STA301 – Midterm Fall 2012 (December)

Question (Marks: 5)

The numbers of airplane accidents in a year are 1, 2, 3, 4 with corresponding probabilities 1/6, 2/6, 2/6 and 1/6. What is the variance of annual accidents?

Solution:-

X	P	PX	X^2	PX^2
1	1/6	1/6	1	1/6
2	2/6	2/3	4	4/3
3	2/6	1	9	3
4	1/6	2/3	16	8/3
Total		$\sum PX = 5/2$		$\sum PX^2 = 43/6$

$\sum PX = E(X)$ $\sum PX^2 = E(X)^2$

$VAR(X) = E(X)^2 - EX^2$

$= \frac{43}{6} - \left(\frac{5}{2}\right)^2$

$= \frac{11}{12}$

Question (Marks: 3)
A ball is selected at random from a bag contains 2 white, 5 black and 7 green balls. What is the probability that it is a
White ball
Green ball

Solution:-

$$\text{White Ball} = \frac{\binom{2}{2}\binom{5}{0}\binom{7}{0}}{\binom{14}{2}} = \frac{1.1.1}{91} = \frac{1}{91}$$

$$\text{Black ball} = \frac{\binom{2}{0}\binom{5}{0}\binom{7}{7}}{\binom{14}{7}} = \frac{1.1.1}{3432} = \frac{1}{3432}$$

Question (Marks: 3)
For the given data calculate the mean deviation.
+ 3 - 3 - 4 - 1 +1 + 4

Solution:

X	$\lvert X - \overline{X} \rvert$
3	3
-3	3
-4	4
-1	1
1	1
4	4
$\sum X = 0$	$\sum \lvert X - \overline{X} \rvert = 16$

Mean = 0

$$M.D = \frac{\sum \lvert X - \overline{X} \rvert}{n} = \frac{16}{6} = \frac{8}{3}$$

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Question (Marks: 2)
"If P (A|B) = P (B|A) then P (A) = P (B)".
Indicate whether the above statement is true or false? Also give reason.
Solution:-
Yes this statement is true, because

$$P(A/B)=\frac{P(A\cap B)}{P(B)} \qquad \textit{and}$$

$$P(B/A)=\frac{P(A\cap B)}{P(A)} \qquad \textit{therfore}$$

Therefore there is difference just in denominator
If the Values of P (A|B) = P (B|A re same then the denominator should also be same

Question (Marks: 2)
Why we use coefficient of variation?
Answer:- (Page 93)
We calculate variation if we have to compare different data with the same variable but with very different arithmetic means.

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Q1: find the missing value in the formula ? (Marks: 2)

$$P(A|B)=\frac{P(A\cap B)}{?}$$

Answer:- (Page 159)
P (B) is missing.

Q2: what is Coefficient of Correlation? (Marks: 2)
Answer:- (Page 128)
A numerical measure of the strength of the linear relationship between two random variables X and Y is known as Pearson's Product-Moment Coefficient of Correlation.

Q3: why the mean of the probability distribution of a random variable X is technically called the EXPECTED VALUE of the random variable X ? (Marks: 3)
Answer:- (Page 170)
Because we expect the mean from of the random variable from the data.

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Q4: For the give data
Means = 3.8,
Median = 2.3 and
Standard Deviation = 1.3,
Now Find the Pearson's Coefficient of skweness ? (Marks: 2)

Answer:-

$$\text{Pearson's Coefficient of Skewness} = \frac{3(mean - median)}{S.D}$$

$$= \frac{3.8 - 2.3}{1.3} = 1.154$$

It is positively skewed

Q5: Compute the mean deviation from mean for the following data (where Mean = = 40.4) (Marks: 5)

X	**30**	**35**	**40**	**45**	**50**
F	**4**	**7**	**11**	**8**	**5**

Answer:-

X	F	$\lvert X - \overline{X} \rvert,\ \overline{X} = 40.4$	$f\lvert X - \overline{X} \rvert$
30	4	10.4	41.6
35	7	33.4	233.8
40	11	0.4	4.4
45	8	4.6	36.8
50	5	9.6	48
	$\sum f = 35$		$\sum f\lvert X - \overline{X} \rvert = 364.4$

$$\text{M.D} = \frac{\sum f\lvert X - \overline{X} \rvert}{n} = \frac{364.4}{35} = 10.41$$

