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Paper = Bio statistics

Module = 6th semester

Date = 22-6-2020

Q No1: (A)

Ans: calculate the correlation coefficient between X and Y.

X	Y	XY	X^2	Y^2
3	25	75	9	625
4	24	96	16	576
5	20	100	25	400
6	20	120	36	400
7	19	133	49	361
8	17	136	64	289
9	16	144	81	256
10	13	130	100	169
11	10	110	121	100
13	8	104	169	64
76	172	1148	670	3240

$$rxy = \frac{\Sigma XY - \frac{(\Sigma x)(\Sigma y)}{n}}{\sqrt{\left\{\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right\}\left\{\Sigma Y^2 - \frac{(\Sigma Y)^2}{n}\right\}}}$$

$$rxy = \frac{1148 - \frac{(76)(172)}{10}}{\sqrt{\left\{670 - \frac{(76)^2}{10}\right\}\left\{3240 - \frac{(172)^2}{10}\right\}}}$$

$$rxy = \frac{1148 - 1307.2}{\sqrt{\{670 - 577.6\}\{3240 - 2958.4\}}}$$

$$r_{xy} = \frac{-159.2}{\sqrt{\{92.4\}\{281.6\}}}$$

$$r_{xy} = \frac{-159.2}{\sqrt{26019.84}}$$

$$\boxed{r_{xy} = -0.98}$$

(B):

Sol:

x	y	x^2	y^2	xy
20	5	400	25	100
11	15	121	225	165
15	14	225	196	210
10	17	100	289	170
17	8	289	64	136
18	9	324	81	162
21	12	441	144	252
25	16	625	256	400
28	18	784	324	504
165	114	3309	1604	2099

the Estimated least square regression line of Y on X is:

P.T.O

$\hat{Y} = a + bX$

$$b = \frac{n\sum XY - (\sum X)(\sum Y)}{n\sum X^2 \quad (\sum X)^2}$$

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

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

$b = 0.031$

$a = \bar{Y} - b\bar{X}$

$$a = \frac{\sum Y}{n} - b\frac{\sum X}{n}$$

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

$= 12.66 - 0.031(18.33)$

$= 12.66 - 0.56823$

$= 12.0917$

Thus the estimated regression line is.

$\hat{Y} = 12.0917 - 0.031X$

For predicted values of Y on $X = 20, 11, 15, 25, 28$

$X = 20$

$\hat{Y} = 12.0917 - 0.031(20) = 11.47$

$X = 11$

$\hat{Y} = 12.0917 - 0.031(11)$

$(\hat{Y} = 11.7507)$

P.T.O

$X = 15$

$~~\hat{Y} = 11.7587~~$

$\hat{Y} = 12.0917 - 0.031(15)$

$\boxed{\hat{Y} = 11.62}$

$X = 25$

$\hat{Y} = 12.0917 - 0.031(25)$

$\boxed{\hat{Y} = 11.31}$

$X = 28$

$\hat{Y} = 12.0917 - 0.031(28)$

$\boxed{\hat{Y} = 11.22}$

Now regression line for X on Y is

$\hat{X} = a_0 + b_0 Y$

$$b_0 = \frac{n\sum XY - (\sum X)(\sum Y)}{n\sum Y^2 - (\sum Y)^2}$$

$$b_0 = \frac{9(2099) - (165)(114)}{9(1604) - (114)^2}$$

$$b_0 = \frac{81}{14436 - 12996}$$

$$b_0 = \frac{81}{1440} = 0.056$$

$$a_0 = \bar{X} - b_0 \bar{Y}$$

$$= \frac{\sum X}{n} - b_0 \frac{\sum Y}{n}$$

P-T-O

$= 18.33 - 0.056(12.66)$
$= 18.33 - 0.70$
$\bar{a}_0 = 17.63$

So estimated regression line for x on Y is
$\hat{X} = 17.63 - 0.056X$

For predicted values of x for $Y = 5, 15, 9, 12, 16, 18$

$Y = 5$
$\hat{X} = 17.63 - 0.056(5)$
$\boxed{\hat{X} = 17.35}$

$Y = 15$
$\hat{X} = 17.63 - 0.056(15)$
$\boxed{\hat{X} = 16.79}$

$Y = 9$
$\hat{X} = 17.63 - 0.056(9)$
$\boxed{\hat{X} = 17.12}$

$Y = 12$
$\hat{X} = 17.62 - 0.056(12)$
$\boxed{\hat{X} = 16.95}$

$Y = 16$
$\hat{X} = 17.63 - 0.056(16)$
$\hat{X} = 16.73$
$Y = 18$

P.T.O

$\hat{x} = 17.63 - 0.056\,(18)$

$\boxed{\hat{x} = 16.62}$

Q NO 2:

Ans (A):

we can observe when we toss a coin 5 times.

