Paper 4-Fundamentals of Business Mathematics and Statistics

SET - I

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

Section – A
(Fundamentals of Business Mathematics)

I. Answer any two questions. Each question carries 5 marks [2 × 5 = 10]

(1) Suppose your mom decides to gift you `10,000 every year starting from today for the next five years. You deposit this amount in a bank as and when you receive and get 10% per annum interest rate compounded annually. What is the present value of this annuity?

Answer:

Gift money given by mom (p) = Rs. 10,000/-
n = 5 years, i = 10%
Future value of Annuity Immediate

$$F.V_{(I)} = \frac{P}{i}\left[(1+i)^n - 1\right](1+i)$$

$$= \frac{10000}{0.10}\left[(1+0.10)^5 - 1\right](1+0.10)$$

$$= \frac{10000}{0.10}(0.61051)\ (1.1)$$

$$= ` 67,156.10$$

∴ Present value of Annuity Immediate,

$$P.V_{(I)} = \frac{F' V_{(I)}}{(1+i)^n}$$

$$= \frac{67,156.10}{(1.1)^5}$$

$$= \frac{67,156.10}{1.6105}$$

$$= ` 41,698.98$$

(2) Solve $y + z = x^{-1}$, $z + x = y^{-1}$, $x + y = z^{-1}$

Answer:

$y + z = x^{-1}$	$y + z = y^{-1}$	$x + y = z^{-1}$
$\Rightarrow y + z = \frac{1}{x}$	$\Rightarrow z + x = \frac{1}{y}$	$\Rightarrow x + y = \frac{1}{z}$
$\Rightarrow xy + xz = 1 \longrightarrow (1)$	$\Rightarrow yz + xy = 1 \longrightarrow (2)$	$\Rightarrow xz + yz = 1 \longrightarrow (3)$

By doing (1) + (2) + (3) we set
$2(xy + yz + zx) = 3$

$\Rightarrow$ $xy + yz + zx = \frac{3}{2} \longrightarrow (1)$

From (4)

$xy = \frac{3}{2} - (yz + zx)$ Similarly, $yz = \frac{1}{2}$, $zx = \frac{1}{2}$

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

Now $(xy)(yz)(zx) = (\frac{1}{2})(\frac{1}{2})(\frac{1}{2}) = \frac{1}{8}$ (1)

$(xyz)^2 = \frac{1}{8}$

$\therefore xyz = \pm \frac{1}{2\sqrt{2}}$

(3) The total cost function of a firm is $c = \frac{1}{3}x^3 - 3x^2 + 10x + 10$ where c is the total cost and x is output.

A tax at the rate of ` 2 per unit of output is imposed and the producer adds it to his cost. If the market demand function is given by *p* = 2512 – 3x, where *p* is the price per unit of output. Find the profit maximizing output and hence the price.

Answer:

Given total cost function of a firm is

$c = \frac{1}{3}x^3 - 3x^2 + 10x + 10 + 2x$

$= \frac{1}{3}x^3 - 3x^2 + 12x + 10$

Given demand function.

$P = 2512 - 3x$ P = Price, x = Output

$\therefore$ Revenue (R) = Px

$= (2512 - 3x)\,x$

$= 2512x - 3x^2$

For Maximum profit, MR = MC

$\Rightarrow \frac{dR}{dx} = \frac{dc}{dx}$

$\Rightarrow 2512 - 6x = \frac{1}{3}(3x^2) - 3(2x) + 12$

$\Rightarrow 2512 - 6x = x^2 - 6x + 12$

$x^2 = 2500$

$x = \oplus 2500 = 50$ units

Price (P) = 2512 – 3x = 2512 – 3 (50)

= 2512 – 150

= ` 2362

II. Answer any two questions. Each question carries 3 marks [2 × 3 = 6]

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

Answer:

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

⇨ $2\oplus a - 2\oplus b = \oplus a + \oplus b$

⇨ $\oplus a = 3\oplus b$

S.O.B.S $\boxed{a = 9b}$

L.H.S. $= \frac{a^2+ab+b^2}{a^2-ab+b^2} = \frac{81b^2+9b^2+b^2}{81b^2-9b^2+b^2} = \frac{91b^2}{73b^2} = \frac{91}{73}$

2. Solve $(\oplus 5)^{4x-4} - 5^{2x-3} = 20$.

Answer:

