Probability and Statistics Questions

MCQ Question 1

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If 35 is removed from the data, 30, 34, 35, 36, 37, 38, 39, 40 then the median increases by:

1. 2
2. 1.5
3. 1
4. 0.5

Answer (Detailed Solution Below)

Option 4 : 0.5

Probability and Statistics MCQ Question 1 Detailed Solution

Given:

The data = 30, 34, 35, 36, 37, 38, 39, 40

Formula used:

The median for odd number = $\left(\frac{n+1}{2}\right)^{th}$

The median for even number = $\frac{(\frac{n}{2})^{th} + (\frac{n}{2}+1)^{th}}{2}$ Where, n = The total number of terms (odd or even)

Calculation:

Let us assume the median of the even number be X

⇒ The total even number = 8

⇒ Then the value of n = 8

⇒ The median of the even number = $\frac{(\frac{8}{2})^{th} + (\frac{8}{2}+1)^{th}}{2}$ = (4 + 5)/2 = (36 + 37)/2 = 36.5

⇒ When 35 removed then total number = n = 7

⇒ The median of the data when 35 is removed = $(\frac{7+1}{2})^{th}$ = 8/2 = 4th term = 37

⇒ The difference of the median = 37 - 36.5 = 0.5

∴ **The required result will be 0.5.**

MCQ Question 2

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Find the median, mode and mean of 9, 5, 8, 9, 9, 7, 8, 9, 8?

1. 9, 9, 9
2. 9, 8, 9
3. 8, 9, 8
4. 8, 9, 9

Answer (Detailed Solution Below)

Option 3 : 8, 9, 8

Probability and Statistics MCQ Question 2 Detailed Solution

Concept:

As per the given data,

9, 5, 8, 9, 9, 7, 8, 9, 8

Arranging the numbers in numerical order

5, 7, 8, 8, 8, 9, 9, 9, 9

Since there is an odd number of numbers, the middle number is the median of the given data

⇒ Median = 8

The value which appears mostly is considered as mode, as 9 is repeated 4 times.

⇒ Mode = 9

Mean = (9 + 5 + 8 + 9 + 9 + 7 + 8 + 9 + 8)/9 = 8

∴ Median, mode and mean = (8, 9, 8)

MCQ Question 3

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A continuous random variable X has the distribution function
$F(x) = 0$ if $x < 1$
$= k(x - 1)^4$ if $1 < x < 3$
$= 1$ if $x > 3$
The value of k is

1. $\frac{1}{16}$

2. $\frac{1}{4}$

3. $\frac{1}{\ }$

3. $\frac{}{8}$

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

Answer (Detailed Solution Below)

Option 1 : $\frac{1}{16}$

Probability and Statistics MCQ Question 3 Detailed Solution

Concept:

For a continuous random variable, f(x) is called probability density function if it satisfies-

$$\int_{-\infty}^{\infty} f(x)dx = 1$$

Relation between Probability density function f(x) and Probability distribution function is:

$$f(x) = \frac{d}{dx}\{F(x)\}$$

Calculation:

Here Probability distribution function F(x) is given

$$\because \int_{-\infty}^{\infty} f(x)dx = 1$$

$$\Rightarrow \int_{-\infty}^{1} f(x)dx + \int_{1}^{3} f(x)dx + \int_{3}^{\infty} f(x)dx = 1$$

$$\Rightarrow \int_{-\infty}^{1} \frac{d}{dx}\{F(x)\}dx + \int_{1}^{3} \frac{d}{dx}\{F(x)\}dx + \int_{3}^{\infty} \frac{d}{dx}\{F(x)\}dx = 1$$

$$\Rightarrow \int_{-\infty}^{1} \frac{d}{dx}\{0\}dx + \int_{1}^{3} \frac{d}{dx}\left\{k(x-1)^4\right\}dx + \int_{3}^{\infty} \frac{d}{dx}\{1\}dx = 1$$

$$\Rightarrow \int_{1}^{3} 4k(x-1)^3dx = 1$$

$$\Rightarrow 4\frac{k}{4}\left[(x-1)^4\right]_1^3 = 1$$

$$\Rightarrow k\left[(3-1)^4\right] = 1$$

$$\Rightarrow k = \frac{1}{16}$$

MCQ Question 4

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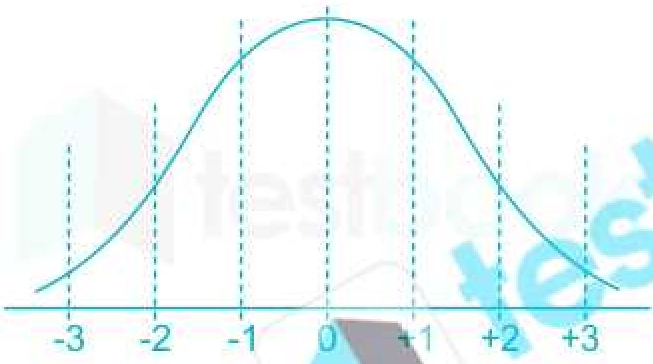
The area (in percentage) under standard normal distribution curve of random variable Z within limits from −3 to +3 is _____

Answer (Detailed Solution Below) 99.6 - 99.8

Probability and Statistics MCQ Question 4 Detailed Solution

Explanation:

A standard normal distribution having zero mean and unit variance. A standard normal curve has 99.7% area in limits -3 to +3



Note: A standard normal curve has **68% area** in limits **-1 to +1** and **95% area** in limits **-2 to +2.**

These are the standard results.

