Final Exam Paper: - Bio Statistics

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Q.No. (01)

(a) Calculate the correlation coefficient between X and Y.

Price (X)	3	4	5	6	7	8	9	10	11	13
Demand(Y)	25	24	20	20	19	17	16	13	10	8

- **Solution:-**

Q No: 1 part (a)

Lets :: $u = X - n/2 \Rightarrow u = X - 7$

:: $v = y - n/2 \Rightarrow v = y - 19$

X	Y	u	v	u^2	v^2	uv
3	25	-4	6	16	36	-24
4	24	-3	5	9	25	-15
5	20	-2	1	4	1	-2
6	20	-1	1	1	1	-1
7	19	0	0	0	0	0
8	17	1	-2	1	4	-2
9	16	2	-3	4	9	-6
10	13	3	-6	9	36	-18
11	10	4	-9	16	81	-36
13	8	6	-11	36	121	-66
76	172	6	-18	96	314	-170

:: Formula :: For Finding r

Now:

$$r = \frac{\sum uv - (\sum u)(\sum v)/n}{\sqrt{\left[\sum u^2 - \frac{(\sum u)^2}{n}\right]\left[\sum v^2 - \frac{(\sum v)^2}{n}\right]}}$$

Putting the value of table in Formula.

$$r = \frac{-170 - \frac{6 \times -18}{10}}{\sqrt{\left[96 - \frac{96}{10}\right]\left[314 - \frac{314}{10}\right]}}$$

$$r = \frac{\frac{-1700 + 108}{10}}{\sqrt{\left[\frac{960 - 96}{10}\right]\left[\frac{3140 - 314}{10}\right]}}$$

$$r = \frac{\frac{-1,592}{10}}{\sqrt{\left[\frac{864}{10}\right]\left[\frac{2826}{10}\right]}}$$

$$r = \frac{\frac{-1592}{10}}{\sqrt{\left[\frac{2441664}{100}\right]}}$$

$$r = \frac{\frac{-1592}{10}}{\frac{1562.58}{10}} = \frac{-1592 \times 10}{1562.58 \times 10}$$

$$r = \frac{-15,920}{15625.8} = \boxed{-1.01} \rightarrow \text{Ans}$$

(b) Given the following set of values.

X	20	11	15	10	17	18	21	25	28
Y	5	15	14	17	8	9	12	16	18

(a) Determine the equation of the least squares regression line of Yon X and X on Y.

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

- **Solution:-**

Part (a)

x	y	xy	x^2	y^2
20	5	100	400	25
11	15	165	121	325
15	14	210	225	196
10	17	170	100	289
17	8	306	288	64
18	9	162	324	81
21	12	252	441	144
25	16	400	625	258
28	18	504	784	324
165	114	2269	3309	1604

∴ The regression equation of y on x is

$$\hat{y} = a + bx$$

$$\Rightarrow \quad b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$$

$$\Rightarrow \quad b = \frac{9(2269) - (165)(114)}{9(3309) - (165)^2}$$

$$\Rightarrow \quad b = \frac{20421 - 18810}{29781 - 27225} = \frac{1611}{2556}$$

$$\Rightarrow \quad \boxed{b = 0.63} \rightarrow (A)$$

$$a = \frac{\Sigma y}{n} - b\left(\frac{\Sigma x}{n}\right)$$

$$a = \frac{114}{9} - 0.63\left(\frac{165}{9}\right)$$

$$a = 18.66 - 0.63(18.33)$$

$$a = 12.66 - 11.55$$

$$a = 1.11$$

$\therefore$ Thus regression Eq x on y

$$\hat{x} = a + b.y$$

$$b = \frac{n\Sigma xy - \Sigma x\Sigma y}{n\Sigma y^2 - (\Sigma y)^2}$$

$$b = \frac{9(2269) - (165)(114)}{9(1604) - (114)^2}$$

$$b = \frac{20421 - 18810}{14436 - 12396}$$

$$b = \frac{1611}{1440}$$

$$\boxed{b = 1.12} \longrightarrow (13)$$

Thus the celtromated regression

ne of x ~~ab~~ on y

$\hat{x} = a + by$

$\hat{x} = 4.15 + 1.12 y$

$\boxed{x = 5.27.}$ ⟶ part (a).

Q No 1 part (B) . (b)

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Predicted values of y for
x = 20, 11, 15, 25, 28.

$\hat{y} = a + bx$
$= 1.11 + 0.63(20)$ $x = 20$

$\hat{y} = 1.11 + 12.6$.