Given equation is $(\oplus 5)^{4x-4} - 5^{2x-3} = 20$

⇨ $5^{\frac{4x-4}{2}} - 5^{2x-3} = 20$

⇨ $5^{2x-2} - 5^{2x-3} = 20$

⇨ $5^{2x}\left(\frac{1}{25} - \frac{1}{125}\right) = 20$

⇨ $5^{2x}\left(\frac{5-1}{125}\right) = 20$

⇨ $5^{2x}\left(\frac{4}{125}\right) = 20$

⇨ $5^{2x} = 625 = 5^4$

$\therefore 2x = 4$

$x = 2$

3. If $y = \log\left(x + \sqrt{x^2+a^2}\right)$ then find $(a^2 + x^2)\, y_2 + xy_1$

Answer:

Given $y = \log\left(x + \sqrt{x^2+a^2}\right)$

Diff w.r. to x.

$\frac{dy}{dx} = \frac{1}{x+\sqrt{x^2+a^2}} \cdot 1 + \frac{1}{2\sqrt{x^2+a^2}} \cdot 2x$

$= \frac{1}{x+\sqrt{x^2+a^2}} \cdot \left(1 + \frac{x}{\sqrt{x^2+a^2}}\right)$

$= \frac{1}{x+\sqrt{x^2+a^2}} \cdot \frac{x+\sqrt{x^2+a^2}}{\sqrt{x^2+a^2}}$

$= \frac{1}{\sqrt{x^2+a^2}}$

$y_1\sqrt{x^2+a^2} = 1$

S.O.B.S.

$y_1^2 (x^2 + a^2) = 1$

$y_1^2 (2x) + (a^2 + x^2)\, 2y_1 y_2 = 0$

⇨ $2y_1[(a^2 + x^2)y_2 + xy_1 = 0$

⇨ $(a^2 + x^2)y_2 + xy_1 = 0$

III. Choose the correct answer **[5 ×1 = 5]**

1. Some money is distributed between A and B in the ratio 2:3. If A receives `72 then B receives –

(a) ` 90

(b) ` 144

(c) ` 108

(d) None of these

Answer:

2x, 3x.

2x = ` 72

X = ` 36

∴ B = 3x = (3) (36) = Rs. 108. (Option: c)

2. Set of even positive integers less than equal to 6 by selector method.

(a) {x / < 6}

(b) {x/x = 6}

(c) {x/x ≤ 6}

(d) None of these

Answer:

{x/x ≤ 6} (Option: c)

3. $\frac{1}{\log_a bc + 1} + \frac{1}{\log_b ca + 1} + \frac{1}{\log_c ab + 1}$ **is equal to _____**

(a) 1

(b) 2

(c) 3/2

(d) None of these

Answer:

$$\frac{1}{\log_a bc + \log_a a} + \frac{1}{\log_b ca + \log_b b} + \frac{1}{\log_c ab + \log_c c}$$

$$= \frac{1}{\log_a abc} + \frac{1}{\log_b abc} + \frac{1}{\log_c abc}$$

$$= \log_{abc} a + \log_{abc} b + \log_{abc} c$$

$$= \log_{abc} abc$$

= 1 (Option: a)

4. f(x) = 2x -1,
fx1 is continuous at x = ____
(a) 0
(b) -1
(c) 2
(d) None of these

Answer:

L.H.L = $\lim_{x \to 0^-} 2x - 1' 1 = \lim_{x \to 0^-} 3x = 0.$

R.H.L = $\lim_{x \to 0^+} 2x - 1' 1 = \lim_{x \to 0^+} x = 0.$

∴ L.H.L = R.H.L
Continuous at x = 0 (Option: a)

5. $\int \frac{dx}{x \log x}$ **= ___**
(a) logx
(b) $\frac{1}{\log x}$
(c) $\frac{1}{\log (\log x)}$
(d) log (log x)

Answer:

$\int \frac{dx}{x \log x}$ Let $t = \log x$

$= \int \frac{dt}{t}$ $\frac{dt}{dx} = \frac{1}{x}$

= log 1 logx1 $dt = \frac{dx}{x}$ (Option: d)

IV. Fill in the blanks **[5 × 1 = 5]**

1. The C.I on a certain sum of money for 2 years at 8% p.a. compounded annually is ` 1040. The sum is _____

Answer:

Let the certain sum be Rs. P.
I = 8% p.a. n = 2 years, C.I. = Rs. 1040.

