Name Naveed Rahman

ID 14144

Department Bs Radiology

Semeste 6^{th}

Subject Bio Statistics

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Question No: 1

Section (a)

Calculate the Co-efficient of Correlation between X and Y

X	Y	$D_x = (X-8)$	D_y	D_x^2	D_y^2	D_xD_y
3	25	-5	8	25	64	-40
4	24	-4	7	16	49	-28
5	20	-3	3	9	9	-9
6	20	-2	3	4	9	-6
7	19	-1	2	1	4	-2
8	17	0	0	0	0	0
9	16	1	-1	1	1	-1
10	13	2	-4	4	16	-8
11	10	3	-7	9	49	-21
13	8	5	-9	25	81	-45
Total 76	172	-4	2	94	282	-160

$$\bar{X} = \frac{\Sigma X}{n} \Rightarrow \frac{76}{10} \Rightarrow 7.6 \cong 8 \qquad \bar{Y} = \frac{\Sigma Y}{n} \Rightarrow \frac{172}{10} \Rightarrow 17.2 \cong 17$$

Co-efficient of Correlation

$$r = \frac{\Sigma D_x D_y - (\Sigma D_x)(\Sigma D_y / n)}{\sqrt{\Sigma D_x^2 - (\Sigma D_x)^2/n}\ \sqrt{\Sigma D_y^2 - (\Sigma D_y)^2/n}}$$

$$r = \frac{\Sigma D_x D_y - (\Sigma D_x)(\Sigma D_y)/n}{\sqrt{\Sigma D_x^2 - (\Sigma D_x)^2/n}\sqrt{\Sigma D_y^2 - (\Sigma D_y)^2/n}}$$

$$\Rightarrow \frac{-160 - (-4)(2)/10}{\sqrt{94 - \frac{(-4)^2}{10}}\sqrt{81 - \frac{(2)^2}{10}}}$$

$$\Rightarrow \frac{-160 - (-8/10)}{\sqrt{94 - 1.6}\sqrt{81 - 0.4}}$$

$$\Rightarrow \frac{-160 + 0.8}{\sqrt{92.4}\sqrt{80.6}}$$

$$\Rightarrow \frac{-159.2}{9.6 \times 8.97} \Rightarrow \frac{-159.2}{86.11}$$

$$\Rightarrow -1.85$$

Q. No. 1 Section (B)

The necessary calculation for determining the equation of least square regression line.

	X	Y	X^2	Y^2	ΣXY
1	20	5	400	25	100
2	11	15	121	225	165
3	15	14	225	196	210
4	10	17	100	289	170
5	17	8	289	64	136
6	18	9	324	81	162
7	21	12	441	144	252
8	25	16	625	256	400
9	28	18	784	324	504
Total	165	114	3309	1604	2099

(a) The estimated linear Regression line

$$\hat{y} = a + bX,$$

a and b are least square estimated of the parameter α and β so.

$$b = \frac{n\Sigma XY - (\Sigma X)(\Sigma Y)}{n\Sigma X^2 - (\Sigma X)^2} \quad \text{and} \quad a = \bar{Y} - b\bar{X}$$

$$b = \frac{9 \times 2099 - (165)(114)}{9 \times 3309 - (165)^2}$$

$$= \frac{18891 - 18810}{29781 - 27225} \Rightarrow \frac{81}{2556}$$

P.T.O

$$b = \frac{81}{2556}$$

$\Rightarrow 0.031$

$a = \bar{Y} - b\bar{X}$ where $\bar{Y} = \frac{\Sigma Y_i}{n} \Rightarrow \frac{114}{9} \Rightarrow 12.66$

$\bar{X} = \frac{\Sigma X_i}{n} \Rightarrow \frac{165}{9} \Rightarrow 18.33$

$a = 12.66 - 0.031 \times 18.33$

$\Rightarrow 12.66 - 0.568$

$\Rightarrow 12.09$

$\hat{Y} = 12.09 + 0.031\,X$

(b) Find the predicted values of Y for X = 20, 11, 15, 25, 28 and X for Y = 5, 15, 9, 12, 16, 18