Q: A husband and wife appear in an interview for two vacancies in the same post. The probability of husband's selection is 2/7 and probability of wife's selection is 3/5. (Marks: 5)
What is the probability that
(a)Both of them will select?
(b)Only one of them is selected
(c)None of them is selected

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Answer:-
Let A and B be the events if the husband's and wife's selection, respectively.
Given that P (A) = $\frac{2}{7}$ and P (B) = $\frac{3}{5}$

(a)the probability that both of them will selected is:

$$P(A \text{ and } B) = P(A)P(B) = \frac{2}{7} \times \frac{3}{5} = \frac{6}{35} = 0.171$$

(b) The probability that only one of them will be selected is:

$$P(A) = \frac{2}{7} \qquad P(\bar{A}) = 1 - \frac{2}{7} = \frac{5}{7}$$

$$P(B) = \frac{3}{5} \qquad P(\bar{B}) = 1 - \frac{3}{5} = \frac{2}{5}$$

$$P(\bar{B}) + P(\bar{A}) = \frac{5}{7} + \frac{2}{5} = \frac{25+14}{35} = \frac{39}{35} = 1.114$$

(c) The probability that none of them will be selected is:

$$P(\bar{B}) \times P(\bar{A}) = \frac{5}{7} \times \frac{2}{5} = \frac{2}{7}$$

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Compute the mean deviation from mean for the following data. (Where = =Mean X 18.6)
X 14.5 16.5 18.5 20.5 22.5
Frequency 3 5 11 7 3 (Marks: 5)
Answer:- Rep

How the moment ratios b 1 and b 2 are helpful in determining the shape of a distribution? (Marks: 3)
Answer:- (Page 119)
b1 is used to determine the distribution is symmetric or not while b2 is used to determine whether the distribution is positively skewed or negatively skewed.

What are the basic properties of random experiment? (Marks: 3)
Answer:- (Page 145)
A random experiment has three properties:
• The experiment can be repeated, practically or theoretically, any number of times.
• The experiment always has two or more possible outcomes. An experiment that has only one possible outcome is not a random experiment.
• The outcome of each repetition is unpredictable, i.e. it has some degree of uncertainty.

Write down the principle of least squares method. (Marks: 2)
Answer:- (Page 122)
The principle of least squares method is to find the line of best Fit

What is the main drawback of grouping process in construction of a frequency table? (Marks: 2)
Answer:- (Page 147)
A frequency table has the disadvantage that the identity of individual observations is lost in grouping process.

Which two suits of playing cards are made of red color? (Marks: 2)
Answer:-
Heart and Diamond are of red color

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1. Write the use of Venn diagram in set theory. (2 Marks)
Answer:- (Page 134)
The Venn diagrams are used to represent sets and subsets in a pictorial way and to verify the relationship among sets and subsets.

2. Can we apply Bayes theorem in the situation where partition of sample space S is created by more than two sets. (2 Marks)
Answer:-
Yes we can apply Bayes theorem in the situation where partition of sample space S is created by more than two sets.

3. Why the mean of the probability distribution of a random variable X is technically called the Expected value of the random variable X. (3 Marks)
Answer:- Rep

4. in an experiment the stiffness of a spring, the length of the spring under different loads was measured and the regression lines (X on Y and Y on X) were fitted to the model, which gave us the following results:
bxy= 0.67 and byx= 0.38 (here xy and yx are in the subscript of b)
Calculate the correlation coefficient. (3 Marks)
Answer:-

$$= \sqrt{b_{xy}.b_{yx}}$$
$$= \sqrt{0.67 \times 0.38}$$
$$= \sqrt{0.2546}$$
$$= 0.5046$$

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5. Assume that X is a number chosen at random from the set of integers between 1 and 14 both inclusive. What is the probability that **(5 Marks)**

(i) X is an even number.

Solution:-

Even = 2,4,6,8,10,12,14

P(X=even) = 7/14= ½

(ii) X is multiple of 5 or 6.

Solution:-

Multiple of 5 or 6 =5,10,6,12

Probability= 4/14 =2/7

6. Find the first two moments about mean from the following data: **(5 Marks)**

X= 34,70,42,54,40,68,56,38,36,72.

