Paper 4 - Fundamentals of Business Mathematics and Statistics

Paper-4: Fundamentals of Business Mathematics and Statistics

Time Allowed: 3 Hours **Full Marks: 100**

The figures in the margin on the right side indicate full marks.
This question paper has two sections.
Both the sections are to be answered subject to instructions given against each.

Section – A

I. (a) Choose the correct answer **(9 × 2 = 18)**

(1) The ratio of present age of Jadu to that of Madhu is 4 : 5. If the present age of Madhu is 30 years, then the present age of Jadu is –
(a) 20 years (b) 25 years (c) 24 years (d) 35 years.

(2) A sum of money becomes double in 20 years at S.I. In how many years will it be triple –
(a) 40 (b) 35 (c) 38 (d) 42

(3) Compound interest on ₹ 1000 at 8% p.a. compounded half-yearly for 2 years is –
(a) 169.90 (b) 196.60 (c) 175.10 (d) 199.40

(4) A boy saves 1p today, 2p tomorrow, 3p day after tomorrow. How much he can save in 12days?
(a) 68 (b) 70 (c) 78 (d) 87

(5) The product of three terms in G.P. is 1000. What is its middle term?
(a) 12 (b) 14 (c) 16 (d) 10

(6) In a group of 63 persons, 24 persons take wheat but not rice, 37 persons take wheat then find the number of persons taking rice but not wheat?
(a) 39 (b) 26 (c) 62 (d) None.

(7) If $3^x = 5^y = (225)^z$ then z = ___
(a) $\frac{xy}{x+y}$ (b) $2\frac{xy}{x+y}$ (c) 2 (x+y) (d) None of these

(8) If $^8c_r - {}^7c_3 = {}^7c_2$ then r = _____
(a) 3 (b) 4 (c) 2 (d) 6

(9) If the roots of the equation $\frac{3}{4}x^2 + 9x + c^3 = 0$ are equal then c is equal to _____
(a) 5 (b) 3 (c) 8 (d) 5

I. (b) State whether the following statements are true or false **(6 × 1 = 6)**

(1) The mean proportional of 4x and $16x^3$ is $12x^2$ **( )**

(2) $1+2+3+\ldots\ldots\ldots+(n-1) = \frac{n(n-1)}{2}$ **( )**

(3) The G.M of 2 and 6 is $\pm\sqrt[3]{2}$ ( )

(4) The statement {2} belongs to {2, 3, 5} is true or false ( )

(5) The integral part of the value of logarithm of a number is called characteristic ( )

(6) The total number of arrangements of the letters in the expression $x^3y^2z^4$ when written in full length is 1260 ( )

Answer: I (a)

(1) Let the present ages of Jadhu and Madhu be 4x yers and 5x years respectively.

$\because 5x = 30 \Rightarrow x = 6$

$\therefore$ The present age of Jadhu is 4(6) = 24 years (c)

(2) Let the Sum be ₹ P, t = 20 years

$\therefore$ A = ₹ 2p

$\because A = P\left(\frac{1+rt}{100}\right)$

$\Rightarrow 2\cancel{P} = \cancel{P}\left(\frac{1+20r}{100}\right)$

$\Rightarrow 20r = 100 \Rightarrow r = 5\%$

$\therefore 3\cancel{P} = \cancel{P}\left(\frac{1+rt}{100}\right)$

$2 = \frac{5}{100}t \Rightarrow t = \frac{200}{5} = 40\text{yrs.}$ (a)

(3) $\because$ P = ₹1000, i = 8% n = 2yrs.

