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Paper Statistics

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Q3 (a) Constract the unGrouped frequency distribution of these data.

Number	Frequency	Tally
0	1	I
1	4	IIII
2	8	~~IIII~~ III
3	11	~~IIII~~ ~~IIII~~ I
4	8	~~IIII~~ III
5	5	~~IIII~~
6	4	IIII
7	3	III
8	2	II
9	1	I
10	3	III

(b) constract the frequency distribution of these data

(Number Groups)	Frequency
0 - 2	13
3 - 5	24
6 - 8	9
9 - 11	4

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Q2 Find the following

(a) A fair coin is tossed 5 times. Find the probability of obtaining various number 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 trial) has two possible outcomes, heads (success) and tails (failure)

ii) the probability of a head (success) is $p = 1/2$ 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 bionomial probability distribution with $p = 1/2$ and $n = 5$ the possible value of x are 0, 1, 2, 3, 4 and 5. Hence

$P(\text{no head}) = P(X=0) = \binom{5}{0}\left[\frac{1}{2}\right]^0\left[\frac{1}{2}\right] = 1 \times \left[\frac{1}{2}\right]^5 = \frac{1}{32}$.

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

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

$P(3 \text{ heads}) = P(x=3) = \begin{bmatrix} 5 \\ 3 \end{bmatrix} \left[\frac{1}{2}\right]^3 \left[\frac{1}{2}\right]^{5-3}$

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

$P(4 \text{ heads}) = P(x=4) = \begin{bmatrix} 5 \\ 4 \end{bmatrix} \left[\frac{1}{2}\right]^4 \left[\frac{1}{2}\right]^{5-4}$

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

$P(5 \text{ heads}) = P(x=5) = \begin{bmatrix} 5 \\ 5 \end{bmatrix} \left[\frac{1}{2}\right]^5 \left[\frac{1}{2}\right]^0$

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

These probabilities can also be obtained by expanding the bionomial $\left(\frac{1}{2} + \frac{1}{2}\right)^5$ The bionomial distribution probability number of head obtained in 5 tosses of a fair coin is

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

Part (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.

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iii) Exactly equal to 11 games

iv) 6 or more games.

b) (i) $P(x \geq 4) = ?$

$= 1 - P(x < 4)$

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

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

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

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

$= 1 - \left[10 \left(\frac{1}{3}\right)^{10} + 10 \left(\frac{2}{3}\right) \left(\frac{1}{3}\right)^9 + 45 \right.$

$\left. \left(\frac{2}{3}\right)^2 \left(\frac{1}{3}\right)^8 + 120 \left(\frac{2}{3}\right)^3 \left(\frac{1}{3}\right)^7 \right]$

$= 1 - [0.0002 + 0.0003 + 45(0.44)(0.0002)$
$+ 120(0.296)(0.0005)]$

$= 1 - [0.0002 + 0.003 + 0.004 + 0.017$

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$= 1 - [0.0215]$

$P(x \geq 4) = 0.97$

ii) $P(x = 4/10) = ?$

$P(x = 4/10) = f = (4/10) = 0$

Because a r.v X with a binomial distribution takes only one of the integer value of 0, 1, 2 .... n

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

$P(x = 11) = ?$

$P(x = 11) = f(6) = 0$, because x take any value 0, 1, 2, 3 .. 10

) $P(x \geq 6) = ?$

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

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

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

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

$= \left[210(0.087)(0.012)+80(0.058)(0.037)+45(0.038)(0.11)(0.017)\right]$

$P(x \geq 6) = \boxed{0.6725}$

This is the required solution of the probability.

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Q 1:- Part (a)

x	y	x^2	y^2	xy
3	25	9	625	75
4	24	16	576	96
5	20	25	400	100
6	20	36	400	120
7	19	49	361	133
8	17	64	289	136
9	16	81	256	144
10	13	100	169	130
11	10	121	100	110
12	8	144	64	96
75	172	645	3246	1140

$n = 10$, $\Sigma x = 75$, $\Sigma y = 172$, $\Sigma x^2 = 645$

$\Sigma y^2 = 3246$, $\Sigma xy = 1140$

Substituting In to the computing formula for r gives

$$r = \frac{\Sigma xy - \left[(\Sigma x)(\Sigma y)\right]/n}{\sqrt{\left[\Sigma x^2 - (\Sigma x)^2/n\right]\left[\Sigma y^2 - (\Sigma y)^2/n\right]}}$$

~~$r = 1140 - [$~~

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$$r = \frac{1140 - \left[(75)(172)\right]/10}{\sqrt{\left[645 - (75)^2/10\right]\left[3246 - (172)^2/10\right]}}$$

$$r = \frac{1140 - 1290}{\sqrt{\left[645 - 5625/10\right]\left[3246 - 2958.4\right]}}$$

$$= \frac{-150}{(82.5)(287.6)}$$

$$= \frac{-150}{(82.5)(287.6}$$

$$\frac{-150}{23727}$$

$= -0.01$ Ans.

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Determine the equation of the least square regression line of y on x and x on y

	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
Total	165	124	3309	1604	2099

Regression line y on x

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

$$b = \frac{9(2099) - (165)(124)}{9(3309) - (665)^2}$$

$$b = \frac{18891 - 20460}{29781 - 27225}$$

$$b = \frac{-1569}{2556}$$

$$\boxed{b = -0.6}$$

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

$$a = \frac{124 - (-0.6)(165)}{9}$$

$$a = \frac{124 - (-99)}{9}$$

$$a = 24.7$$

Regression line x on y

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

$$b = \frac{9(2099) - (165)(124)}{9(1604) - (124)^2}$$

$$b = \frac{18891 - 20460}{14436 - 15376}$$

$$b = \frac{-1569}{-940}$$

$$b = 1.7.$$

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$$a = \frac{\Sigma x - b\Sigma y}{n} = \frac{165 - (1.7)(124)}{9}$$

$$a = \frac{165 - 210.8}{9}$$

$$a = \frac{-45.8}{9}$$

$$a = -5.1$$

Hence the required regression line is given by

$$\hat{X} = a_1 + by$$

$$\boxed{\hat{X} = -5.1 + 1.7y}$$

Q1 Part(B) Find the predicated value of y for $x = 20, 11, 15, 25, 28$ and x for $y = 5, 15, 9, 12, 16, 18$

$$\hat{y} = 24.7 - 0.6x$$

$$\hat{X} = -5.1 + 1.7y$$

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x	y	$\hat{y} = 24.7 - 0.6x$	$\hat{x} = .5.1 + 1.7y$
20	5	12.7	3.4
11	15	18.1	20.4
15	9	15.7	10.2
25	12	9.7	15.3
28	16	7.9	22.1
	18		25.5

This is the required predisted value.