$C.I. = P\left[(1+i)^n - 1\right]$

$\Rightarrow C.I. = P\left[(1+\frac{8}{100})^2 - 1\right]$

$= P[(1.08)^2 - 1]$
$= P\ (0.1664)$

$\therefore P = \frac{1040}{0.1664} = ` 6250.$

2. If 3, x, 27 are in continued proportion then x = _____

Answer:

Given 3, x, 27 are in continued proportion
i.e., $x^2 = 3(27) = 81$
$x = \pm 9$

3. If A and B are two sets then A ∩ (B – A) is _____

Answer:

$A \cap (B - A) = \phi$.

4. If $\begin{bmatrix} 2 & 1 & 4 \\ 1 & 0 & 3 \end{bmatrix}$ then a_{22} = _____

Answer:

Given $A = \begin{bmatrix} 2 & 1 & 4 \\ 1 & 0 & 3 \end{bmatrix}$

$\therefore a_{22} = 0$

5. If $y = (\sqrt{x} + 1)^2$ then $\frac{dy}{dx}$ = _____

Answer:

Given $y = (\sqrt{x} + 1)^2$
Diff. w.r. to x

$$\frac{dy}{dx} = 2(\sqrt{x} + 1) \cdot \frac{1}{2\sqrt{x}}$$

$$\frac{dy}{dx} = 1 + \frac{1}{\sqrt{x}}$$

V. State whether the following statements are true or false [5 × 1 = 5]

1. If the ratio of two positive numbers is 4:5 and their L.C.M is 140 then the numbers are 35, 45.

Answer:

L.C.M. of 35, 45 is 315.
$\therefore$ The statement is False. (F)

2. The number of different words that can be formed from the letters of the word "TRIANGLE" so that no two vowels come together is 36000.

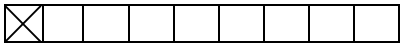
Answer:

Given the word : TRIANGLE.
Total No. of arrangements = 8!.
No. of vowels come together = 6!3!
Required Permutation = 8! – 3!6!
= 40320 – 4320
= 36000. (T)

3. The total number of 9 digits numbers which have all different digits is $9 \times \underline{|9}$.

Answer:

The different digits are, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9



The total no. of 9 digits numbers which have all different digits = $9 \times 9_{8p}$ = $9 \times \underline{|9}$. (T)

4. $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ is called singular matrix if ac – bd = 0.

Answer:

$\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ is called singular

$\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ = ad = bc = 0. But given that ac – bd = 0. (F)

5. f and g are two continuous functions of their common domain D then f – g is continuous.

Answer:

According to properties of continuous function, f and g are two continuous function of their common domain D then, (f – g) is continuous. (T).

VI. Match the following **[5 × 1 = 5]**

1.	If $\frac{a}{5} = \frac{b}{4} = \frac{c}{9}$ then $\frac{a+b+c}{c}$ = _____	A	3 × 2
2.	$(A^c)^c$	B	7
3.	The order of a matrix is 2 × 3 then order of its transpose is ____	C	$\frac{1}{2}\log\frac{19}{7}$
4.	${}^nC_{n-2} = 21$ then n = _____	D	A
5.	$\int_2^8 \frac{dx}{2x+3}$ = _____	E	2

Answer:

1.	Let $\frac{a}{5}=\frac{b}{4}=\frac{c}{9}=k$ (say) $\therefore$ a = 5k, b = 4k, c = 9k $\therefore \frac{a+b+c}{c}=\frac{18k}{9k}=2$	E	2
2.	$(A^c)^c = A$	D	A
3.	3 × 2	A	3 × 2
4.	${}^{n}C_{n-2} = 21$ $\Rightarrow \frac{\lfloor n}{\lfloor 2 \lfloor n-2}=21$ $\Rightarrow \frac{n(n-1)(n-2)!}{(n-2)!}=42$ $\Rightarrow$ n(n – 1) = 7 × 6 $\therefore$ (n = 7)	B	7
5.	$\int_2^8 \frac{dx}{2x+3}=\frac{1}{2}\int_2^8 \frac{2}{2x+3}dx$ $=\frac{1}{2}\log\lvert 2x+3\rvert\Big\rvert_2^8$ $=\frac{1}{2}$ [log 19 – log 7] $=\frac{1}{2}\log\frac{19}{7}$	C	$\frac{1}{2}\log\frac{19}{7}$