$C.I = P\{(1+i)^n - 1\}$

$= 1000\left[\left(\frac{1+8}{200}\right)^4 - 1\right] = 1000\left[(1.04)^4 - 1\right]$

= 1000 (0.16985)

= 169.90 (₹) (a)

(4) $\because$ 1 + 2+ 3 + ...+ up to 12 days.

a = 1, d = 1

$\because S_n = \frac{n}{2}[2a + (n-1)d]$

$= 6[2 + (11)] = (13)6 = 78$ (option (c))

(5) Let the three numbers in G. P be

$\frac{a}{r}, a, ar$ $\therefore$ Middleterm = 10

$\because \left(\frac{a}{\cancel{r}}\right)(a)(a\cancel{r}) = 1000$

$a^3 = 1000 = 10^3$

$a = 10$

(Option d)

(6) Let the persons who take wheat ne W and rice be 'R'

$\therefore$ n (W) = 37

N (W $\cap$ R) = 37 – 24 = 13

$\because$ n (W $\cup$ R) = n (W) +n (R) - n (M $\cap$ R)

$\Rightarrow$ 63 = 37 + n (R) – 13

= 24 + n (R)

$\therefore$ n (R) = 63 – 24 = 39

N (R only) = n (R) – n (W $\cap$ R) = 39 – 13 = 26 (option b)

(7) Let $3^x = 5^y = (225)^2 = k$ (say)

$\therefore 3^x$

$x \log_3 k \mid y = \log_5 k \mid z = \log_{225} k$

$\therefore \frac{1}{x} = \log_k 3 \quad \frac{1}{y} \log_k 5, \quad \frac{1}{2} = \log_k 225$

$\frac{1}{2} = \log_k 15^2 = 2 \log_k 15$

$= 2\left(\log_k 5 + \log_k 3\right)$

$\frac{1}{2} = 2\left(\frac{1}{y} + \frac{1}{x}\right) = 2\left(\frac{x+y}{xy}\right)$

$\therefore \quad Z = \frac{xy}{2(x+y)}$ (option d)

(8) $\because$ $8c_r - 7c_3 = 7c_2$

$\Rightarrow 8_{cr} = 7_{c2} = 7_{c3} = 8_{c3}$

$\therefore$ r = 3 (option a)

(9) $\because b^2 - 4ac = 0$

$\Rightarrow 9^2 - 4\left(\frac{3}{4}\right) c^3 = 0$

$\Rightarrow 81 - 3^{c3} = 0$

$\Rightarrow 3^{c3} = 81$

$\Rightarrow c^3 = \frac{81}{3} = 37 = 3^3$

$\therefore$ c = 3 (option b)

Answer: I (b)

(1) Meam proportional = $\sqrt{(4x)(16x^3)} = \sqrt{64x^4} = 8x^2$ So, Answer (F)

(2) $1 + 2 + \ldots\ldots\ldots\ldots n - 1 = \frac{n(n-1)}{2}$ (T)

(3) G. M b/w 2 & 6 is $\sqrt{12} = \pm 2\sqrt{3}$ (F)

(4) The statement $\{2\} \in \{2, 3, 5\}$ is False (F)

(5) The integral part of the value of logarithm of a number is called characteristic (T)

(6) The total no. of arrangements of the letters in the expansion $x^3y^2z^4$ when written in full length is $\frac{\angle 9}{\angle 2 \angle 3 \angle 4} = \frac{9 \times 8 \times 7 \times 6 \times 5 \times \angle 4}{2 \times 6 \times \angle 4} = 1260$ (T)

II. Answer any four questions. Each question carries 4 marks (4 × 4 = 16)

(1) If $\frac{\sqrt{a}-\sqrt{b}}{\sqrt{a}+\sqrt{b}} = \frac{1}{2}$ prove that $\frac{a^2+ab+b^2}{a^2-ab+b^2} = \frac{91}{73}$

(2) A sum of ₹ 46,875 was lent out at simple interest and at the end of 1 year 8 months the total amount was ₹ 50,000. Find the rate of interest p.a.

(3) Find the sum of n terms of the series
0.7 + 0.77 + 0.777 + …… to n terms.

