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Q#01: Compute and Analyse the results of the least square regression equation and Co-efficient of Correlation of Y on X for the following data. Compare your manual result with outcome of SPSS?

Temperature	Chirps Perminute.
53	20
62	32
57	45
71	60
78	80
12	100
86	120
87	140
96	160
91	180
94	200
94	210

Sol: The estimated regression line of Y on X is

$$Y = a + bX$$

and the two normal equations are

$$\Sigma Y = n a + b \Sigma X$$

$$\Sigma XY = a \Sigma X + b \Sigma X^2$$

To compute the necessary Simultaneous we arrange the computation in table below

X	Y	XY	X ²	Y ²
53	20	1060	2809	400
62	32	1984	3844	1024
57	45	2565	3249	2025
71	60	4260	2601	3600
78	80	6240	6084	6400
12	100	1200	144	10,000
86	120	10320	7396	14400
87	140	12180	7469	19600
96	160	15360	9210	25600
91	180	16380	8281	32400
94	200	18800	8836	40,000
94	210	19740	8836	44100
Σ 881	1347	110089	68759	199549

Now

$$\bar{X} = \frac{\Sigma X}{n} = \frac{881}{12} = 73.416$$

$$\bar{Y} = \frac{\Sigma Y}{n} = \frac{1347}{12} = 112.25$$

$$b = \frac{n \sum XY - (\sum X)(\sum Y)}{n \sum X^2 - (\sum X)^2}$$
$$= \frac{(12)(110089) - (881)(1347)}{12(68759) - (881)^2}$$

$$b = 2.745$$

Also

$$a = \bar{Y} - b\bar{X}$$
$$a = -112.25 - 2.745(73.416)$$

$$a = -89.27$$

Hence the desired estimated regression line of Y on X is

$$\hat{Y} = (a + bx) = (-89.27) + 2.745x$$

$$\hat{Y} = 2.745x - 89.27$$

Hence $\hat{Y} = 2.745x - 89.27$ is estimated regression eq. appropriate for predicting the Y given the X

$$(B) \quad r = \frac{\sum XY - (\sum X)(\sum Y)}{n}$$

$$\sqrt{\left[\frac{\sum X^2 - (\sum X)^2}{n} \right] \left[\frac{\sum Y^2 - (\sum Y)^2}{n} \right]}$$

$$r = \frac{110089 - \frac{(881)(1347)}{12}}{\sqrt{\left[\frac{68759 - \frac{(881)^2}{12}}{12} \right] \left[\frac{199549 - \frac{(1347)^2}{12}}{12} \right]}}$$

$$r = \frac{11196.75}{\sqrt{(4078.9167)(48348.25)}}$$

So

$r = 0.79791$ is Co-efficient of Co-relation

Q#2

Part

[B] OF 12 eggs in refrigerator, 2 are bad. From these, 4 eggs are chosen at random to make a cake. What are the probabilities that

- (i) Exactly one is bad?
 (ii) At least one is bad?

Answer The total number of possible equally likely outcomes in S is;

$$n(S) = \binom{12}{4}$$

$$n(S) = \frac{12!}{4!(12-4)!} = 495$$

(i) Let X represents "Exactly one is bad"

$$n(X) = \binom{2}{1} \binom{10}{3}$$

$$n(X) = \left(\frac{2!}{2!(2-1)!} \right) \left(\frac{10!}{3!(10-3)!} \right)$$

$$n(X) = (2)(120)$$

$$n(X) = 240$$

So the probability is;

$$P(X) = \frac{n(X)}{n(S)} = \frac{240}{495}$$

$$P(X) = 0.48$$

[ii] Let Y represent "At least one is bed"

$$n(Y) = \binom{10}{3} \binom{2}{1} + \binom{10}{2} \binom{2}{2}$$

$$n(Y) = \frac{10!}{3!(10-3)!} \binom{2!}{1!(2-1)!} +$$

$$\frac{10!}{2!(10-2)!} \binom{2!}{2!(2-2)!}$$

$$n(Y) = (120)(2) + (45)(1)$$

$$n(Y) = 240 + 45$$

$$n(Y) = 285$$

So The Probability is

$$P(Y) = \frac{n(Y)}{n(S)}$$

$$P(Y) = \frac{285}{495}$$

$$P(Y) = 0.58 \quad \text{Answer.}$$

Q#2

Part A box Contains 4 red, 4 white and 5 green balls

[A] Three balls are drawn from the box together

Find the probability that may be

[i] All different colours

[ii] All of the same colours

Sol: The total number of possible equally outcomes in S is;

$$n(S) = \binom{13}{3}$$

$$n(S) = \frac{13!}{3!(13-3)!}$$

$$n(S) = 286$$

[i] Let X represents "All of different colour"