(i) each toss of a coin has two possible outcomes i.e head (success) and tail (Failure).

(ii) the probability of success which is $P = \frac{1}{2}$ remains the same.

(iii) The successive ~~to~~ tossed of coins are independent.

(iv) The coin is tossed for a fixed number of time i.e 5 times.

So r.v X which denotes the number of heads (success) have binomial probability distribution with $P = \frac{1}{2}$ and $n = 5$. the possible values of x are 1, 2, 3, 4, 5 Hence.

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

P.T.O

$$\binom{5}{0}\left(\frac{1}{2}\right)^{0}\left(\frac{1}{2}\right)^{5-0} = \frac{1}{32}$$

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

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

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

$$= \frac{10}{32}$$

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

$$= \frac{5}{32}$$

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

((B) part)

Sol:

We observed that

(i) there are two possible out-comes i-e A will win or will not win the Game.

(ii) the probability of A's winning in each game is $P = 2/3$

P-T-O

(iii) The successive games are independent.
(iv) there are 10 games so binomial probability distribution.
Let x denotes the number of games won by A.

(i) at least 4 games:

$P(x \geq 4) = 1 - P(x < 4)$

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

$$= 1 - \left[\left(\frac{1}{3}\right)^{10} + \binom{10}{1}\left(\frac{2}{3}\right)^{1}\left(\frac{1}{3}\right)^{9} + \binom{10}{2}\left(\frac{2}{3}\right)^{2}\left(\frac{1}{3}\right)^{8} + \binom{10}{3}\left(\frac{2}{3}\right)^{3}\left(\frac{1}{3}\right)^{7}\right\}$$

$$= 1 - \{0.000016 + 0.000338 + 0.00304 + 0.0162]$$

$$= 1 - 0.019$$

$P(x \geq 4) = 0.981$

(ii) Exactly $4/10$ games

$$P[x=4] = \binom{10}{4}\left(\frac{2}{3}\right)^{4}\left(\frac{1}{3}\right)^{6}$$

P-T-O

$P[x=4] = 0.05$

(iii) Exactly equal to 11 games

$P[x=11] = 0$ (impossible)

(iv) 6 or more Games.

$P[x \geq 6]$

$= \{P[x=6] + P[x=7] + P[x=8] + P[x=9] + P[x=10]\}$

$= \left[\binom{10}{6}\left(\frac{2}{3}\right)^6\left(\frac{1}{3}\right)^4 + \binom{10}{7}\left(\frac{2}{3}\right)^7\left(\frac{1}{3}\right)^3 + \binom{10}{8}\left(\frac{2}{3}\right)^8\left(\frac{1}{3}\right)^2 + \binom{10}{9}\left(\frac{2}{3}\right)^9\left(\frac{1}{3}\right) + \binom{10}{10}\left(\frac{2}{3}\right)^{10}\right\}$

$P[x \geq 6] = 0.22 + 0.26 + 0.19 + 0.08 + 0.01$

$\boxed{P[x \geq 6] = 0.76}$

Q No3:

Sol:

(1) Ungrouped frequency data.

Stem	Tallybar	Frequency
0	ǀ	1
1	ǀǀǀǀ	4
2	卌 ǀǀǀ	8
3	卌 卌ǀ	11
4	ǀǀǀǀ ǀǀǀ	8
5	卌	5
6	ǀǀǀǀ	4
7	ǀǀǀ	3
8	ǀǀ	2
9	ǀ	1
10	ǀǀǀ	3
		50

(b): Grouped frequency distributions

Range = 10 − 0 = 10

class size = $\frac{10}{6}$ = 2 = h

class	F
0 – 1	5
2 – 3	19
4 – 5	13
6 – 7	7
8 – 9	3
10 – 11	3
	50

End