(4) If $a = b^2 = c^3 = d^4$ prove that $\log_a(abcd) = 1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}$

(5) Find n if $^{n}P_3 : {}^{n+2}P_3 = 5 : 12$

(6) Solve $\sqrt{\frac{x}{1-x}}+\sqrt{\frac{1-x}{x}} = \frac{13}{6}$

Answer: II

(1) Given $\frac{\sqrt{a}-\sqrt{b}}{\sqrt{a}+\sqrt{b}} = \frac{1}{2}$

By doing Componendo & dividendo

$$\frac{\sqrt{a}-\sqrt{b}+\sqrt{a}+\sqrt{b}}{\sqrt{a}-\sqrt{b}+\sqrt{a}-\sqrt{b}} = \frac{1+2}{1-2}$$

$$\Rightarrow \frac{2\sqrt{a}}{-2\sqrt{a}} = 3$$

S. O. B. S

$$\frac{a}{b} = 9 \quad \Rightarrow a = 9b$$

$$\text{L.H.S} = \frac{a^2+ab+b^2}{a^2-ab+b^2}$$

$$= \frac{81b^2+9b^2+b^2}{81b^2-9b^2+b^2} = \frac{91b^2}{73b^2} = \frac{91}{73} = \text{R.H.S}$$

(2) Let the sum be P = ₹46,875

t = 1 year 8th months

$= 1\frac{8}{12} = 1\frac{2}{3} = \frac{5}{3}$ yrs.

$\because$ A = ₹50,000

$\because$ $A = P(1+\frac{rt}{100})$

$\Rightarrow 50,000 = 46,875\,(1+\frac{r}{100}\times\frac{5}{3})$

$1.067 - 1 = \frac{5r}{300}$

$\frac{0.067\times 300}{5} = r$

r = 4.02%

= 4%

(3) Let S = 0.7 + 0.77 + 0.777 + …….. to n terms

$= \frac{7}{10}+\frac{77}{100}+\frac{777}{1000}+\ldots\ldots\text{to n terms}$

$= \frac{7}{9}\left[\frac{9}{10}+\frac{99}{10^2}+\frac{999}{10^3}+\ldots\ldots\text{to n terms}\right]$

$= \frac{7}{9}\left[\left(\frac{1-1}{10}\right)+\left(\frac{1-1}{10^2}\right)+\left(\frac{1-1}{10^3}\right)+\ldots\ldots\ldots\text{to n terms}\right]$

$= \frac{7}{9}\left[(1+1+\ldots\ldots\ldots\text{to n terms})-\left(\frac{1}{10}+\frac{1}{10^2}+\ldots\ldots+\frac{1}{10^n}\right)\right]$

$= \frac{7}{9}\left[n-\frac{\frac{1}{10}\left(\frac{1-1}{10^n}\right)}{\frac{1-1}{10}}\right]$ $\quad\because S_n = \left[\frac{a\left(1-r^n\right)}{1-r}\right]$ $a<1$

$= \frac{7}{9}\left[n-\frac{(1-10^{-n})}{9}\right]$

$= \frac{7}{81}\left[9n-(1-10^{-n}\right]$

(4) Let $a^1 = b^2 = c^3 = d^4 = k$ (Say)

$\therefore a^1 = k \mid b^2 = k \mid c^3 = k \mid d^4 = k$

$1 = \log_a k \mid 2 = \log_b k \mid 3 = \log_c k \mid 4 = \log_d k$

$\log_k a = 1 \quad \log_k b = \frac{1}{2} \quad \log_k c = \frac{1}{3} \quad \log_k d = \frac{1}{4}$

$\text{Log}_a (abcd): = \log_k a + \log_k b + \log_k c + \log_k d \qquad (\therefore k = a)$