MCQ Question 5

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A bag contains 4 white, 5 red and 6 blue balls. Three balls are drawn at random form the bag. The probability that all of them are red is:

1. $\frac{2}{91}$
2. $\frac{3}{22}$
3. $\frac{1}{22}$
4. $\frac{2}{77}$

Answer (Detailed Solution Below)

Option 1 : $\frac{2}{91}$

Probability and Statistics MCQ Question 5 Detailed Solution

Explanation:

The total number of out comes in selecting 3 balls out of total 15 balls is $^{15}C_3$

Total out comes in selecting 3 red balls from total 5 red balls is $^{5}C_3$

∴ The probability of getting all three red balls is

$$P = \frac{5_{C3}}{15_{C_3}} = \frac{5\times4\times3}{15\times14\times13} = \frac{2}{91}$$

MCQ Question 6

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Three cards were drawn from a pack of 52 cards. The probability that they are a king, a queen, and a jack is

1. $\frac{16}{5525}$
2. $\frac{64}{2197}$
3. $\frac{3}{13}$
4. $\frac{8}{16575}$

Answer (Detailed Solution Below)

Option 1 : $\frac{16}{5525}$

Probability and Statistics MCQ Question 6 Detailed Solution

Explanation:

Number of ways in which a king can be drawn from the pack of 52 cards is $^4C_1$ since there are 4 kings in a deck of cards

Similarly, a queen and a jack can be drawn in $^4C_1$ ways

∴ Number of ways in which a king, a queen and a jack can be drawn is $= {}^4C_1 \times {}^4C_1 \times {}^4C_1$

Number of ways in which three cards can be drawn from the pack of 52 cards is

$= {}^{52}C_3$

$\therefore The\ required\ probability = \frac{sample\ space}{Total\ possible\ ways}$

$\therefore The\ required\ probability = \frac{{}^4C_1 \times {}^4C_1 \times {}^4C_1}{{}^{52}C_3}$

$= \frac{4\times4\times4}{\frac{52\times51\times50}{6}}$

$= \frac{16}{5525}$

MCQ Question 7

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Consider two exponentially distributed random variables X and Y, both having a mean of 0.50. Let Z = X + Y and r be the correlation coefficient between X and Y. If the variance of Z equals 0, then the value of r is _______ (*round off to 2 decimal places).*

Answer (Detailed Solution Below) **-1 - -0.98**

Probability and Statistics MCQ Question 7 Detailed Solution

Let λ be the parameter of exponential distribution

So, for exponentially distributed random variables X & Y

Expected Value or Mean $E(X) = \frac{1}{\lambda}$

Variance: $Var\ (X) = \frac{1}{\lambda^2}$

Var (X + Y) = Var X + Var Y + 2 Cov (X, Y)

Where Cov (X, Y) = Covariance of X and Y

Correction coefficient is given by:

$$r = \frac{Cov\ (X, Y)}{\sqrt{Var(X)Var(Y)}}$$

__Calculation:__

Given: E(X) = E(Y) = 0.5

$$\frac{1}{\lambda_1} = \frac{1}{\lambda_2} = 0.5$$

$\lambda_1 = \lambda_2 = 2$

$$Var\ (X) = \frac{1}{\lambda_1^2} = \frac{1}{2^2} = 0.25$$

$$Var\ (Y) = \frac{1}{\lambda_2^2} = \frac{1}{2^2} = 0.25$$

Also it is given, Z = X + Y

And Var (Z) = 0

∴ Var (X + Y) = 0

Var X + Var Y + 2 Cov (X, Y) = 0

On putting values:

0.25 + 0.25 + 2 Cov (X, Y) = 0

$$Cov\ (X,\ Y) = -\frac{0.5}{2} = -0.25$$

Correction coefficient is given by:

$$r = \frac{Cov\ (X,\ Y)}{\sqrt{Var(X)Var(Y)}} = \frac{-0.25}{\sqrt{0.25 \times 0.25}} = -1$$

MCQ Question 8

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A box contains the following three coins.
I. A fair coin with head on one face and tail on the other face.
II. A coin with heads on both the faces.
III. A coin with tails on both the faces.
A coin is picked randomly from the box and tossed. Out of the two remaining coins in the box, one coin is then picked randomly and tossed. If the first toss results in a head, the probability of getting a head in the second toss is