Solution:-

X	$\left(X-\overline{X}\right)$	$\left(X-\overline{X}\right)^2$
34	-17	289
70	19	361
42	-9	81
54	3	9
40	-11	121
68	17	289
56	5	25
38	-13	169
36	-15	225
72	21	441
	$\sum\left(X-\overline{X}\right)=0$	$\sum\left(X-\overline{X}\right)^2=2010$

$$\overline{X}=\frac{510}{10}=51$$

$$m_1=\frac{\sum\left(X-\overline{X}\right)}{n}=0$$

$$m_2=\frac{\sum\left(X-\overline{X}\right)^2}{n}=\frac{2010}{10}=201$$

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Q#2: for a data set P(A)=0.77,P(B)=0.23 and find the and. (Marks: 2)

Answer: 157

P (A∪B) = P (A) + P (B)

= 0.77+0.23

=1

Q#4:Find the data values, calculate person coefficient of skewness using mode of data 0.75,0.89,0.79,0.88,0.99,0.65,0.91,0.59,0.75 (Marks: 5)

Solution:

Mean = 7.2/9=0.8 Mode = 0.75

X	X^2
0.75	0.5625
0.89	0.7921
0.79	0.6241
0.88	0.7744
0.99	0.9801
0.65	0.4225
0.91	0.8281
0.59	0.3481
0.75	0.5625
$\sum X = 7.2$	$\sum X^2 = 5.8944$

$$S.D = \sqrt{\left\{\frac{\sum X^2}{n} - \left(\frac{\sum X}{n}\right)^2\right\}}$$

$$= \sqrt{\frac{5.8944}{9} - \left(\frac{7.2}{9}\right)^2}$$

$$= \sqrt{0.6549 - 0.64}$$

$$= \sqrt{0.0149}$$

$$= 0.1221$$

$$\text{Pearson's Coefficient of Skewness} = \frac{mean - \text{mod}\, e}{S.D}$$

$$\frac{0.8 - 0.75}{0.1221} = 0.4095$$

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Q#5: write the two nominal equations of the regression line of X on Y. (Marks: 2)

Answer:- (Page 124)

NORMAL EQUATIONS

$$\left.\begin{aligned}\sum Y &= na + b\sum X \\ \sum XY &= a\sum X + b\sum X^2\end{aligned}\right\}$$

Q#6:A man tossed a fair dice and obtain the following sample space S (Marks: 5)

$$S = \begin{pmatrix} (1,1) & (2,1) & (3,1) & (4,1) & (5,1) & (6,1) \\ (1,2) & (2,2) & (3,2) & (4,2) & (5,2) & (6,2) \\ (1,3) & (2,3) & (3,3) & (4,3) & (5,3) & (6,3) \\ (1,4) & (2,4) & (3,4) & (4,4) & (5,4) & (6,4) \\ (1,5) & (2,5) & (3,5) & (4,5) & (5,5) & (6,5) \\ (1,6) & (2,6) & (3,6) & (4,6) & (5,6) & (6,6) \end{pmatrix}$$

What is the conditional probability that the sum of two die will be 7 given that sum is greater then 6.

Solution:

Let A be the event that sum of 7 appears and B be the event the both dice show a number greater than 6 then,

$$A = \{(1,6) \quad (2,5) \quad (3,4) \quad (4,3) \quad (5,2) \quad (6,1)\}$$

$$B = \{(1,6),(6,1),(2,4),(4,2),$$

$$(2,5),(5,2),(2,6),(6,2),$$

$$(3,4),(4,3),(3,6),(4,4),$$

$$(4,5),(5,4),(4,6),(6,4),$$

$$(5,5),(5,6),(6,5),(6,6)\}$$

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define five number theory? (Marks: 2)

Answer:- (Page 97)

A five-number summary consists of X0,Q1, Median, Q3, and Xm ; It provides us quite a good idea about the shape of the distribution.

define rule of combination? (Marks: 2)

Answer:- (Page 143)

A combination is any subset of r objects, selected without regard to their order, from a set of n distinct objects.

chebycheves theorem inequality find karni the k=2 and k=3 limets of fraction between them btany the? (Marks: 5)

Answer:- (Page 94)

a) At least 1-1/22 = 3/4 will fall within 2 standard deviations of the mean, i.e. within the interval $(\overline{X} - 2S, \overline{X} + 2S)$

b) At least 1-1/32=8/9 of the data-values will fall within 3 standard deviations of the mean, i.e. within the interval $(\overline{X} - 3S, \overline{X} + 3S)$

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