Paper 4-Fundamentals of Business Mathematics and Statistics

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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?**
2. **A sum of money invested at C.I payable yearly amounts to ₹10,816 at the end of the second year and to ₹ 11,248.64 at the end of the third year. Find the rate of interest and the sum.**
3. **Solve $y + z = x^{-1}$, $z + x = y^{-1}$, $x + y = z^{-1}$**

Answer:

1. ∵ Gift money given by mom (p) = ₹ 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,

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

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

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

= ₹ 41,698.98

2. Let the sum be Rs. P and rate of interest be i%.
∵ A_1 = 10,816 (₹) A_2 = ₹ 11,248.64, n = 1
C.I. = $A_2 - A_1$ = 11,248.64 – 10,816
= ₹ 432.64.

∵ C.I. = $P[(1+i)^n-1]$
=> 432.64 = $10,816\ [(1+i)^n-1]$
=> $0.04 = (1+i)^1 - 1$
=> $1 + i = 1.04$

$$i = 1.04 - 1 = 0.04 \times 100 = 4\%$$

∵ A = $P[(1+i)^n-1]$

$\Rightarrow 10,816 = P\left(1 + \frac{4}{100}\right)^2$

$= P\,(1.04)^2$

$= P\,(1.0816)$

$\because \quad P = \frac{10816}{1.0816} = ₹\ 10,000.$

3.

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

By doing (1) + (2) + (3) we set

$2(xy + yz + zx) = 3$

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

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 $(xy)\,(yz)\,(zx) = \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = \frac{1}{8}$ (1)

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

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

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

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

5. What sum of money will produce ₹ 28,600 as an interest in 3 years and 3 months at 2.5% p.a. simple interest?

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

Answer:

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

Diff w.r. to x.

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

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

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

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

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

S.O.B.S.

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

$y_1^2 (2x)+(a^2+x^2)\, 2y_1y_2 = 0$

$\Rightarrow \quad 2y_1[(a^2+x^2)y_2 + xy_1 = 0$

$(a^2+x^2)y_2 + xy_1 = 0$

5. Let the sum be ₹ P.

Given S.I. = ₹ 28,600, r = 2.5% p.a. S.I.

t = 3 years 3 months

$= 3\frac{3}{12} = 3\frac{1}{4}$ years

$\because \quad$ S.I. $= \frac{prt}{100}$

$\Rightarrow \quad 28{,}600 = P \times \frac{2.5}{100} \times \frac{13}{4}$

$\therefore \quad P = \frac{28600 \times 100 \times 4}{13 \times 2.5} =$ ₹ 3,52,000.

$\therefore \quad$ The required sum be ₹ 3,52,000.

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

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

$\Rightarrow \quad 5^{2x-2} - 5^{2x-3} = 20$

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

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

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

$\Rightarrow \quad 5^{2x} = 625 = 5^4$

$\therefore 2x = 4$

$x = 2$

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

7. $\left[\log\left(\frac{a^2}{bc}\right)+\log\left(\frac{b^2}{ac}\right)+\log\left(\frac{c^2}{ab}\right)\right]$ **is equal to -**

(a) 0

(b) 1

(c) 2

(d) abc

8. The ratio $\frac{5}{3}:2\frac{1}{4}$ is -

(a) ratio of lesser inequality
(b) ratio of greater inequality
(c) 20 : 9
(d) 5 : 27

9. f(x) = 2x - 1 x 1 is continuous at x = ____

(a) 0
(b) -1
(c) 2
(d) None of these

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

(a) 1
(b) 2
(c) 3/2
(d) None of these

11. $\int \frac{dx}{x\log x}$ = ___

(a) logx
(b) $\frac{1}{\log x}$
(c) $\frac{1}{\log(\log x)}$
(d) log (log x)

Answer:

7. $\left[\log\left(\frac{a^2}{bc}\right)+\log\left(\frac{b^2}{ca}\right)+\log\left(\frac{c^2}{ab}\right)\right]$

$= \log\left(\frac{a^2}{bc}\right)\times\left(\frac{b^2}{ca}\right)\times\left(\frac{c^2}{ab}\right)$

$= \log\left(\frac{a^2b^2c^2}{a^2b^2c^2}\right)$

$= \log 1 = 0$ (Option : a)

8. The ratio $\frac{5}{3}:2\frac{1}{4}$

$= \frac{5}{3}:\frac{9}{4}$

$= \frac{5}{3}(12):\frac{9}{4}(12)$

$= 20 : 27$

Here $20 < 27$

$\therefore$ Ratio of lesser inequality. (Option : a)

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

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

$\therefore$ L.H.L = R.H.L

Continuous at x = 0 (Option: a)