1. $\frac{2}{5}$

2. $\frac{1}{3}$

3. $\frac{2}{3}$

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

Answer (Detailed Solution Below)

Option 2 : $\frac{1}{3}$

Probability and Statistics MCQ Question 8 Detailed Solution

Concept:

Conditional probability is defined as:

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

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

Application:

Let event A is defined as:

A = Getting head in the first toss

Event B is defined as:

B = Getting head in the second toss

According to the question, we need to find the probability of getting a head in the second toss when

Already a head has occurred in the first toss, i.e.So, the probability of getting head in the first toss will be:

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

P(A) = P(fair coin is selected) × P(Getting head) + P(double-headed coin is selected) × P(getting head)

$$= \frac{1}{3} \times \frac{1}{2} + \frac{1}{3} \times 1 = \frac{1}{6} + \frac{1}{3} = \frac{1}{2}$$

$$P(A) = \frac{1}{2}$$

Now, finding the probability of getting head in both tosses will be:

$$P(A \cap B) = \underbrace{\overset{First\ toss}{\left(\frac{1}{3} \cdot \frac{1}{2}\right)} \quad \overset{second\ toss}{\left(\frac{1}{2} \cdot 1\right)}}_{\substack{when\ first\ fair \\ coin\ is\ tossed}} + \underbrace{\overset{First\ toss}{\left(\frac{1}{3} \cdot 1\right)} \quad \overset{second\ toss}{\left(\frac{1}{2} \cdot \frac{1}{2}\right)}}_{\substack{When\ first\ double \\ headed\ coin\ is\ tossed}}$$

$$P(A \cap B) = \frac{1}{12} + \frac{1}{12} = \frac{1}{6}$$

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

$$P\left(\frac{B}{A}\right) = \frac{\frac{1}{6}}{\frac{1}{2}} = \frac{1}{3}$$

MCQ Question 9 View this Question Online >

Mode of the data 7.5, 7.3, 7.2, 7.2, 7.4, 7.7, 7.7, 7.5, 7.3, 7.2, 7.6, 7.2 is

1. 7.3
2. 7.5
3. 7.2
4. 7.6

Answer (Detailed Solution Below)

Option 3 : 7.2

Probability and Statistics MCQ Question 9 Detailed Solution

Given:

The data = 7.5, 7.3, 7.2, 7.2, 7.4, 7.7, 7.7, 7.5, 7.3, 7.2, 7.6, 7.2

Concept:

Mean: Mean is the average or the most common value in a collection of numbers

Median: The middle value of the given numbers when arranged in an order.

Mode: The mode is the value that is repeatedly occurring in given numbers

Calculation:

When we arrange the data in a manner

⇒ 7.2, 7.2, 7.2, 7.2, 7.3, 7.3, 7.4, 7.5, 7.5, 7.6, 7.7, 7.7

We can see that 7.2 is frequently occurring in given data then,

The mode of the given data = 7.2

∴ The required result will be 7.2.

MCQ Question 10

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Let X be a continuous random variable with PDF

$$f_x(x) = \begin{cases} 4x^3 & 0 < x \le 1 \\ 0 & otherwise \end{cases}$$

The value of $P\left(X \le \frac{2}{3} | X > \frac{1}{3}\right)$ **is**

1. $\frac{1}{9}$

2. $\frac{5}{27}$

3. $\frac{5}{16}$

4. $\frac{3}{16}$

Answer (Detailed Solution Below)

Option 4 : 3

Option 4 : $\frac{3}{16}$

Probability and Statistics MCQ Question 10 Detailed Solution

$$P\left(X \le \frac{2}{3} | X > \frac{1}{3}\right) = \frac{P\left(X \le \frac{2}{3} \cap X > \frac{1}{3}\right)}{P\left(X > \frac{1}{3}\right)}$$

$$= \frac{P\left(\frac{1}{3} < X \le \frac{2}{3}\right)}{P\left(X > \frac{1}{3}\right)}$$

$$P\left(\frac{1}{3} < X \le \frac{2}{3}\right) = \int_{1/3}^{2/3} 4x^3 dx = \left[x^4\right]_{\frac{1}{3}}^{\frac{2}{3}} = \frac{15}{81} = \frac{5}{27}$$

$$P\left(X > \frac{1}{3}\right) = \int_{1/3}^{1} 4x^3 dx$$

$$= \left[x^4\right]_{\frac{1}{3}}^{1}$$

$$= 1 - \frac{1}{81} = \frac{80}{81}$$

$$P\left(X \le \frac{2}{3} | X > \frac{1}{3}\right) = \frac{\frac{5}{27}}{\frac{80}{81}} = \frac{5}{27} \times \frac{81}{80} = \frac{3}{16}$$