$= 1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}$ hence proved

(5) $\because {}^nP_3;\ n + {}^2P_3 = 5:12$

$$\Rightarrow \frac{\angle n}{\cancel{\angle n-3}} \times \frac{\angle n-1}{\angle n+2} = \frac{5}{12}$$

$$\Rightarrow \frac{\cancel{\angle n}}{\angle n-3} \times \frac{(n-1)(n-2)\cancel{(n-3)!}}{(n+2)(n+1)\cancel{(n!)}} = \frac{5}{12}$$

$$\Rightarrow 12\left[n^2 - 3n + 2\right] = 5\left[n^2\ 3n + 2\right]$$

$$\Rightarrow 12n^2 - 36n + 24 = 5n^2\ 15n + 10$$

$$\Rightarrow 7n^2 - 51n + 14 = 0$$

$$\Rightarrow 7n^2 - 49n - 2n + 14 = 0$$

$$\Rightarrow 7n(n-7) - 2(n-7) = 0$$

$$\Rightarrow (n-7)(7n-2) = 0$$

$$\therefore n = 7 \text{ or } \frac{2}{7}$$

$$\therefore n = 7$$

(6) $\because \sqrt{\frac{x}{1-x}} + \sqrt{\frac{1-x}{x}} = \frac{13}{6}$

Let $t = \sqrt{\frac{x}{1-x}}$

$$\therefore t + \frac{1}{t} = \frac{13}{6}$$

$$\Rightarrow \frac{t^2+1}{t} = \frac{13}{6}$$

$$\Rightarrow 6t^2 + 6 = 13t$$

$$\Rightarrow 6t^2 - 13t + 6 = 0$$

$$\Rightarrow 6t^2 - 9t - 4t + 6 = 0$$

$$\Rightarrow 3t(2t-3) - 2(2t-3) = 0$$

$$\Rightarrow (2t-3)(3t-2) = 0$$

$$\therefore t = \frac{3}{2} \text{ (or) } \frac{2}{3}$$

Case (i)

$$\sqrt{\frac{x}{1-x}} = \frac{3}{2}$$

$$\frac{x}{1-x} = \frac{9}{4}$$

$$\Rightarrow 4x = 1-9x$$

$$13x = 1$$

$$x = \frac{1}{13}$$

Case (ii)

$$\sqrt{\frac{x}{1-x}} = \frac{2}{3}$$

$$\frac{x}{1-x} = \frac{4}{9}$$

$$\Rightarrow 9x = 4 - 4x$$

$$13x = 4$$

$$x = \frac{4}{13}$$

Section – B

III. (a) Choose the correct answer (12 × 2 = 24)

(1) If the co-efficient of correlation between x and y is ¾ and the standard deviation of x is 4 and standard deviation of y is 3, the covariance between x and y will be _____
(a) 9 (b) 6 (c) 7 (d) 8

(2) The middle most value of a frequency distribution table is known as
(a) Mean (b) Median (c) Mode (d) Range

(3) The Harmonic mean for the series 6, 5, 3, 6, 7, 10 and 12 is ……..
(a) 5.87 (b) 6.21 (c) 5.12 (d) 5.98

(4) If Median = 5, Quartile Deviation = 2.5 then the co-efficient of Quartile Deviation is _____
(a) 20 (b) 50 (c) 125 (d) 5

(5) What is the co-efficient of range for the following wages of 8 workers? ₹ 80, ₹ 65, ₹ 90, ₹ 60, ₹ 75, ₹ 70, ₹ 72, ₹ 85
(a) ₹ 30 (b) ₹ 20 (c) ₹ 30 (d) ₹ 20

(6) For a moderately skewed distribution of marks in statistics for a group of 100 students, the mean mark and median mark were found to be 50 and 40. What is the modal mark?
(a) 15 (b) 20 (c) 25 (d) 30

(7) If x and y satisfy the relationship y = -5 + 7x, the value of r is
(a) 0 (b) -1 (c) +1 (d) None

(8) When one regression co-efficient is positive, the other would be
(a) Negative (b) Positive (c) Zero (d) None of them

(9) The line $y = 13 - \frac{3x}{2}$ is the regression equation of
(b) y on x (b) x on y (c) both (d) none

(10) The odds in favour of one student passing a test are 3 : 7. The odds against another student passing at are 3 : 5. The probability that both pass is
(a) 7/16 (b) 21/80 (c) 9/80 (d) 3/16