$\boxed{\hat{y} = 13.71}$ — (i)

$\hat{y} = 1.11 + 0.63(11)$ $x = 11$

$\boxed{y = 10.56}$ — (ii)

$\hat{y} = 1.11 + 0.63(15)$

$x = 15$

$\boxed{\hat{y} = 10.56}$ — (iii)

$\hat{y} = 1.11 + 0.63(25)$

$x = 25$

$\boxed{\hat{y} = 16.86}$ — (iv)

$\hat{y} = 1.11 + 0.63(28)$

$\boxed{\hat{y} = 18.75}$ → (v) $x = 28$

Predicted value of x for y

$y = 5, 15, 9, 12, 16, 18$

$\bar{x} = 4.15 + 1.12(5)$ $\quad y = 5$

$\boxed{\bar{x} = 9.75}$ (i)

$\bar{x} = 4.15 + 1.12(15)$ $\quad y = 15$

$\boxed{\bar{x} = 20.95}$ (ii)

$\bar{x} = 4.15 + 1.12(9)$ $\quad y = 9$

$\boxed{\bar{x} = 14.23}$ (iii)

$\bar{x} = 4.15 + 1.12(12)$ $\quad y = 12$

$\boxed{\bar{x} = 17.59}$ (iv)

$\bar{x} = 4.15 + 1.12(16)$ $\quad y = 16$

$\boxed{\bar{x} = 22.07}$ (v)

$\bar{x} = 4.15 + 1.12(18)$ $\quad y = 18$

$\boxed{\bar{x} = 24.31}$

QNO.02

Find the following

(a) A fair coin is tossed 5 times. Find the probabilities of obtaining various numbers of heads.

Answer:-

Lets us regard the tossing of a coin as exporimcency then we observe that

- Each toss of coin has two possible outcomes head and fail.
- The probability of a head (success) is P=1/2 and the teamaker the some for successive tosses
- The successive tosses of the coin independent.
- The coin is tossed 5 times.

  Therefore the r.v.x which denote the member of head (success) has a binomial probability destruction with P=1/2 and n=5 the possible value of as are 0,2,3,4 and 5 hence.

(b) A and B play a game in which A,s probability of winning is 2/3.In a series of 10 games, what is the probability that A will win(i) at least 4 games,(ii) Exactly equal to 4/10 games.
(iii) Exactly equals to 11 games (iv) 6 or more games.

P(no head) = P(x=0) =

$$\left[\frac{5}{0}\right]\left[\frac{1}{2}\right]^0\left[\frac{1}{2}\right]^5 = 1\times\left[\frac{1}{2}\right]^5 = \frac{1}{32}$$

= P(1 head) = P(x=1) =

$$\left[\frac{5}{1}\right]\left[\frac{1}{2}\right]^1\left[\frac{1}{2}\right]^{5-1} = 5\times\left[\frac{1}{2}\right]^5 = \frac{5}{32}$$

=) P(2 heads) = P(x-2) =

$$\left[\frac{5}{2}\right]\left[\frac{1}{2}\right]^2\left[\frac{1}{2}\right]^{5-2} = 10\times\left[\frac{1}{2}\right]^5 = \frac{10}{32}$$

=) P(3 heads) = P(x=3) =

$$\left[\frac{5}{3}\right]\left[\frac{1}{2}\right]^3\left[\frac{1}{2}\right]^{5-3} = 10\times\left(\frac{1}{2}\right)^5 = \frac{10}{32}$$

=) P(4 heads) = P(x=4)

$$\left[\frac{5}{4}\right]\left[\frac{1}{2}\right]^4\left[\frac{1}{2}\right]^{5-4} = \cancel{10}\, 5\times\left(\frac{1}{2}\right)^5 = \frac{5}{32}$$

=) P(5 heads) = P(x=5)

$$\left[\frac{5}{5}\right]\left[\frac{1}{2}\right]^5\left[\frac{1}{2}\right]^0 = 1\times\left[\frac{1}{2}\right]^5 = \frac{1}{32}$$

Probability can also be obtain by (page 7) expanding the binomial $(1/2 + 1/2)^5$.

The binomial P, d for number of head obtain in 5 tosses of fair coin is.

x	0	1	2	3	4	5
$f(x)$	1/32	5/32	10/32	10/32	5/32	1/32

Q.2 (b) page 10

Ans (b)

⇒ Two possible out come i.e.:
A will win or will not. ~~winning~~ ~~cannot~~ ~~not~~ ~~winning~~.

⇒ probability: A ~~will~~ win ~~winning~~ $p = 2/3$

= 10 games.