VII. Answer the following in one (or) two steps **[4 × 1 = 4]**

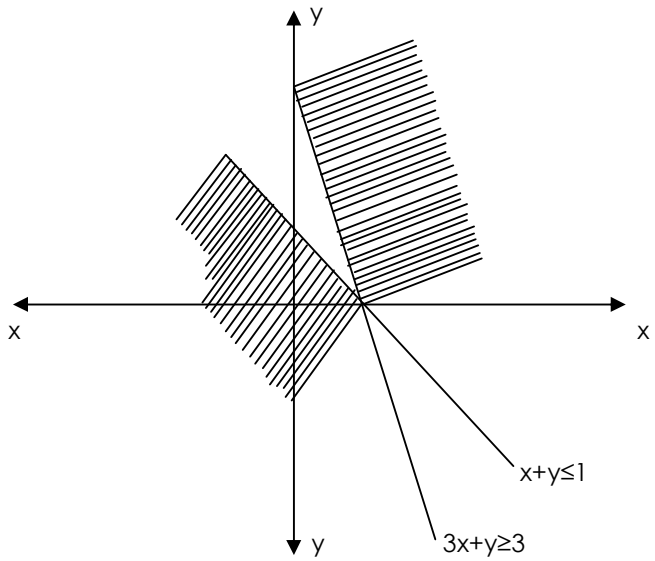
1. **Construct the truth table for "$p \rightarrow q$".**
2. **Draw the graph of $x + y \leq 1$, $3x + y \geq 3$ $x \geq 0$, $y \geq 0$**
3. **In a class each student plays either Cricket (or) Foot Ball. If 50 students plays football, 30 students play Cricket while 15 students play both, then find number of students in a class.**
4. **Evaluate $\lim_{x \to 12} \frac{x-12}{x^2-144}$**

Answer:

1. Truth table for "$p \rightarrow q$".

P	q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

2. Given in equations $x + y \le 1$, $3x + y \ge 3$, $x \ge 0$, $y \ge 0$.



3. Let the students who play cricket be 'C' and who play football be F.

   $n(F) = 50$. $N(c) = 30$, $n(F \cap C) = 15$.

   $\therefore$ No. of students in the class is

   $n(F \cup C) = n(F) + n(c) - n(F \cap C)$

   $= 50 + 30 - 15$

   $= 80 - 15$

   $n(F \cup C) = 65$

4. $\lim_{x \to 12} \frac{x-12}{x^2-144} = \frac{0}{0}$ (Indetermine form)

   $= \lim_{x \to 12} \frac{(x-12)}{(x+12)(x-12)} = \frac{1}{12+12} = \frac{1}{24}$

Section – B
(Fundamentals of Business Statistics)

VIII. Answer any Nine questions of the following. Each question carries 2 marks [9 × 2 = 18]

1. **The number of accidents for seven days in a locality are given below:**

C	0	1	2	3	4	5	6
Frequency	15	19	22	31	9	3	2

What is the number of cases when 3 or less accident occurred?
   a) 56
   b) 6
   c) 68
   d) 87
2. **What is the HM of 1, ½, 1/3, …. 1/n?**
   a) n
   b) 2n
   c) $\frac{2}{(n+1)}$
   d) $\frac{n(n+1)}{2}$
3. **If the median of 5, 9, 11, 3, 4, x, 8 is 6, the value of x is equal to**
   a) 6
   b) 5
   c) 4
   d) 3
4. **If x and y are related by x-y-10=0 and mode of x is known to be 23, then the mode of y is**
   a) 20
   b) 13
   c) 3
   d) 23
5. **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
6. **If median = 12, Q_1 = 6, Q_3 = 22 then the coefficient of quartile deviation is**
   a) 33.33
   b) 60
   c) 66.67
   d) 70
7. **If the quartile deviation of x is 8 and 3x + 6y = 20, then the quartile deviation of y is**
   a) -4
   b) 3
   c) 5
   d) 4

8. The sum of the difference of rank is
- **a) 1**
- **b) -1**
- **c) 0**
- **d) None**

9. If r = 0.6 then the coefficient of non-determination is
- **a) 0.4**
- **b) -0.6**
- **c) 0.36**
- **d) 0.64**

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 fall is
- **a) 7/16**
- **b) 21/80**
- **c) 9/80**
- **d) 3/16**