The Predicted value of Y for X

where

$\hat{Y} = 12.09 + 0.031\,X$

when $X = 20$ $\hat{Y} = 12.71$

$X = 11$ $\hat{Y} = 12.43$

$X = 15$ $\hat{Y} = 12.55$

$X = 25$ $\hat{Y} = 12.865$

$X = 28$ $\hat{Y} = 12.96$

Now for X

when $\hat{X} = \frac{\hat{Y} - 12.09}{0.031}$

$Y = 5$ $X = -228.7$

$Y = 15$ $X = 98.8$

$Y = 9$ $X = -99$

$Y = 12$ $X = -2.903$

$Y = 16$ $X = 126.12$

$Y = 18$ $X = 190.6$

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Q2,

Ans, Therefore the r.v X which denotes The number of head (successes) has a binomial Probability distribution with $p = 1/2$ and $n = 5$. The Possible value of x are 0, 1, 2, 3, 4 and 5. Hence

$$P(\text{No head}) = P(x=0) = \binom{5}{0}\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = 1 \times \left(\frac{1}{2}\right)^5 = \frac{1}{32}$$

$$P(1\text{ head}) = P(x=1) = \binom{5}{1}\left(\frac{1}{2}\right)^1\left(\frac{1}{2}\right)^{5-1} = 5 \times \left(\frac{1}{2}\right)^5 = \frac{5}{32}$$

$$P(2\text{ head}) = P(x=2) = \binom{5}{2}\left(\frac{1}{2}\right)^2\left(\frac{1}{2}\right)^{5-2} = 10 \times \left(\frac{1}{2}\right)^5 = \frac{10}{32}$$

$$P(3\text{ head}) = P(x=3) = \binom{5}{3}\left(\frac{1}{2}\right)^3\left(\frac{1}{2}\right)^{5-3} = 10 \times \left(\frac{1}{2}\right)^5 = \frac{10}{32}$$

$$P(4\text{ head}) = P(x=4) = \binom{5}{4}\left(\frac{1}{2}\right)^4\left(\frac{1}{2}\right)^{5-4} = 5 \times \left(\frac{1}{2}\right)^5 = \frac{5}{32}$$

$$P(5\text{ heads}) = P(x=5) = \binom{5}{5}\left(\frac{1}{2}\right)^5\left(\frac{1}{2}\right)^0 = 1 \times \left(\frac{1}{2}\right)^5 = \frac{1}{32}$$

These Probability can also be obtained by expanding the binomial $\left(\frac{1}{2}+\frac{1}{2}\right)^5$. The binomial Probability distribution for the numbers of heads obtained in 5 tosses of a fair Coin is

x	0	1	2	3	4	5
$f(x)$	$\frac{1}{32}$	$\frac{5}{32}$	$\frac{10}{32}$	$\frac{10}{32}$	$\frac{5}{32}$	$\frac{1}{32}$

Question No (02)

Section (b)

A and B play a game in which A,s prob: of wing 2/3 In a series of 10 gamess what is the prob: that A will win

i) at least 4 games.

We have $n = 10$ and $p = 2/3$

so $q = 1 - 2/3$

$\Rightarrow \frac{1}{3}$

$P(X \geq 4) = 1 - P(X<4)$: (at least 4 means 4 or more)

$$\Rightarrow 1 - \sum_{x=0}^{3} \binom{10}{x} \left(\frac{2}{3}\right)^{x} \left(\frac{1}{3}\right)^{10-x}$$

$$\Rightarrow 1 - \left[\binom{10}{0}\left(\frac{2}{3}\right)^{0}\left(\frac{1}{3}\right)^{10-0} + \binom{10}{1}\left(\frac{2}{3}\right)^{1}\left(\frac{1}{3}\right)^{10-1} + \binom{10}{2}\left(\frac{2}{3}\right)^{2}\left(\frac{1}{3}\right)^{10-2} + \binom{10}{3}\left(\frac{2}{3}\right)^{3}\left(\frac{1}{3}\right)^{10-3} \right]$$

$$\Rightarrow 1 - \left[\left(\frac{1}{3}\right)^{10} + 10\left(\frac{2}{3}\right)\left(\frac{1}{3}\right)^{9} + 45\left(\frac{2}{3}\right)^{2}\left(\frac{1}{3}\right)^{8} + 120\left(\frac{2}{3}\right)^{3}\left(\frac{1}{3}\right)^{7} \right]$$

