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SUBJECT : BIOSTATISTIC

PROGRAMME : BS DENTAL TECHNOLOGY (6th SEMESTER)

Q NO 1

Answers: (A)

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	306	289	64
18	9	162	324	81
21	12	252	441	144
25	16	400	625	258
28	18	504	784	324
165	114	2269	3309	1604

The regression equation of y on x is

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

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

$$= \frac{9(2269) - (165)(114)}{9(3309) - (165)^2}$$

$$= \frac{20421 - 18810}{29781 - 27225} = \frac{1611}{2556}$$

$$\boxed{b = 0.63}$$

$\hat{y} - \bar{T} - 0$

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

$$= \frac{114}{9} - 0.63\left(\frac{165}{9}\right)$$

$$= 12.66 - 0.63\,(18.33)$$

$$= 12.68 - 11.55$$

$$\boxed{a = 1.11}$$

Thus estimated regression line of

y on x is

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

$$\hat{x} = 1.11 + 0.63x$$

Now regression Eq x on y

$$\hat{x} = a + by$$

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

$$= \frac{9(2269) - (165)(114)}{9(1604) - (114)^2}$$

$$b = \frac{20421 - 18810}{14436 - 12396}$$

$$= \frac{1611}{1440}$$

$$\boxed{b = 1.12}$$

P - T - O

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

$$= \left(\frac{165}{9}\right) - 1.12\left(\frac{114}{9}\right)$$

$$= 18.33 - 1.12\,(12.66$$

$$\boxed{a = 4.15}$$

Thus the estimated regression line of
x on y
$\hat{x} = a + by$
$\hat{x} = 4.15 + 1.12\,y$

PART
(B)
predicted values of Y
for $x = 20, 11, 15, 25, 28$
$\hat{y} = a + bx$
$= 1.11 + 0.63\,(20)$ $x = 20$
$\boxed{\hat{y} = 13.71}$

$\hat{y} = 1.11 + 0.63\,(11)$ $x = 11$
$\boxed{\hat{y} = 8.04}$

$\hat{y} = 1.11 + 0.63\,(15)$ $x = 15$
$\boxed{\hat{y} = 10.56}$

P-T-O

$\hat{y} = 1.11 + 0.63(25)$ $x = 25$

$\boxed{\hat{y} = 16.86}$

$\hat{y} = 1.11 + 0.63(28)$ $x = 28$

$\boxed{\hat{y} = 18.75}$

predicted values of x for

$y = 5, 15, 9, 12, 16, 18$

$\bar{x} = 4.15 + 1.12\,y$

$= 4.15 + 1.12(5)$ $y = 5$

$\boxed{x = 9.75}$

$\bar{x} = 4.15 + 1.12(15)$ $y = 15$

$\boxed{\bar{x} = 20.95}$

$\bar{x} = 4.15 + 1.12(9)$ $y = 9$

$\boxed{\bar{x} = 14.23}$

$\bar{x} = 4.15 + 1.12(12)$ $y = 12$

$\boxed{\bar{x} = 17.59}$

$\bar{x} = 4.15 + 1.12(16)$ $y = 16$

$\boxed{\bar{x} = 22.07}$

$x = 4.15 + 1.12(18)$ $y = 18$

$\boxed{\bar{x} = 24.31}$

Q No 2

Answer: part (A)

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 tails.
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.

Therefor 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.

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

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

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

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

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

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

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

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

$\boxed{\text{PART B}}$

Two possible outcome : win & not win

2) Prob A winning $p = 2/3$

2) 10 game

2 $n = 8$ ($p = 2/3$

2 Successive games won & lost independly

(i) $P(x=4) = {}^{10}C_4 (2/3)^4 (1/3)^6 = \frac{1128}{5651} = \boxed{0.1996}$

(ii) $P(x \geq 4) = 1 - p(x<4)$: 4 mean 4 win

$= 1 - \sum_{x=0}^{3} \left({}^{10}C_x (2/3)^x (1/3)^{8-x}\right)$

$= 1 - \left\{\left(\frac{1}{3}\right)^{10} + 10\left(\frac{2}{3}\right)(1/3) + 28(2/3)^2(1/3)^2 + 8\left(2/3\right)^3(1/2)^2\right)$

$= 1 - \frac{1}{6561}(~~1~~ + 16 + 28 + 448)$

$1 - \frac{577}{6561} = \frac{5984}{6561} = 0.9121$

P.T.O

(iii) $P(x \geq 8) = \sum_{x=8}^{10} \binom{10}{x}\left(\frac{2}{3}\right)^{x}\left(\frac{1}{3}\right)^{10-x}$

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

$= \frac{100}{1561}(30+16+2) = \frac{100 \times 48}{6561} = \frac{4800}{3181} = 2194$

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

$= {}^{10}C_{3}\left(\frac{2}{3}\right)^{3}\left(\frac{1}{3}\right) + \left({}^{10}C_{4}\right)\left(\frac{2}{3}\right)^{4}\left(\frac{1}{3}\right)^{6} + \binom{10}{5}\left(\frac{2}{3}\right)^{5}\left(\frac{1}{3}\right)^{5} + \binom{10}{6}\left(\frac{2}{3}\right)^{6}\left(\frac{1}{3}\right)^{4}$

$\frac{(2)^3}{3^{10}}(50+160+240+244)$

$\frac{10 \times 644}{6561} = \frac{6440}{1561} = \boxed{0.98155}$

Q NO 3

Answer part A

Given data

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

ungrouped frequency distribution

No	Tally mark	Frequency	Cumulative freq
0			
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~~	5	37
7	IIII	4	41
8	II	3	44
9	I	2 1	46
10	III	3	47 50

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	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

Grouped frequency distribution for given data

$N = 50 \qquad x_0 = 1 \qquad x_m = 10$

Range $= x_m - x_0$

$R = 10 - 1 = (9)$

$K = 1 - 3.3 \log N$

$= 1 + 3.3 \log(50)$

$= 1 + 3.3\,(1.695)$

$= 1 + 5.6060$

$K = 6.606 = \boxed{7}$

$h =$ Class interval $= \dfrac{\text{Rang}}{K}$

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

We find out the information from data.

N = 50, R = 9, K = 7, h = 2

Classes	Frequency	Class boundry	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 50

R. Frequency	R. Frequency %	C.F	R.CF
5/50	5/50 × 100 = 10	5	5/50 = 0
19/50	19/50 × 100 = 38	24	24/50 = 0
13/50	13/50 × 100 = 26	22	37/50 = 0
7/50	7/50 × 100 = 14	44	44/50 = 0
3/50	3/50 × 100 = 6	40	47/50 =
3/50	3/50 × 100 = 6	50	50/50 =