11. What is the probability that a leap year selected at random would contain 53 Saturdays?
- **a) 1/7**
- **b) 2/7**
- **c) 1/12**
- **d) ¼**

12. A and B are two events such that P(A) = 1/3, P(B)=1/4, P(A+B)=1/2 then P(B/A) is equal to
- **a)** $\frac{1}{4}$
- **b) 1/3**
- **c) ½**
- **d) none of these**

Answer:

1. d
2. c
3. a
4. b
5. b
6. b
7. d
8. c
9. d
10. b
11. b
12. a

IX. Answer any nine questions of the following. Each question carries 2 marks [9 × 2 = 18]

1. Find the third decile for the numbers 15, 10, 20, 25, 18, 11, 9, 12.

2. What is the modal value for the numbers 4, 3, 8, 15, 4, 3, 6, 3, 15, 3, 4.

3. **A class of 40 students has an average of 56 marks in Math exam. But later on it was found that terms 48, 54 and 67 were misread as 68, 45 and 87. Find correct mean.**
4. **If for two numbers, the mean is 25 and the Harmonic mean is 9, what is the geometric mean?**
5. **In a Moderately Asymmetrical Distribution Compute M.D. and S.D. Given Q.D. = 50**
6. **Three series with equal terms and equal Mean have S.D.'s 6, 7, 8; Find combined S.D.**
7. **For a moderately skewed distribution, arithmetic mean = 160, mode = 157 and standard deviation = 50, Find Karl Pearson coefficient of Skewness.**
8. **If two regression coefficients are 0.8 and 1.2 then what would be the value of coefficient of correlation?**
9. **A dice is rolled. What is the probability that a number 1 or 6 may appear on the upper face?**
10. **4 coins are tossed. Find the probability that at least one head turns up.**
11. **If P(A)=1/4, P(B) = 1/2, P(AUB) = 5/8, then P(A∩B) is:**
12. **The probability that a number selected at random from the set of numbers {1,2,3,….,100} is a cube is:**

Answer:

1. Given series 15, 10, 20, 25, 18, 11, 9, 12
   Ascending order:
   9, 10, 11, 12, 15, 18, 20, 25
   N = no. of terms
   3rd Decile = D_3 $= 3\left(\frac{n+1}{10}\right)^{th}$ term
   $= 3\left(\frac{8+1}{10}\right)^{th}$ term
   $= 3\left(\frac{9}{10}\right)^{th}$ term
   $= 2.7^{th}$ term
   = 2nd term + 0.7 (3rd term – 2nd term)
   = 10 + 0.7 (11 – 10)
   = 10 + 0.7
   = 10.7

2. Given series 4, 3, 8, 15, 4, 3, 6, 3, 15, 3, 4
   Mode = 3
   Note: The most frequent occurring term is nothing but modal value.

3. Total of 40 terms = 56 × 40 = 2240
   Correct terms = 48 + 54 + 67 = 169
   Incorrect terms = 68 + 45 + 87 = 200
   ∴ Correct Total = Incorrect total + correct terms – Incorrect terms
   = 2240 + 169 – 200
   = 2209.
   Correct Mean $= \frac{\text{Correct Total}}{\text{No. of terms}}$
   $= \frac{2209}{40}$

= 55.2225.

4. Given A.M. = 25
H.M. = 9
G.M. = $\sqrt{(A.M.)(H.M.)} = \sqrt{25 \times 9} = \sqrt{225}$
G.M. = 15.

5. Given Q.D. = 50
Now S.D. = $\frac{3}{2}$(Q.D.)
= $\frac{3}{2}(50)$
= 75
M.D. = $\frac{4}{5}$(S.D.)
= $\frac{4}{5}(75)$
= 60.

6. Given S.D's = 6, 7, 8
Given that terms and Means are equal.
$\therefore \quad \sigma = \sqrt{\frac{\sigma_1^2 + \sigma_2^2 + \sigma_3^2}{\text{Ç}}}$
$\sigma = \sqrt{\frac{(6)^2 + (7)^2 + (8)^2}{3}}$
$\sigma = \sqrt{\frac{36 + 49 + 64}{3}}$
$\sigma = \sqrt{49.66}$
$\sigma = 7.04$

7. Given Mean = 160
Mode = 157
S.D. = 50
Now Karl Pearson Coe. of Skewness = S_{KP}
$S_{KP} = \frac{\bar{x} - z}{\sigma}$
= $\frac{160 - 157}{50}$
= $\frac{3}{50}$
= 0.06.