= $n =$ $p = 2/3$

⇒ Successive game won & last
independently

(i) $P(x=4) = \frac{10}{4} \left(\frac{2}{3}\right)^4 \left(\frac{1}{3}\right)^4 = \frac{1128}{5651} = 0.1996$

(ii) $P(x>4) = 1 - P(x<4)$: 4 or team 4 or more

$= 1 - \sum_{x=0}^{3} \left(\frac{10}{x}\right)\left(\frac{2}{3}\right)^x \left(\frac{1}{3}\right)^{8-x}$

$= 1 - \left[\left(\frac{1}{3}\right) + 10 \left[\frac{2}{3}\right]\left[\frac{1}{3}\right] + 28 \left(\frac{2}{3}\right)^2 \left(\frac{1}{3}\right)^2 + 56 \left[\frac{2}{3}\right]^3 \left(\frac{1}{3}\right)^5 \right]$

$1 - \frac{1}{65.61} (1 + 16 + 28 + 448)$

$1 - \frac{577}{6561} = \frac{5984}{6561} = \boxed{0.9121}$

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(iii) (Page 11) $P(x \geq 6) = \sum_{x=6}^{8} \binom{8}{x} \left(\frac{2}{3}\right)^{x} \left(\frac{1}{3}\right) +$

$= \binom{8}{6} \left(\frac{2}{3}\right)^{6} \left(\frac{1}{3}\right)^{2} \binom{10}{7} \left(\frac{1}{3}\right) + \binom{10}{10} \left(\frac{2}{3}\right)^{10}$

$\frac{100}{6561} (36+16+2) = \frac{100 \times 48}{6561}$

$\frac{4800}{2187} = 2.194$

$P(3 \leq x \leq 6) = \sum_{x=3}^{6} \binom{10}{x} \left(\frac{2}{3}\right)^{x} \left(\frac{1}{3}\right)^{8-x}$

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

$= \left(\frac{(2)^2}{3^{10}}\right) (60+160+240+244)$

$\frac{10 \times 644}{6561} = \frac{6440}{6561} = \boxed{0.98155}$

Q.No. (03)

The following figures give the number of children born to 50 women

2	6	1	5	4	3	3	8	10	1

4	3	3	0	5	2	1	4	10	3
5	3	3	6	3	3	2	2	7	4
1	4	2	4	4	4	6	8	10	7
7	5	6	5	3	2	3	9	2	2

(a) Construct the ungrouped frequency distribution of these data.
(b) Construct the grouped frequency distribution of these data

Solution:-

2No 3 part (a):.

2	6	1	5	4	3	3	8	10	1
4	3	3	0	5	2	1	4	10	3
5	3	3	6	3	3	2	2	7	4
1	4	1	4	4	1	6	8	10	7
7	5	6	5	1	2	3	9	2	2.

Con compled Frequency distribution

No	Tolly Marks	Frequency	concetive Freauence
0	𝍷	1	1
1	𝍷𝍷𝍷𝍷	4	5
2	𝍸 𝍷𝍷𝍷	8	13
3	𝍸 𝍸 𝍷	11	24
4	𝍸 𝍷𝍷𝍷	8	32
5	𝍷𝍷𝍷𝍷	5	37
6	𝍷𝍷𝍷	4	41
7	𝍷𝍷	3	44
8	𝍷𝍷	2	46
9	𝍷	1	41
10	𝍷𝍷𝍷	3	50

Q No 3 : (b).

Give information of Children bor
x. 50 women

2	6	1	5	4	3	3	8	10	1
4	3	3	0	5	2	1	4	10	3
5	3	3	6	3	3	2	2	7	4
1	4	2	4	4	4	6	8	10	7
7	5	6	5	3	2	3	9	2	2

group Frequency distribution for give data

N = 50 data.

N = 50 $\quad x_0 = 1 \quad x_m = 10$

Range = $x_m - x_0$

R = 10 - 1 $\boxed{9}$

K = 1 + 3.3 log N.

= 1 + 3.3 log (50)

= 1 + 3.3 (1.698).

(9)

$K = 1 + 5.6066$

$K = 6.606 \Rightarrow \boxed{K = 6}$ — (I)

h = Class internval = $\frac{Rang}{K}$

$h = \frac{9}{7} = 1.285 = \boxed{2}$ — (II)

We Find out the informalution foom data.

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N = 50 , R = 9 , k = 6 , h = 2

Classes	Frequency	class bonding	Main point
0 - 1	5	0.5 - 1.5	1
2 - 3	19	1.5 - 3.5	2.5
4 - 5	13	3.5 - 5.5	4.5
0 - 7	7	5.5 - 7.5	6.5
8 - 9	3	7.5 - 9.5	8.5
10 - 11	3	10.5 - 11.5	11

Total = 50.

R. Frequency	R. Frency	C.F	R.C.F
5/50	5/50 x 100 = 0	5	5/50 = 0
19/50	19/50 x 100 = 38	24	24/50 = 0
13/50	13/50 x 100 = 26	37	37/50 = 0
7/50	7/50 x 100 = 14	44	44/50 = 0
3/50	3/50 x 100 = 6	47	47/50 = 0
3/50	3/50 x 100 = 6	50	50/50 = 0