}}{\frac{1}{4} \times \frac{27}{28} + \frac{3}{4} \times \frac{1}{28}} = \frac{27^9}{30_{10}} = \frac{9}{10}$$

$$K = 9$$

Concepts:

1. Probability:

Probability is defined as the extent to which an event is likely to happen. It is measured by the ratio of the favorable outcome to the total number of possible outcomes.

The definitions of some important terms related to probability are given below:

Sample space

The set of possible results or outcomes in a trial is referred to as the sample space. For instance, when we flip a coin, the possible outcomes are heads or tails. On the other hand, when we roll a single die, the possible outcomes are 1, 2, 3, 4, 5, 6.

Sample point

In a sample space, a sample point is one of the possible results. For instance, when using a deck of cards, as an outcome, a sample point would be the ace of spades or the queen of hearts.

Experiment

When the results of a series of actions are always uncertain, this is referred to as a trial or an experiment. For Instance, choosing a card from a deck, tossing a coin, or rolling a die, the results are uncertain.

Event

An event is a single outcome that happens as a result of a trial or experiment. For instance, getting a three on a die or an eight of clubs when selecting a card from a deck are happenings of certain events.

Outcome

A possible outcome of a trial or experiment is referred to as a result of an outcome. For instance, tossing a coin could result in heads or tails. Here the possible outcomes are heads or tails. While the possible outcomes of dice thrown are 1, 2, 3, 4, 5, or 6.