(11) Probability of throwing an even number with an ordinary six faced dice is
(a) ½ (b) 0 (c) 1 (d) - ½

(12) If the relationship between two variables x and y is given by 2x + 3y + 4 = 0, then the value of the correlation co-efficient between x and y is
(a) 0 (b) 1 (c) -1 (d) Negative

III. (b) State whether the following statements are true or false (12 × 1 = 12)

(1) Mode is the value that has maximum frequency ( )

(2) The sum of deviation of individual observations from mean is zero ( )

(3) There is no difference between co-efficient of variation and variance ( )

(4) Median can never be equal to mean in a skewed distribution ( )

(5) If events are mutually exclusive then their probabilities are less than one ( )

(6) Sum of probability of an event A and its complements is 1 ( )

(7) If x and y satisfy the relationship y = -5 +7x, the value of r is zero ( )

(8) In the line $y = 19 - \frac{5x}{2}$, b_{yx} is equal to -5/2 ( )

(9) The slope of the regression line of y on x is b_{yx} ( )

(10) Two regression line coincide when r = 2 ( )

(11) In a moderately asymmetrical distribution A.M. < G.M. < H.M. ( )

(12) In a normal distribution SD > MD > QD ( )

Answer: III (a)

(1) (a)

(2) (b)

(3) (a)

(4) (b)

(5) (b)

(6) (b)

(7) (c)

(8) (b)

(9) (a)

(10) (d)

(11) (a)

(12) (c)

Answer: III (b)

(1) (T)

(2) (T)

(3) (F)

(4) (T)

(5) (F)

(6) (T)

(7) (F)

(8) (T)

(9) (T)

(10) (F)

(11) (T)

(12) (T)

IV. Answer any four questions. Each question carries 6 marks (4 × 6 = 24)

(1) Draw a histogram of the following frequency distribution showing the number of boys in the register of a school.

Age (in years)	No. of boys (in '000)
2-5	15
5-8	20
8-11	30
11-14	40
14-17	25
17-20	10

(2) Find A.M. of the following distributions:

	₹	c.f.		Marks	c.f.
(i)	less than 4	2	(ii)	More than 0 and above	10
	less than 8	6		More than 5 and above	8
	less than 12	13		More than 10 and above	5
	less than 16	18		More than 15 and above	1
	less than 20	20		More than 20 and above	0

(3) Find the standard deviation of the following series:

x	f
10	3
11	12
12	18
13	12
14	3
Total	48

(4) The following data gives the distribution of the total population and those who are totally or partially blind among them. Find out Karl Pearson's coefficient of correlation.

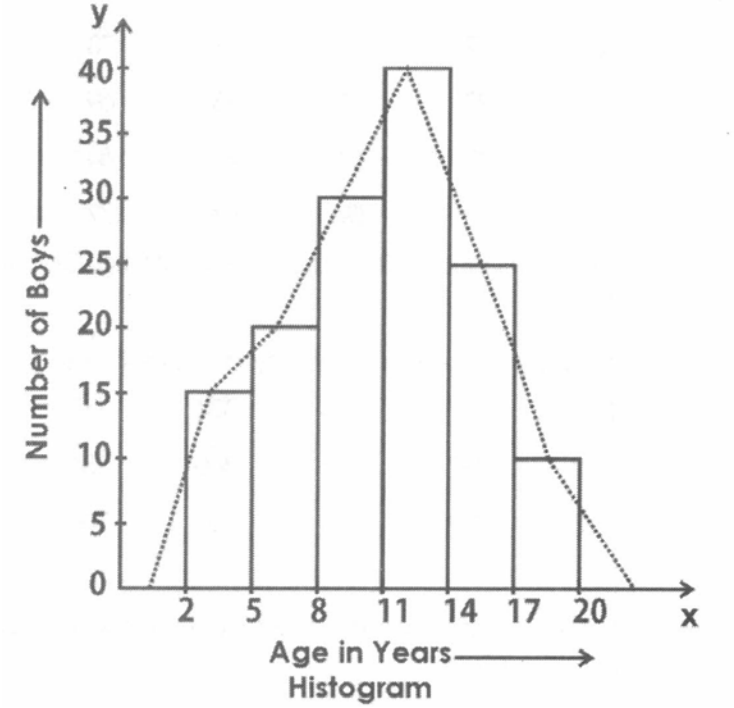
Age (in years)	No. of persons (in '000)	Blind
15	80	12
16	100	30
17	120	48
18	150	90
19	200	150
20	250	200