8. Given $b_{xy} = 0.8$
$b_{yx} = 1.2$
Now Coe. of correlation = r

$r = \sqrt{b_{xy} \times b_{yx}}$

$r = \sqrt{(0.8)(1.2)}$

$r = \sqrt{0.96}$ $\quad r = 0.98.$

9. The probability of getting I on upper face of die is

$P(I) = 1/6$

The Probability of getting 6 on upper face of die is

$P(6) = 1/6$

Now probability of getting 1 or 6 on upper face of die

$P(1 \cup 6) = 1/6 + 1/6$

$= 2/6.$

10. When 4 coins are tossed.

$\cap(s) = 2^4 = 16$

Probability of getting all: tails is

$P(TTTT) = 1/16$

Probability of getting atleast one head is P(A)

$P(A) = 1 - 1/6$

$= 15/16.$

11. $P(A) = ¼$ $\quad P(B) = ½$ $\quad P(A \cup B) = 5/8$

$P(A \cap B) = P(A) + P(B) - P(A \cup B)$

$= ¼ + ½ - 5/8$

$= \frac{2+4-5}{8} = 1/8.$

12. Given $\cap(s) = \{1, 2, 3, \ldots\ldots\ldots\ldots 100\}$

$\cap(s) = 100$

Now probability of getting selected number is a cube is P(A).

Now $\cap(A) = \{1^3, 2^3, 3^3, 4^3\}$

$\cap(A) = \{1, 8, 27, 64\}$

$\cap(A) = 4$

$\therefore P(A) = \frac{Ç(A)}{Ç(S)}$

$= \frac{4}{100}$

$= \frac{1}{25}$

X. Answer any FOUR of the following questions **[4 × 6 = 24]**

1. Construct Histogram and frequency polygon from the following data:

Profit (`)	0-10	10-20	20-30	30-40	40-50	50-60
No. of shops	12	18	27	24	10	6

2. Find mode

Class interval	below 10	10-15	15-20	20-25	25-30	above 30
Frequency	21	47	67	89	55	21

3. Compute co-efficient of Standard Deviation from the following data:

X	0-10	10-20	20-30	30-40	40-50
F	5	15	30	65	80

4. Given the bivariate data

X	2	6	4	3	2	2	8	4
Y	7	2	1	1	2	3	2	6

Find Co-efficient of Correlation.

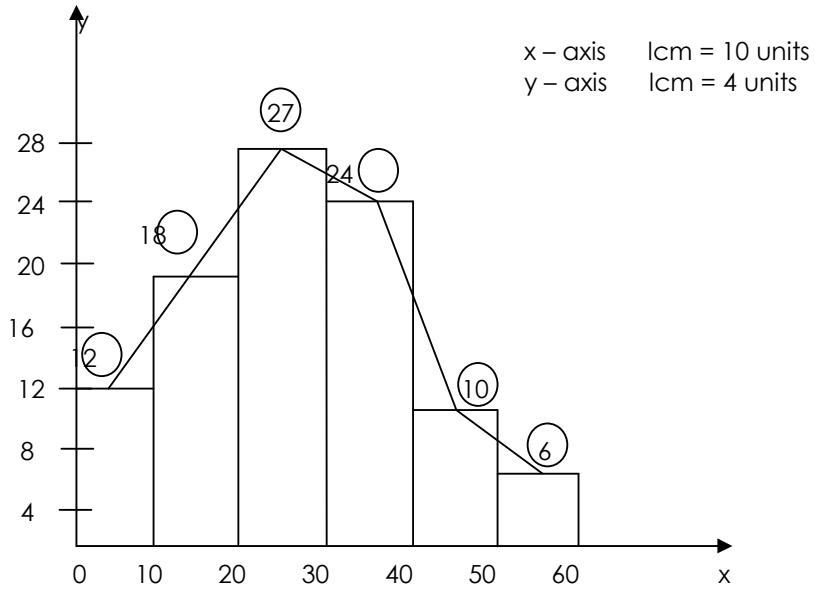
5. Compute i) Laspeyre's, ii) Paasche's iii) Dorbish and Bowley's Price Index Numbers for the following data:

Commodity	2002		2003	
	Price	Quantity	Price	Quantity
A	5	10	4	12
B	8	6	7	7
C	6	3	5	4

6. Two students X and Y work independently on a problem. The probability that X will solve it is (3/4) and the probability that Y will solve it is (2/3). What is the probability that the problem will be solved?

