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①

Q1

(a) Calculate the Correlation coefficient b/w X & Y.

	X	Y	Dx (X-8)	Dy (Y-17)	Dx^2	Dy^2	DxDy
	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
Σ	76	172	-4	2	94	282	-160

(2)

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

$$= \frac{-160 - (-4)(2)/10}{\sqrt{94 - (-4)^2/10}\sqrt{282 - (2)^2/10}}$$

$$= \frac{-152/10}{\sqrt{\frac{110}{10}}\sqrt{\frac{278}{10}}}$$

$$= \frac{-15.2}{\sqrt{(11)(27.8)}}$$

$$= \frac{-15.2}{92.2}$$

$= -0.164$ Ans

(b) Given the following set of values

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 linear regression line of Y on X is

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

where a and b are the least square estimate of parameter α and β ~~repr~~ respectively and are given by

$$b = \frac{n\sum xY - (\sum x)(\sum Y)}{n\sum x^2 - (\sum x)^2} \quad \text{and} \quad a = \bar{Y} - b\bar{x}$$

Substituting the sums, we get

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

$$b = \frac{18891 - 18810}{29781 - 27225}$$

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

$$b = 0.031$$

$$a = \frac{114}{9} - (0.031)\left(\frac{165}{9}\right)$$

$$a = 12.66 - (0.031)(18.33)$$

$$a = 12.66 - (0.56)$$

$$a = 12.66 - 0.56$$

$$a = 12.1$$

Thus the estimated regression line is

$$\hat{y} = 12.1 - 0.031\,X$$

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Least Square regression Line for x on Y

$$X = a + by$$

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

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

$$b = \frac{18891 - 18810}{14436 - 12996}$$

$$b = \frac{81}{1440}$$

$$b = 0.056$$

<u>Now:</u>

$$a = \frac{1}{n}(\Sigma x - b\Sigma y)$$

$$a = \frac{1}{9}(165 - (0.056)(114))$$

$$a = \frac{1}{9}(165 - 6.384)$$

$$a = \frac{1}{9}(158.6) = 17.62$$

Therefore

$X = a + by$

$$\boxed{X = 17.62 + 0.056Y}$$

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

x	Y	$Y = 12.09 + 0.031x$	$X = 17.62 + 0.056Y$
20	5	$= 12.09 + (0.031)(20) = 12.71$	$= 17.62 + (0.056)(5) = 17.9$
11	15	$= 12.09 + (0.031)(11) = 12.4$	$= 17.62 + (0.056)(15) = 18.4$
15	14	$= 12.09 + (0.031)(15) = 12.5$	$= 17.62 + (0.056)(9) = 18.1$
10	17	$= 12.09 + (0.031)(25) = 12.8$	$= 17.62 + (0.056)(12) = 18.2$
17	8	$= 12.09 + (0.031)(28) = 12.9$	$= 1762 + (0.056)(16) = 18.5$
18	9		$= 17.62 + (0.056)(18) = 18.6$
21	12		
25	16		
28	18		

Q 3

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

(a)

women ungrouped	Tally	Frequency
0	1	1
1	1111	4
2	11111111	8
3	11111111111	11
4	11111111	8
5	11111	5
6	1111	4
7	111	3
8	11	2
9	1	1
10	111	3
	Total	50

(b) Grouped ~~ct~~ frequency distribution

Group	Tally	Frequency
0-1	𝍸	5
2-3	𝍸 𝍸 𝍸 1111	19
4-5	𝍸 𝍸 111	13
6-7	𝍸 11	07
8-9	111	03
10-11	111	03
	Totall	50

Q.No 2

(a) A fair Coin is tossed 5 times. Find the probabilities of obtaining various number of head.

Answer

(a) ⇒ Let us regard the tossing of a coin as an experiment. Then we observe that.

① Each Toss of Coin has two possible outcomes, head and tail.

② The probability of a head (success) is $p = 1/2$ and remain the same for successive tosses.

③ The Successive tosses of the coin are independent

④ The coin is tossed 5 times.

There fore the r.v X which denotes the number of heads (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

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$$P(\text{no head}) = P(X=0) = \binom{5}{0}\left(\tfrac{1}{2}\right)^0\left(\tfrac{1}{2}\right)^5$$

$$= 1\times\left(\tfrac{1}{2}\right)^5 = \tfrac{1}{32}$$

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

$$= 5\times\left(\tfrac{1}{2}\right)^5 = \tfrac{5}{32}$$

$$\cancel{P(2\text{ head}) = P(x=2) = \binom{5}{2}\left(\tfrac{1}{2}\right)}$$

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

$$= \tfrac{10}{32}$$

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

$$= \tfrac{10}{32}$$

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

$$= \tfrac{5}{32}$$

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

$$= \tfrac{1}{32}$$

These probabilities can also be obtained by expanding the binomial $(\frac{1}{2}+\frac{1}{2})^5$. The binomial p.d for the number of heads obtained in 5 tosses of fair coin is

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

Q2 (b) A and B . . . .

. . . . .

Answer(b)

We observe that

a) There are two possibles outcomes, i.e A will win or will not win the games

b) The probability of A is winning in each ~~paper~~ game is $p = 2/3$

c) The successive games are independently won or lost; and

d) There are 10 games

Therefore the Binomial probability distribution with $n=10$ & $p = 2/3$ is appropriate.

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Let X denote the number of games won by A Then

$n = 10$

$p = 2/3$

$q = 1 - p$

$q = 1 - 2/3$

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

$$1 - \sum_{x=0}^{3} \binom{10}{x} \left(\frac{2}{3}\right)^{x} \left(\frac{1}{3}\right)^{9} + 45\left(\frac{2}{3}\right)^{2}\left(\frac{1}{3}\right)^{8}$$

$$+ 120\left(\frac{2}{3}\right)^{3}\left(\frac{1}{3}\right)^{7}$$

$$1 - \frac{1}{59049}\left(1 + 20 + 180 + 960\right)$$

$$1 - 0.0197$$

$$\boxed{P(x \geq 4) = 0.9803}$$

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

$= 210 \left(\frac{16}{81}\right) \frac{1}{729}$

$= \frac{3360}{59049}$

$\boxed{P(x=4) = 6.056}$

(iii) $P(x=11) = 0 \quad (0) =$ because x can take only value $0, 1, 2, 3, \ldots - 10$

(iv) 6 or more games

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

$= \binom{10}{6}\left(\frac{2}{3}\right)^6 \left(\frac{1}{3}\right)^4 + \binom{10}{7}\left(\frac{2}{3}\right)^9 \left(\frac{1}{3}\right)^1 + \binom{10}{10}\left(\frac{2}{3}\right)^{10}\left(\frac{1}{3}\right)^0$

$= 0.228 + 0.261 + 0.196 + 0.087 + 0.018$

$\boxed{P(x \geq 6) = 0.79}$