Name : M. Usama.

ID : 13622

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Submitted To : Sir, Shamim.

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Q1:-

Part 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:-

lets us change the orgin of x and y.

$u = x-7$, $v = y-19$.

x	y	u	v	u^2	v^2	uv
3	25	-4	6	-16	-256	64
4	24	-3	5	-9	-225	45
5	20	-2	1	-4	-196	28
6	20	-1	1	-1	-169	13
7	19	0	0	0	144	0
8	17	1	-2	1	-121	-11
9	16	2	-3	4	-100	-20
10	13	3	-6	9	-81	-27
11	10	4	-9	16	-64	-32
13	8	6	-11	36	-36	-36
Total 76	172	6	-18	36	-1392	24

(2)

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

$$r = \frac{24 - (6)(\frac{-18}{10})}{\sqrt{\left[(36) - (\frac{36}{10})\right]\left[-1392 - \frac{(-18)^2}{10}\right]}}$$

$$r = \frac{24 + 10.8}{\sqrt{(36 . 3.6)(-1392 + 32.4}}$$

$$r = \frac{34.8}{\sqrt{(32.4)(-1359.6}}$$

$$r = \frac{34.8}{\sqrt{+44051.04}}$$

$$r = \frac{34.8}{209.8} \Rightarrow 0.165 \text{ Ans.}$$

Hence the correlation b/w x and is 0.165.

Q1.

Part 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 y on x and x on y.

Solution.

x	y	xy	x^2	y^2
20	5	100	400	25
11	15	165	121	225
15	14	210	225	196
10	17	170	100	289
17	8	136	289	64
18	9	162	324	81
21	12	252	441	144
25	16	400	625	256
28	18	504	784	324
165	114	2,099	3309	1604

$$\hat{y} = a + bx \quad \text{--- (1)}$$

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

$$b_{yx} = \frac{9 \times 2099 - 165 \times 114}{9 \times 3{,}309 - (165)^2}$$

$$b_{yx} = \frac{81}{2556} = 0.0316$$

$$a = \bar{y} - b\bar{x} \quad \text{--- (2)}$$

$$\bar{x} = \frac{\Sigma x}{n} = \frac{165}{9} = 18.33$$

$$\bar{y} = \frac{\Sigma y}{n} = \frac{114}{9} = 12.66$$

$$a = 12.66 - 0.0316 \times 18.33$$

$$a = 12.081$$

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

$$\hat{y} = 12.081 + 0.0316x.$$

$$x = a + by.$$

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

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

$$b_{xy} = \frac{81}{1440} \Rightarrow 0.05625$$

$$a = \bar{y} - b\bar{x}$$

$$a = 12.66 - 0.05625 \times 18.33$$

$$a = 11.62$$

$$x = a + by$$

$$\boxed{x = 11.62 + 0.05625y}$$

(B). Find the predicted values of y for x = 20, 11, 15, 25, 28 and x for y = 5, 15, 9, 12, 16, 18.

x	y	xy	x^2
20	5	100	400
11	15	165	121
15	14	210	225
10	17	170	100
17	8	136	289
18	9	162	324
21	12	252	441
25	16	400	625
28	18	504	784
Σ 114	Σ 165	Σ 2,099	Σ 3,309

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

$$b = \frac{9 \times 2{,}099 - 165 \times 114}{9 \times 3309 - (165)^2}$$

$$b = \frac{81}{2556} \Rightarrow 0.0316$$

$$\bar{x} = \frac{\Sigma x}{n} = \frac{165}{9} = 18.33$$

$$\bar{y} = \frac{\Sigma y}{n} = \frac{114}{9} = 12.66$$

$$a = \bar{y} - b\bar{x}$$

$$a = 12.66 - 0.0316 \times 18.33$$

$$a = 12.66 - 0.579$$

$$a = 12.081$$

The estimate regression model.

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

$$\hat{y} = 12.08 + 0.0316\,x$$

Prediction of y when $x = 20+11+15+25+28 = 99$

$$\hat{y} = 12.081 + 0.0316\,(99)$$

$$\hat{y} = 12.081 + 3.128$$

$$\boxed{\hat{y} = 15.209}$$ Ans.

Q2 :- Find the following:

(A) A fair coin is tossed 5 times.

Find the probabilities of obtaining various numbers of heads.

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

(i). Each toss of a coin (i.e each trail) has two possible outcomes, heads (success) and tails (failure);

(ii). The probability of a head (success) is $p = \frac{1}{2}$ and remains the same for successive tosses;

(iii). The successive tosses of the coin are independent; and.

(iv). The coin is tossed 5 times.