Answer:

1.



2. GROUPING TABLE:

Class Interval	I	II	III	IV	V	VI
5 - 10	2	49				
10 - 15	47			116		
15 - 20	67 f_0	(156)	114		(203)	
20 - 25	89 f_1		(144)			(211)
25 - 30	55 f_2	76		(165)		
30 - 35	21					

ANALYSIS TABLE:

Class Interval	I	II	III	IV	V	VI	Total
5 - 10							0
10 - 15					X		1
15 - 20		X			X	X	3
20 - 25	x	x	X	X	x	X	6
25 - 30			x	X		x	3
30 - 35				x			1

l = 20, c = 5, f_1 = 89, f_0 = 67, f_2 = 55

Mode $= l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times c$

$= 20 + \frac{89 - 67}{178 - 67 - 55} \times 5$

= 21.964.

3.

x	f	m	fm	$dx = m - \bar{x}$	dx^2	fdx^2
0 – 10	5	5	25	- 30.26	915.67	4578.35
10 – 20	15	15	225	- 20.26	410.47	6157.05
20 – 30	30	25	750	- 10.26	105.27	3158.1
30 – 40	65	35	2275	- 0.26	0.068	4.42
40 – 50	80	45	3600	9.74	94.87	7589.4
	195		6875			21487.33

$\bar{x} = \frac{\sum fm}{\sum f}$

$= \frac{6875}{195}$

= 35.26

S. D. $= \sqrt{\frac{\sum fdx^2}{\sum f}}$

$$= \sqrt{\frac{21487.33}{195}}$$

$$= \sqrt{110.19}$$

$$= 10.49$$

$$\text{Coe. of S. D.} = \frac{SD}{\bar{x}}$$

$$= \frac{10.49}{35.26}$$

$$= 0.2975$$

4.

x	y	$x = x - \bar{x}$	$y = y - \bar{y}$	x^2	y^2	xy
2	7	- 1.875	4	3.52	16	-7.5
6	2	2.125	-1	4.52	1	-2.125
4	1	0.125	-2	0.015	4	-0.25
3	1	0.875	-2	0.765	4	-1.75
2	2	- 1.875	-1	3.515	1	1.875
2	3	- 1.875	0	3.515	0	0
8	2	4.125	-1	17.01	1	-4.125
4	6	0.125	3	0.015	9	0.375
31	24			32.87	36	-13.5

$\bar{x} = \frac{31}{8} = 3.875$ $\quad \bar{y} = \frac{24}{8} = 3$

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

$$r = \frac{-13.5}{\sqrt{(32.87)(36)}}$$

$$r = \frac{-13.5}{34.39}$$

$r = - 0.39.$

5.

P_0	Q_0	P_1	Q_1	P_0Q_0	P_1Q_1	P_0Q_1	P_1Q_1
5	10	4	12	50	40	60	48
8	6	7	7	48	42	56	49
6	3	5	4	18	15	24	20
				116	97	140	117

$$\text{Laspeyre's} = \frac{\sum p_1q_0}{\sum p_0q_0}$$

$$= \frac{97}{116} \times 100$$

$$= 83.62$$

$$\text{Pasche's} = \frac{\sum p_1q_1}{\sum p_0q_1} \times 100$$

$$= \frac{117}{140} \times 100$$

$$= 83.57$$

Dorbish & Bowley's $= \frac{L + P}{2}$

$$= \frac{83.62 + 83.57}{2}$$

$$= \frac{167.19}{2}$$

$$= 83.595.$$

6. Given $P(x) = ¾$

$P(y) = 2/3$

$P(x \cup y) = ?$

Given x, y are independent terms

$P(x \cup y) = P(x) + P(y) - P(x) \times P(y)$

$$= \frac{3}{4} + \frac{2}{3} - \frac{3}{4} \times \frac{2}{3}$$

$$= \frac{9 + 8 - 6}{12}$$

$$= \frac{9}{12}$$

$$= \frac{3}{4}.$$