Statistics

Question1

If the variance of the numbers $9, 15, 21, \ldots, (6n+3)$ is P, then the variance of the first n even numbers is

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Options:

A.

$9P$

B.

$3P$

C.

$\frac{P}{9}$

D.

$\frac{P}{3}$

Answer: C

Solution:

Given, $a = 9, d = 6$

$\therefore$ Variance,

$$P = \frac{6^2\left(n^2-1\right)}{12} = 3\left(n^2-1\right)$$

$$\Rightarrow \quad n^2 - 1 = \frac{P}{3} \qquad \ldots(i)$$

Now, variance of $2, 4, 6, \ldots, 2n$

$$a = 2, d = 2$$

Variance, $\frac{\left(4^2\left(n^2-1\right)\right.}{12}$

$$= \frac{4\left(n^2-1\right)}{12} = \frac{n^2-1}{3}$$

$$= \frac{\frac{P}{3}}{3} = \frac{P}{9}$$

Question2

The mean deviation from the median for the following data is

x_i	2	9	8	3	5	7
f_i	5	3	1	6	6	1

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Options:

A.

2

B.

$\frac{8}{3}$

C.

$\frac{9}{2}$

D.

9

Answer: A

Solution:

Given data,

x_i	2	9	8	3	5	7
f_i	5	3	1	6	6	1

x_i	f_i	Cumulative frequency
2	5	5
9	3	8
8	1	9
3	6	15
5	6	21
7	1	22

Total frequency $N = 22$ (even)

$\Rightarrow \quad \frac{N}{2} = \frac{22}{2} = 11$

Since, the cumulative frequency just greater than $\frac{N}{2}$ i.e., 11 is 15 and the value of x corresponding to 15 is 3 .

$\therefore$ Median $= 3$

Now, mean deviation

$= \frac{1}{N} \Sigma f_i \left| x_i - \text{ Median } \right|$

x_i	f_i	$\left\|x_i - 3\right\|$	$f_{\|} \left\|x_i - 3\right\|$
2	5	1	5
9	3	6	18
8	1	5	5
3	6	0	0
5	6	2	12
7	1	4	4

So, $\Sigma f_i \left|x_i - 3\right| = 44$

So, mean deviation $= \frac{44}{22} = 2$

Question3

If three dice are thrown, then the mean of the sum of the numbers appearing on them is

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Options:

A.

58.5

B.

76.66

C.

71.75

D.

10.5

Answer: D

Solution:

The numbers on a single die are 1 , 2, 3, 4, 5 and 6 .

$$\begin{aligned} \text{So, the mean } &= \frac{1+2+3+4+5+6}{6} \\ &= \frac{21}{6} = 3.5 \end{aligned}$$

When multiple dice are thrown, the mean of the sum of the numbers appearing on them = the sum of means of individual dice.

Since, each die has mean 3.5.

So, the mean of the sum of the numbers appearing on three dice

$= 3.5 + 3.5 + 3.5 = 10.5$

Question4

The variance of the data: $1, 2, 3, 5, 8, 13, 17$ is approximately

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Options:

A. 31.14

B. 29.57

C. 30.62

D. 32.71

Answer: A

Solution:

$\bar{x} = \frac{1+2+3+5+8+13+17}{7}$

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

x_i	$(x-\bar{x})^2$
1	36
2	25
3	16
5	4
8	1
13	36
17	100
	218

$$\text{Variance } = \frac{\Sigma(x_1 - x)^2}{7}$$

$$= \frac{218}{7} = 3114$$

Question5

The variance of the first 10 natural numbers which are multiples of 3 is

Options:

A. 53

B. 73

C. 52.5

D. 74.25

Answer: D

Solution:

To calculate the variance of the first 10 natural numbers that are multiples of 3, we use the formula for variance:

$\sigma^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i)^2 - (\bar{x})^2$

Here, let $x_i = 3k$ where $k \in [1, 10]$. So the numbers are $3 \times 1, 3 \times 2, \ldots, 3 \times 10$.

First, we find the sum of squares of these numbers:

$\sigma^2 = \frac{1}{n} \times 9\sum_{k=1}^{10} k^2 - 9(\bar{k})^2$

Calculating step-by-step:

The formula for the sum of squares of the first n natural numbers is:

$\sum_{k=1}^{n} k^2 = \frac{n(n+1)(2n+1)}{6}$

Substituting $n = 10$:

$\sum_{k=1}^{10} k^2 = \frac{10\times11\times21}{6}$

The mean $\bar{k}$ of the first 10 natural numbers is:

$\bar{k} = \frac{1}{10}\sum_{k=1}^{10} k = \frac{10\times11}{2\times10}$

Plugging these into the variance formula:

$\sigma^2 = \frac{9}{10} \times \frac{10\times11\times21}{6} - 9\left(\frac{10\times11}{20}\right)^2$

This simplifies to:

$\sigma^2 = \frac{9}{10} \times 385 - 9 \times 30.25$

Finally, calculating the result:

$\sigma^2 = \frac{9}{10} \times 385 - 272.25 = 74.25$

Thus, the variance of the first 10 multiples of 3 is 74.25.