Therefore the r.v. X which denotes the number of heads (successes) has a binomial 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 -

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

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

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

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

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

$$= 10 \times \left(\frac{1}{2}\right)^5 = \frac{10}{32},$$

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

$$= 10 \times \left(\frac{1}{2}\right)^5 = \frac{10}{32},$$

$$P(4 \text{ heads}) = P(X=4) = \left[\binom{5}{4}\right]\left[\frac{1}{2}\right]^4\left[\frac{1}{2}\right]^{5-4}$$

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

$$P(5 \text{ heads}) = P(X=5) = \left[\binom{5}{5}\right]\left[\frac{1}{2}\right]^5\left[\frac{1}{2}\right]^0$$

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

These probabilities can also be obtained by expanding the binomial $\left[\frac{1}{2}+\frac{1}{2}\right]^5$. The binomial probability distribution for the number of heads obtained in 5 tosses of a fair coin is.

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

Q21- (b)

proof.

winning player A.

$p = 2/3$ and $q = 1-p$

$q = 1 - 2/3 \Rightarrow q = \frac{3-2}{3} = 1/3$

$q = 1/3$

(i) At least 4 games

$P(X \geq 4) = P(X=4) + P(X=5) + P(X=6)$
$+ P(x=7) + P(x=8) + P(x=9)$
$+ P(x=10)$

OR

$P(X \geq 4) = 1 - P(X < 4)$
$= 1 - \{P(X=0) + P(x=1) + P(x=2)$
$+ P(x=3) + P(x=4)\}$

$P(X \geq 4) = 1 - \{(1/3)^{10} + (10)(2/3)(1/3)^9 + 45(2/3)^2(1/3)^8$
$+ 120(2/3)^3(1/3)^7\}$

$$= 1 - \left\{ \frac{1}{59049} + \frac{20}{59049} + \frac{186}{59049} + \frac{96}{59049} \right\}$$

$$P(X \geq 4) = 1 - \frac{(1+20+186+96)}{59049}$$

$$= 1 - \frac{1161}{59049}$$

$$= 1 - 0.019$$

$$P(X \geq 4) = 0.98$$

(ii) $P\left(X = \frac{4}{18}\right) = 0$

that is possible prob.

Hence impossible prob $= 0$

(iii) $P(X = 11) = ?$

Hence $X = 11$ is not include in the is range b/c that is impossible

impossible prob $= 0$

(iv) $P(X \geq 6) = \binom{10}{6}\left(\frac{2}{3}\right)^{6}\left(\frac{1}{3}\right)^{10-6} + \binom{10}{7}\left(\frac{2}{3}\right)^{7}\left(\frac{1}{3}\right)^{3}$

$+ \binom{10}{18}\left(\frac{2}{3}\right)^{8}\left(\frac{1}{3}\right)^{10-8} + \binom{10}{9}\left(\frac{2}{3}\right)^{9}\left(\frac{1}{3}\right)^{10-9}$

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

$P(X \geq 6) = 210\left(\frac{2}{3}\right)^{10}\left(\frac{1}{3}\right)^{4} + 120\left(\frac{2}{3}\right)^{7}\left(\frac{1}{3}\right)^{3} + 45\left(\frac{2}{3}\right)^{8}\left(\frac{1}{3}\right)^{2}$

$+ 10\left(\frac{2}{3}\right)^{9}\left(\frac{1}{3}\right) + 1\left(\frac{2}{3}\right)^{10}\left(\frac{1}{3}\right)^{0}$

$P(X \geq 6) = \frac{13440}{59049} + \frac{15360}{59049} + \frac{11520}{59049} + \frac{5120}{59049}$

$+ \frac{1024}{59049}$

$P(X \geq 6) = \frac{46464}{59049}$

$P(X \geq 6) = 0.78$

Hence proof-

Q 3:-
The following figures give 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.

No	Tally Mark	frequency	C.F
0	I	1	1
1	IIII	4	5
2	~~IIII~~ III	8	13
3	~~IIII~~ ~~IIII~~ I	11	24
4	~~IIII~~ III	8	32
5	~~IIII~~	5	37
6	IIII	4	41
7	III	3	44
8	II	2	46
9	I	1	47
10	III	3	50

Q3:-
Part B:-

Construct the grouped frequency distrubution of the data -

$N = 50$, $x_0 = 1$, $x_m = 10$ -

$Range = x_m - x_0$

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

$K = 1 + 3.3 \log N$

$= 1 + 3.3 \log(50)$

$= 1 + 3.3(1.698)$

$= \cancel{1+...}\ 5$

$= 1 + 5.6066$

$K = 6.606 = \boxed{6}$

$h =$ class interval $= \frac{Rang}{K}$

$h = \frac{9}{7} = 1.285 = \boxed{2}$