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Paper Biostatistics
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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
13	8	169	64	104
$\Sigma = 76$	$\Sigma = 172$	$\Sigma = 670$	$\Sigma = 3240$	$\Sigma = 1148.$

Formula for correlation coefficient.

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

For $n = 10$

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

$$r = \frac{11480 - 13072}{\sqrt{(6700 - 5776)(32400 - 29584)}}$$

$$r = \frac{-1592}{\sqrt{2601984}}$$

$$r = \frac{-1592}{1613.06}$$

$r = 0.98$ Ans.

PART = B

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
Σ = 165	Σ = 114	Σ = 3309	Σ = 1604	Σ = 2099

(a) Formula for least square regression line for Y on x

$$Y = a + bx$$

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

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

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

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

$$b = 0.031$$

Now

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

$$a = \frac{1}{9}\{114 - (0.031)(165)\}$$

$$a = \frac{1}{9}\{114 - 5.115\}$$

$$a = \frac{1}{9}\{108.8\}$$

$$a = 12.09$$

Hence

$$Y = a + bx$$

$$Y = 12.09 + 0.031x$$

Least square regression line.
For x on y

$$x = a + by$$

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

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

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

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

$$b = 0.056$$

Now

$$a = 1/n \{\sum x - b\sum y\}$$

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

$$a = 1/9 \{165 - 6.384\}$$

$$a = 1/9 \{158.6\}$$

$$a = 1762$$

Hence

$$x = a + by$$

$$x = 1762 + 0.056y.$$

(b)

X	Y	$Y = 12.09 + 0.031x$	$X = 17.62 + 0.056y$
20	5	$= 12.09 + (0.031)(27) = 12.71$	$= 17.62 + 0.056(5) = 17.9$
11	15	$= 12.09 + (0.031)(11) = 12.4$	$= 17.62 + 0.056(15) = 18.46$
15	14	$= 12.09 + (0.031)(15) = 12.5$	$= 17.62 + 0.056(9) = 18.124$
10	17	$= 12.09 + (0.031)(25) = 12.8$	$= 17.62 + 0.056(12) = 18.292$
17	8	$= 12.09 + (0.031)(28) = 12.9.$	$= 17.62 + 0.056(16) = 18.516$
18	9		$= 17.62 + 0.056(18) = 18.628$
21	12		
25	16		
28	18		

Q:2

PART ⇒ A.

Let us regard 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 ~~succ~~ successive tosses of the coin are independent.
4) The coin is tossed 5 times.

There fore the r.v X which denotes the numbers of heads (success) 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.

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

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

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

$$P(3\text{ head}) = P(X=3) = \binom{5}{3}\left(\frac{1}{2}\right)^3\left(\frac{1}{2}\right)^{5-3} = 10\times\left(\frac{1}{2}\right)^5 = \frac{10}{32}$$

$$P(4\text{ head}) = P(X=4) = \binom{5}{4}\left(\frac{1}{2}\right)^4\left(\frac{1}{2}\right)^{5-4} = 5\times\left(\frac{1}{2}\right)^5 = \frac{5}{32}$$

$$P(5\text{ head}) = P(X=5) = \binom{5}{5}\left(\frac{1}{2}\right)^5\left(\frac{1}{2}\right)^0 = 1\times\left(\frac{1}{2}\right)^5 = \frac{1}{32}$$

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

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

Part - B

Solution =>

Therefore the Binomial probability dist with $n = 10$.

$P = 2/3$

$q = 1 - P$

$q = 1 - 2/3$

$q = 1/3$

Let x denote the number of won by A then

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

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

$= \left[(1/3)^{10} + 10 (2/3)^1 (1/3)^9 + 45 (2/3)^2 (1/3)^8 \right.$

$\left. + 120 (2/3)^3 (1/3)^7 \right]$.

$= 1 - \frac{1}{59049} \left[1 + 20 + 180 + 960 \right]$

$1 = 0.0197$

$P(x \geq 4) = 0.9803$

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

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

$= \frac{3360}{59049}$

$P(x = 4) = 0.056$.

(iii) $P(x = 11) = f(0)$ = Because X can take only value

$0, 1, 2, 3 \ldots\ldots 10$

(iv) 6 or more games.

$$P(x \geq 6) = \sum_{x=0}^{10} \binom{10}{x} (2/3)^x (1/3)^{10-x}$$

$$= \binom{10}{6}(2/3)^6(1/3)^4 + \binom{10}{7}(2/3)^7(1/3)^3 + \binom{10}{8}(2/3)^8(1/3)^2 + \binom{10}{9}(2/3)^9(1/3)^1 + \binom{10}{10}(2/3)^{10}(1/3)^0$$

$$= 0.228 + 0.261 + 0.196 + 0.087 + 0.016$$

$$P(x \geq 6) = 0.79$$

Q. 3

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

Solution ⇒

Given that

① X_0 (minimum value) $= 0$

X_m (maximum value) $= 10$

② Range $= X_m - X_0$

$= 10 - 0$

$= 10$

③ Let the number of classes $= 06$

④ The class magnitude $= 10/7 = 1.5 = 2.00$

Now ⓐ

Children Born x_i	f	Tally Bar
0	1	I
1	4	IIII
2	8	IIII IIII
3	11	IIII IIII I
5	5	IIII
6	4	IIII
7	3	III
8	2	II
90	1	I
10	3	III
	50	

Now B

Children Born grouped	f
0 - 1	5
2 - 3	19
4 - 5	13
6 - 7	7
8 - 9	3
10 - 11	3
	50