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$$P(X \geq 4) = 1 - \left[\left(\frac{1}{3}\right)^{10} + \frac{20}{3}\left(\frac{1}{3}\right)^{9} + 45\left(\frac{2}{3}\right)^{2}\left(\frac{1}{3}\right)^{8} + 120\left(\frac{2}{3}\right)^{3}\left(\frac{1}{3}\right)^{7} \right]$$

$$\Rightarrow 1 - \left[0.00001 + 6.6\left(\frac{1}{3}\right)^{9} + 20\left(\frac{1}{3}\right)^{8} + 35.5\left(\frac{1}{3}\right)^{8}\right]$$

$$\Rightarrow 1 - \left[0.00001 + \overset{0.0003}{\cancel{0.000002}} + 0.00805 + 0.0054\right]$$

$$\Rightarrow 1 - 0.0056$$

$$\Rightarrow 0.9944$$

(ii) Exactly equal to 4/10 games

$$P(X = 4/10) = \binom{n}{x} p^{x} q^{n-x}$$

$$\Rightarrow f\left(4/10\right) = 0$$

Because x can take ~~value~~ only values 0, 1, 2, 3, 4.
We cannot find the prob: of fraction value like 4/10

(iii) Exactly equals to 11 games

$$P(X=11) = \binom{n}{x} p^{x} q^{n-x}$$

$$\Rightarrow \binom{10}{11}\left(\frac{2}{3}\right)^{11}\left(\frac{1}{3}\right)^{10-11}$$

$$\Rightarrow 0 \left(\frac{2}{3}\right)^{11}\left(\frac{1}{3}\right)^{-1}$$

$\Rightarrow 0$:- because the number of games is 11 which greater than from the given series number of 10 games.

(iv) 6 or more games.

$$P(X \geq 6) = 1 - P(X < 6)$$

$$\Rightarrow 1 - \left[\binom{10}{0}\left(\frac{2}{3}\right)^{0}\left(\frac{1}{3}\right)^{10-0} + \binom{10}{1}\left(\frac{2}{3}\right)^{1}\left(\frac{1}{3}\right)^{10-1} + \binom{10}{2}\left(\frac{2}{3}\right)^{2}\left(\frac{1}{3}\right)^{8} \right.$$

$$\left. \binom{10}{3}\left(\frac{2}{3}\right)^{3}\left(\frac{1}{3}\right)^{7} + \binom{10}{4}\left(\frac{2}{3}\right)^{4}\left(\frac{1}{3}\right)^{6} + \binom{10}{5}\left(\frac{2}{3}\right)^{5}\left(\frac{1}{3}\right)^{5}\right]$$

$$\Rightarrow 1 - \left[0.0056 + 252\,(0.131)\,(0.004)\right]$$

$\Rightarrow 0.863$ Ans complete.

Question No: 3

(a) Construct the ungrouped frequency distribution.

As the data are discrete the ungruped frequency distr are given below.

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As the data are discrete Therefore the ungrouped frequency distribution is prepared below.

No: of children (x)	Tally	No. of Women (f)
0	I	1
1	IIII	4
2	𝍸 III	8
3	𝍸 𝍸 IIII	14
4	𝍸 II	7
5	𝍸	5
6	IIII	4
7	III	3
8	II	2
9	I	1
10	I	1
Total		50

(b) Construct the grouped frequency distribution.

Solution: we have:

Range = 10 − 0 ⇒ 10

Suppose we decide to take 5 classes $\frac{10}{5} \Rightarrow 2$

we take $h = 2$

Class limit		Entries	Frequency
~~0 − 2~~	0 − 1	1, 1, 0, 1, 1	5
~~3 − 5~~	2 − 3	2, 3, 3, 3, 3, 2, 3, 3, 3, 2, 2, 2, 3, 2, 3, 2, 2	20
~~6 − 8~~	4 − 5	5, 4, 4, 5, 4, 5, 4, 4, 4, 4, 5, 5	12
~~9 − 11~~	6 − 7	6, 6, 7, 6, 7, 7, 6,	7
~~12 −~~	8 − 9	8, 8, 9	3
	10 − 11	10, 10, 10	3
		Total	50