(5) By using the following data, find out the two lines of regression.
$\Sigma X = 250$, $\Sigma Y = 300$, $\Sigma XY = 7900$, $\Sigma X^2 = 6500$, $\Sigma Y^2 = 10000$, $N = 10$.

(6) Box I contains three defective and seven non-defective balls, and Box II contains one defective and nine non-defective balls. We select a box at random and then draw one ball at random from the box.
(a) What is the probability of drawing a non-defective ball?
(b) What is the probability of drawing a defective ball?

Answer: IV

(1) C. I. given are in class boundaries.



Histogram (when C.I. are uneqal): If the C.I. are unequal, the frequencies must be adjusted before constructing the histogram. Adjustments are to be made in respect of lowest C.I, For instance if one C.I. is wee as wide as the lowest C.I., then we are to divided the height of the rectangle by two and if again it is three times more, then we are to divide the height of the rectangle by three and so on.

Aliter (with the help of frequency density):

If the width of C.I. are equal, the heights of rectangles will be proportional to the corresponding class frequencies. But if the widths of C.I. are unequal (i.e. some are equal

and others are unequal), then the heights of rectangles will be proportional to the corresponding frequency densities (and not with the class frequencies)

$$\text{Frequency density} = \frac{\text{Class frequency}}{\text{Width of C.I}}$$

(2)

Table: Calculation of A. M.

₹	f	₹	**X**	f	d = (x-A)	fd
0-4	2	0 -4	2	2	-8	-16
4-8	4(= 6-2)	4 -8	6	4	-4	-16
8-12	7(=13-6)	8 -12	10 = (A)	7	0	0
12-16	5 (= 18-13)	12 -16	14	5	4	20
16-20	2 (= 20-18)	16 -20	18	2	8	16
		Total	—	20	—	4

Let A = 10

$$\bar{x} = A + \frac{fd}{f} = 10 + \frac{4}{20} = 10 + 0.2 = 0.2 = ₹10.2$$

Table: Calculation of A. M.

Marks	f	Marks.	X	f	d	D₹	Fd₹
0-5	2(=10-8)	0 -5	2.5	2	-5	-1	-2
5-10	3 (= 8 -5)	5 -10	7.5	3	0	0	0
10-15	4(=5-1)	10 -15	12.5	4	+ 5	1	4
15-20	1(=1-0)	15 -20	17.5	1	+ 10	2	2
	Total	—	10	—	—	4	

Let A = 7.5

$$\text{A. M.} = A + \frac{\sum fd`}{\sum f} \times i = 7.5 + \frac{4}{10} \times 5 = 7.5 + 2 = 9.5 \text{ marks.}$$

(3) Table: Calculation of standard deviation

Devn. From Ass. Mean (12)					
x	f	d	fd	d^2	fd^2
(1)	(2)	(3)	(4) = (2) × (3)	(5) = (3) × (3)	(6) (2) × (5)
10	3	-2	-6	4	12
11	12	-1	-12	1	12
12	18	0	0	0	0
13	12	1	12	1	12
14	3	2	6	4	12
Total	48		0		48

$$\sigma = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2} \quad = \sqrt{\frac{48}{48} - \frac{0}{48}} \quad = \sqrt{1} = 1$$

For (c) the following formula is used.

The idea will be clear from the example shown below:

Formula is, $\sigma = \sqrt{\frac{\sum fd'^2}{\sum f} - \left(\frac{\sum fd'}{\sum f}\right)^2} \times i$ where d' = Step deviation, i. = common factor.

