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Paper	Biostatistics
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Q1 Part (A)

(1)

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
<hr/>				
$\Sigma = 76$	$\Sigma = 172$	$\Sigma = 670$	$\Sigma = 3240$	$\Sigma = 1148$

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 $n = 10$

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

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

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

$$r = -\frac{1592}{161306}$$

$$r = 0.098 \text{ Ans}$$

Q1 -

post = B

X	Y	x ²	y ²	xy
2	5	400	25	300 100
11	15	121	225	165
15	14	225	196	210
10	17	289 100	64 289	170 170
17	10	289	64	136
18	9	324	81	162
21	12	441	144	252
25	16	625	256	400
28	18	784	784	504
$\Sigma = 165$	$\Sigma = 84$	$\Sigma = 3309$	$\Sigma = 1604$	$\Sigma = 2099$

Formula for least square regression
line for y on x

(3)

(3)

$$x = a + bx$$

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

$$b = \frac{(4)(2099) - (165)(114)}{29781 - 27225}$$

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

$$b = 0.031$$

$$\text{Now } a = \frac{1}{n} (\sum y - b \sum x)$$

$$a = \frac{1}{4} \{114 - (0.031)(165)\}$$

$$a = \frac{1}{4} \{114 - 5.115\}$$

$$a = \frac{1}{4} \{108.88\}$$

$$a = -12.09$$

$$\text{Hence } y = a + bx$$

$$y = 12.09 + 0.031x$$

Least Square regression line. (4)

for x on y (4)

$$x = a + by$$

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

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

$$b = \frac{1389 - 18810}{14436 - 12996}$$

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

$$b = 0.056$$

Now

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

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

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

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

$$a = 17.62$$

Hence $x = a + by$

$$x = 17.62 + 0.056y.$$

(b)

x	y
20	5
11	15
15	14
10	17
17	8
18	9
21	12
25	16
28	18

$$\begin{aligned}y &= 12.09 + 0.031x \\ &= 12.09 + (0.031)(20) = 12.71 \\ &= 12.09 + (0.031)(11) = 12.41 \\ &= 12.09 + (0.031)(15) = 12.51 \\ &= 12.09 + (0.031)(10) = 12.31 \\ &= 12.09 + (0.031)(17) = 12.52 \\ &= 12.09 + (0.031)(18) = 12.56 \\ &= 12.09 + (0.031)(21) = 12.65 \\ &= 12.09 + (0.031)(25) = 12.77 \\ &= 12.09 + (0.031)(28) = 12.87\end{aligned}$$

(5)

$$\begin{aligned}x &= 17.62 - 0.056y \\ &= 17.62 - 0.056(5) = 17.9 \\ &= 17.62 - 0.056(15) = 17.76 \\ &= 17.62 - 0.056(14) = 17.82 \\ &= 17.62 - 0.056(17) = 17.65 \\ &= 17.62 - 0.056(8) = 17.95 \\ &= 17.62 - 0.056(9) = 17.91 \\ &= 17.62 - 0.056(12) = 17.74 \\ &= 17.62 - 0.056(16) = 17.51 \\ &= 17.62 - 0.056(18) = 17.41\end{aligned}$$

Q 3 - part (a)

6

Give data -

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	4	2	2

Ungrouped frequency distribution

No	Tally mark	Frequency	Cumulative frequency
1	I	1	1
2	IIII	4	5
3	IIII III	8	13
4	IIII IIII I	11	24
5	IIII III	8	32
6	IIII III	5	37
7	IIII	4	41
8	III	3	44
9	II	2	46
10	I	1	47
	III	3	50

Q No 3 part A
Complete -

We find out the information from data.

$N = 50, R = 9, k = 6, h = 2$

Classes	Frequency	Classboundary	Midpoint
0-1	5	-0.5-1.5	1
2-3	19	1.5-3.5	2.5
4-5	13	3.5-5.5	4.5
6-7	7	5.5-7.5	6.5
8-9	3	7.5-9.5	8.5
10-11	3	10.5-11.5	11

Total = -

R. frequency	R frequency %	C.F	R.C.F
$5/50$	$5/50 \times 100 = 10$	5	$5/50 = 0.1$
$19/50$	$19/50 \times 100 = 38$	24	$24/50 = 0.5$
$13/50$	$13/50 \times 100 = 26$	37	$37/50 = 0.6$
$7/50$	$7/50 \times 100 = 14$	44	$44/50 = 0.8$
$3/50$	$3/50 \times 100 = 6$	47	$47/50 = 0.9$
$3/50$	$3/50 \times 100 = 6$	50	$50/50 = \underline{\underline{1}}$

Q: (3) part (b)

Given information of children born to 50 women.

2	6	1	5	4	3	3	8	10	1
4	3	3	0	5	7	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

Grouped frequency distribution for given data.

$$N = 50 \quad x_0 = 1, \quad x_m = 10$$

$$\text{Range} = x_m - x_0$$

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

$$k = 1 + 3.3 \log N$$

$$= 1 + 3.3 (\log 50)$$

$$= 1 + 3.3 (1.698)$$

$$= 1 + 5.6066$$

$$k = 6.606 = \boxed{6}$$

$$h = \text{Class Interval} = \frac{\text{Range}}{k}$$

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

Q2. part (a)

(9)

Example :-

A fair coin is tossed 5 times
find the probabilities of obtaining various number
of head. 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 for successive tosses of coin are independent.
- (4) The coin is tossed 5 times

Therefore 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.

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

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

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

$$p(3 \text{ heads}) = p(x=3) = \binom{5}{3} \left(\frac{1}{2}\right)^3 \left(\frac{1}{2}\right)^{5-3} = 10 \times \left(\frac{1}{2}\right)^5 = \frac{10}{32}$$

$$p(4 \text{ heads}) = p(x=4) = \binom{5}{4} \left(\frac{1}{2}\right)^4 \left(\frac{1}{2}\right)^{5-4} = 5 \times \left(\frac{1}{2}\right)^5 = \frac{5}{32} \text{ and}$$

$$p(5 \text{ heads}) = p(x=5) = \binom{5}{5} \left(\frac{1}{2}\right)^5 \left(\frac{1}{2}\right)^0 = 1 \times \left(\frac{1}{2}\right)^5 = \frac{1}{32}$$

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

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

Q2 part (b)

(11)

Solution Here-

There fore 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

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

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

$$= 1 - \left[\left(\frac{1}{3}\right)^{10} + 10 \left(\frac{2}{3}\right)^1 \left(\frac{1}{3}\right)^9 + 45 \left(\frac{2}{3}\right)^2 \left(\frac{1}{3}\right)^8 \right]$$

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

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

$$1 - 0.0197$$

$$P(x \geq 4) = 0.9803$$

(ii) $P(X=4) = \binom{10}{4} \left(\frac{2}{3}\right)^4 \left(\frac{1}{3}\right)^6$ (12)

$$= 216 \left(\frac{16}{81}\right) \left(\frac{1}{729}\right)$$

$$= \frac{3360}{59049}$$

$$P(X=4) = 0.056$$

(iii) $P(X=11) = 0$ because X can take only values

0, 1, 2, 3, ..., 10

(iv) 6 or more games

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

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

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

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

$$P = 0.228 + 0.261 + 0.196 + 0.087 + 0.028$$

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