$$n(X) = \binom{4}{1} \binom{4}{1} \binom{5}{1}$$

$$n(X) = \left(\frac{4!}{1!(4-1)!} \right) \left(\frac{4!}{1!(4-1)!} \right) \left(\frac{5!}{1!(5-1)!} \right)$$

$$n(X) = (4)(4)(5)$$

$$n(X) = 80$$

So the Probability is;

$$P(X) = \frac{n(X)}{n(S)}$$

$$P(X) = \frac{80}{286}$$

$$P(X) = 0.28$$

[ii] Let Y represents "All of Same colour"

$$n(Y) = \binom{4}{3} + \binom{4}{3} + \binom{5}{3}$$

$$n(Y) = \frac{4!}{3!(4-3)!} + \frac{4!}{3!(4-3)!} + \frac{5!}{3!(5-3)!}$$

$$n(Y) = 4 + 4 + 10$$

$$n(Y) = 18$$

So Probability is;

$$P(Y) = \frac{n(Y)}{n(S)}$$

$$P(Y) = \frac{18}{286}$$

$$286$$

$$P(Y) = 0.063 \quad \text{Answer.}$$

Q#3 The following are the scores made by three batsman A, B and C in series of innings

A	12	15	6	73	7	12	199	36	84	29
B	47	12	76	48	4	12	37	48	13	3
C	15	23	52	4	24	12	74	52	13	4

- (a) Find the range of batsman A, B and C?
 (b) Who is more consistent player?
 (c) Compare A with B, B with C and A with C?

Sol: Range of Batsman A, B and C:

Range of A:

$$A = 12, 15, 6, 73, 7, 12, 199, 36, 84, 29$$

$$\text{Largest value in data} = L = 199$$

$$\text{Smallest value in data} = S = 6$$

$$\text{Range} = L - S$$

$$= 199 - 6$$

$$\text{Range} = 193$$

Range of B:

$$B = 47, 12, 76, 48, 4, 12, 37, 48, 13, 3$$

$$\text{Largest value in data} = L = 76$$

$$\text{Smallest value in data} = S = 3$$

$$\text{Range} = L - S$$

$$= 76 - 3$$

$$\text{Range} = 73$$

Range of C:

$$C = 15, 23, 52, 4, 4, 24, 12, 74, 52, 13, 4$$

$$\text{Largest value in data} = L = 74$$

$$\text{Smallest value in data} = S = 4$$

$$\text{Range} = 74 - 4$$

$$\text{Range} = 70$$

Q#3

Part

[B] More consistent Player = ?

Batsman A		Batsman B		Batsman C	
X	X ²	Y	Y ²	Z	Z ²
12	144	47	2209	15	225
15	225	12	144	23	529
6	36	76	5776	52	2704
73	5329	48	2304	4	16
7	49	4	16	24	576
12	144	12	144	12	144
199	39601	37	1369	74	5476
36	1296	48	2304	52	2704
84	7056	13	169	13	169
29	841	3	9	4	16
$\Sigma X = 473$	$\Sigma X^2 = 5472$	$\Sigma Y = 300$	$\Sigma Y^2 = 14444$	$\Sigma Z = 273$	$\Sigma Z^2 = 12559$

Batsman A:

$$\bar{X} = \frac{\sum X}{n} \quad \therefore n = 10$$

$$= \frac{473}{10} = 47.3$$

$$S_x = \sqrt{\frac{\sum X^2}{n} - \left(\frac{\sum X}{n}\right)^2}$$

$$= \sqrt{\frac{54721}{10} - \left(\frac{473}{10}\right)^2}$$

$$S_{\bar{x}} = 56.8$$

$$C.V = \frac{56.8}{47.3} \times 100 = 1.200$$

$$C.V = 1.200 \times 100$$

$$C.V = 120$$

Batsman B:

$$Y = \frac{\sum Y}{n} = \frac{300}{10} = 30$$

$$S_y = \sqrt{\frac{\sum Y^2}{n} - \left(\frac{\sum Y}{n}\right)^2}$$

$$= \sqrt{\frac{14444}{10} - \left(\frac{30}{10}\right)^2}$$

$$= \sqrt{1444.4 - 9}$$

$$= 37.88$$

$$C.V = 37.88 \times 100$$

$$C.V = 3788$$

Batsman C

$$\bar{x} = \frac{\sum x}{n} = \frac{273}{10} = 27.3$$

$$S^2 = \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2}$$

$$= \sqrt{\frac{12559}{10} - \left(\frac{273}{10}\right)^2}$$

$$S^2 = 22.59$$

$$C.V = \frac{S^2}{\bar{x}} = \frac{22.59}{27.38}$$

$$C.V = 0.82 \times 100$$

$$C.V = 82$$

Q#3

Part Comparison

[C] Compare A with B

A is consistent

Compare B with A

A is more consistent

Compare A with C

C is more consistent