(4) As we have to find out the correlation between the age of persons and the number of persons who are blinds, we find out percentage of blinds (i.e. blinds per 100 persons of population).

Taking age as X and blinds per 100 persons as Y

Table: Calculation of correlation coefficient

X	Y	x = X- 17.5	y = Y- 50	xy	X^2	Y^2
15	15	-2.5	-35	87.5	6.25	1225
16	30	-1.5	-20	30	2.25	400
17	40	-0.5	-10	5	0.25	100
18	60	0.5	10	5	0.25	100
19	75	1.5	25	37.5	2.25	625
20	80	2.5	30	75	6.25	900
ΣX = 105	ΣY= 300	ΣX = 0	Σ y = 0	Σxy = 24	ΣX^2=17.5	Σy^2 = 3350

$$\bar{x} = \frac{\sum X}{N} = \frac{105}{6} = 17.5$$

$$\bar{Y} = \frac{\sum Y}{N} = \frac{300}{6} = 50$$

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \ \sum y^2}}$$

$$r = \frac{240}{\sqrt{17.5 \times 3350}} = 0.99$$

There is very high positive correlation between the age of a person & blindne s.

(5) Regression line of X on Y is:

$$X - \bar{X} = b_{xy}\left(Y - \bar{Y}\right)$$

Where,

$$b_{XY} = \frac{N\sum XY - \sum X \sum Y}{N\sum Y^2 - (\sum Y)^2}, \bar{X} = \frac{\sum X}{N} \text{ and } \bar{Y} = \frac{\sum Y}{N}$$

$$\bar{X} = \frac{250}{10} 25 \text{ and } \bar{Y} = \frac{300}{10} = 30$$

$$b_{XY} = \frac{10\,(7900) - (250)(300)}{10\,(10000) - (300)^2} = 0.4$$

∴ Regression line of X on Y is

X – 25 = 0.4(Y – 30)

X = 0.4Y – 12+25

X = 0.4Y + 13

∴Regression line of Y on X is

$Y - \bar{Y} = b_{XY}\left(X - \bar{X}\right)$

$b_{YX} = \frac{N\sum XY - \sum X\sum Y}{N\sum X^2 - \left(\sum X\right)^2}$

$= \frac{10(7900) - (250)(300)}{10(6500) - (250)^2} = 1.6$

∴ REGRESSION LINE OF Y ON X IS

Y – 30 = 1.6 (X – 25

Y = 106 × -40 + 30

Y = 106 × -10

Now $r = \sqrt{b_{XY}} \times b_{YX}$

$= \sqrt{0.4 \times 1.6}$

= 0.8

(Since both b_{YX} and b_{XY} are positive)

(6) $P(B_1)$ or Probability that Box I is chosen $= \frac{1}{2}$ $P(B_1)$ or

Probability that Box I is chosen = $\frac{1}{2}$

$P(B_2)$ or Probability that Box II is chosen = ½

P(D) - Probability that a defective Ball is drawn P(ND) = Probability that a non-defective Ball is drawn Joint Probability

$\frac{1}{2} \times \frac{3}{10} = \frac{3}{20}$ $\frac{1}{2} \times \frac{1}{10} = \frac{1}{20}$

$\frac{1}{2} \times \frac{7}{10} = \frac{7}{20}$ $\frac{1}{2} \times \frac{9}{10} = \frac{9}{20}$

(a) P (ND) = P (Box I and non- defective) + P (Box II non- defective)

$= \left(\frac{1}{2} \times \frac{7}{10}\right) + \left(\frac{1}{2} \times \frac{9}{10}\right) = \frac{16}{20}$

(b) P (D) = P (Box I and defective) + /P (Box II defective)

$= \left(\frac{1}{2} \times \frac{3}{10}\right) + \left(\frac{1}{2} \times \frac{1}{10}\right) = \frac{4}{20}$