Question6

If M_1 is the mean deviation from the mean of the discrete data $44, 5, 27, 20, 8, 54, 9, 14, 35$ and M_2 is the mean deviation from the median of the same data, then $M_1 - M_2 =$

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Options:

A. $\frac{7}{9}$

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

C. $\frac{5}{9}$

D. $\frac{4}{9}$

Answer: D

Solution:

We have, data $44, 5, 27, 20, 8, 54, 9, 14, 35$

Data in ascending order is

$5, 8, 9, 14, 20, 27, 35, 44, 54$

Mean

$$(\bar{x}) = \frac{5+8+9+14+20+27+35+44+54}{9}$$

$$= \frac{216}{9} = 24$$

Median $(M) = 20$

$M_1 = \frac{1}{\eta}\Sigma|x_i - \bar{x}|$

$= \frac{1}{9}[19+16+15+10+4+3+11+20+30] = \frac{128}{9}$

$M_2 = \frac{1}{\eta}\Sigma|x_i - M|$

$= \frac{1}{9}[15+12+11+6+0+7+15+24+34]$

$= \frac{124}{9}$

$M_1 - M_2 = \frac{128}{9} - \frac{124}{9} = \frac{4}{9}$

Question7

The mean of a binomial variate $X \sim B(n, p)$ is 1 . If $n > 2$ and $P(X = 2) = \frac{27}{128}$, then the variance of the distribution is

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Options:

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

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

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

D. 4

Answer: A

Solution:

Mean $= 1$

$\Rightarrow np = 1 \Rightarrow P(X = 2) = \frac{27}{128}$

$\Rightarrow {}^nC_2 p^2 q^{n-2} = \frac{27}{128}$

$\Rightarrow \frac{n(n-1)}{2} p^2 \cdot q^{n-2} = \frac{27}{128}$

$\Rightarrow \frac{n(n-1)}{2} \left(\frac{1}{n}\right)^2 \times \left(1 - \frac{1}{n}\right)^{n-2} = \frac{27}{128}$

$\Rightarrow \left(\frac{n-1}{2n}\right)\left(\frac{n-1}{n}\right)^{n-2} = \frac{27}{128}$

$\Rightarrow \quad \frac{(n-1)^{n-1}}{(n)^{n-1} \cdot 2} = \frac{27}{128} = \left(\frac{3}{4}\right)^3 \times \frac{1}{4}$

$\therefore \quad n = 4$

Variance $= npq = \frac{3}{4}$

Question8

The variance of the following continuous frequency distribution is

Classinterval	0-4	4-8	8-12	12-16
Frequency	2	3	2	1

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Options:

A. $\frac{128}{7}$

B. 15

C. 19

D. $\frac{130}{7}$

Answer: B

Solution:

"

Class-interval	x_i	f_i	$f_i x_i$
0-4	2	2	4
4-8	6	3	18
8-12	10	2	20
12-16	14	1	14
	$\sum f_i = 8$		$\sum f_i x_i = 56$

Mean, $\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{56}{8} = 7$

Variance, $\sigma^2 = \frac{\Sigma f_i (x_i - \bar{x})^2}{\Sigma f_i}$

$$= \frac{2(2-7)^2 + \frac{3(6-7)^2 + 2(10-7)^2 + (1)(14-7)^2}{8}}{= \frac{50+3+18+49}{8} = \frac{120}{8} = 15}$$

"

Question9

The mean deviation about the mean for the following data is

Class interval	$0-2$	$2-4$	$4-6$	$6-8$	$8-10$
Frequency	1	3	5	3	1

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Options:

A. 2

B. $\frac{15}{13}$

C. $\frac{22}{13}$

D. $\frac{20}{13}$

Answer: D

Solution:

Let assumed mean $A=5$ and $h=2$

Class interval	Mid Values (x_i)	Frequency (f_i)	$d_i=\frac{x_i-5}{2}$	$f_i d_i$	$\left\|x_i-\bar{X}\right\|$	$f_i\left\|x_i-\bar{X}\right\|$
0-2	1	1	-2	-2	4	4
2-4	3	3	-1	-3	2	6
4-6	5	5	0	0	0	0
6-8	7	3	1	3	2	6
8-10	9	1	2	2	4	4

		N = 13		$\Sigma f_i d_i = 0$		Total = 20

Here, $N = 13, \Sigma f_i d_i = 0$

Mean $\bar{X} = A + h\left(\frac{1}{N}\Sigma f_i d_i\right) = 5$

$\therefore$ Mean deviation about mean $= \frac{1}{N}\Sigma f_i\left|x_i - \bar{X}\right| = \frac{20}{13}$

Question10

Assertion (A) The variance of the first n odd natural numbers is $\frac{n^2-1}{3}$.

Reason (R) The sum of the first n odd natural numbers is n^2 and the sum of the squares of the first n odd natural numbers is $\frac{n\left(4n^2-1\right)}{3}$.

Which of the following alternatives is correct?

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Options:

A. (A) and (R) are true, (R) is correct explanation of (A)

B. (A) and (R) are true, (R) is not a correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

Solution:

Assertion (A) The variance of the first ' n ' odd natural number is $\frac{n^2-1}{3}$, which is correct.

Reason (**R**) The sum of first n odd natural number is n^2 and the sum of the squares of the first n odd natural number is $\frac{(4n-1)}{3}n$. Which is also correct.

and Reason (R) is correct explanation of Assertion (A).

Thus, Assertion (A) and Reason (R) both true. Reason ' R ' is correct explanation of Assertion (A).