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

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

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

$= \log_{abc} abc$

= 1 (Option: a)

11. $\int \frac{dx}{x \log x}$ 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]**

12. $\left(\frac{1}{2} + \frac{1}{3}\right) : \left(\frac{1}{2} \times \frac{1}{3}\right)$ = _____

13. If A and B are two disjoint sets then x (A ∪ B) is equal to ____

14. If $64^x = 2\sqrt{2}$ then x = _____

15. There are 10 points in a plane and among then 4 are collinear. The total number of triangles formed by joining them is ____

16. ∫ logx dx = _____

Answer:

12. $\left(\frac{1}{2} + \frac{1}{3}\right) : \left(\frac{1}{2} \times \frac{1}{3}\right)$

$= \left(\frac{3+2}{6}\right) : \left(\frac{1}{6}\right)$

$= \frac{5}{6} : \frac{1}{6}$

= 5 : 1

13. Given A and B are two disjoint sets then
n(A ∪ B) = n(A) + n (B) – n (A ∩ B).

14. $\therefore \quad 64^x = 2\sqrt{2}$

$\Rightarrow \left[\left(2\sqrt{2}\right)^4\right]^x = \left(2\sqrt{2}\right)^1$

$\Rightarrow (2\sqrt{2})^{4x} = (2\sqrt{2})^1$

$\therefore \quad 4x = 1$

$x = 1/4.$

15. Required No. of Triangle

$= {}^{10}C_3 : {}^4C_3$

$= \frac{\lfloor 10}{\lfloor 7 \lfloor 3} - \frac{\lfloor 4}{\lfloor 3 \lfloor 1} = \frac{10 \times 9 \times 8 \times \lfloor 7}{\lfloor 7 \lfloor 3} - 4$

$= \frac{10 \times 9^3 \times 8^4}{6_3} - 4$

$= 120 - 4$

$= 116.$

16. $\int \log x \, dx = x\log x - x + c.$

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

17. The fourth proportional of ₹ 5, ₹ 3.50, 150gm is 125gms.

18. The statement "I am hungry I will eat something" is true or false.

19. The statement {2} ∈ {2, 3, 5} is true or false.

20. The decimal part of the value of logarithm of a number is called mantissa.

21. $\int_0^1 e^x dx = e + 1$

Answer:

17. ₹ 5, ₹ 3.50, 150gms, d is 125 gm

a b c d

$\because \quad \frac{5}{3.5} = \frac{150}{d}$

$\Rightarrow \quad \frac{50}{35} = \frac{150}{d}$

$\Rightarrow \quad \frac{10}{7} = \frac{150}{d}$

$\Rightarrow \quad d = \frac{150 \times 7}{10} = 105$ gm.

$\therefore$ The given statement is False. (F)

18. The given statement is true. (T)

19. The statement {2} ∈ {2, 3, 5} is False (F)

20. The decimal part of the value of Logarithm of a number is called Mantissa (T)

21. $\int_0^1 e^x dx = e^x \Big|_0^1 = e^x - e^0 = e^x - 1$ (F)

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

22.	**If $\frac{A}{3}=\frac{B}{4}=\frac{C}{5}$ then A:B:C = ___**	**A**	**4**
23.	**$\log_{10000}x = -\frac{1}{4}$ then x = ___**	**B**	**$\log_e(\frac{3}{2})$**
24.	**If (n + 1) ! = 20 (n – 1) ! then n = _____**	**C**	**$\frac{1}{10}$**
25.	**$\lim_{x\to 0}\frac{3^x-2^x}{x}$ = _____**	**D**	**1**
26.	**If $A=\begin{pmatrix}x-2 & 4\\ 3 & 5\end{pmatrix}$ and $B=\begin{pmatrix}-1 & 4\\ 3 & 5\end{pmatrix}$ and A = B then x = ____**	**E**	**3 : 4 : 5**

Answer:

22.	Let $\frac{A}{3}=\frac{B}{4}=\frac{C}{5}$ $\therefore$ a => A : B : C = 3 : 4 : 5	E	3 : 4 : 5
23.	$\because \log_{10000}x = -\frac{1}{4}$ $x=\left(10^4\right)^{-\frac{1}{4}}=10^{-1}=\frac{1}{10}$	C	$\frac{1}{10}$
24.	Given $(n+1)! = 20(n-1)!$ ⇨ $(n+1)\,n(n-1)! = 20\,(n-1)!$ ⇨ $(n+1)(n) = 5\times 4$ $\therefore n = 4$	A	4
25.	$\lim_{x\to 0}\frac{3^x-2^x-1+1}{x}$ $=\lim_{x\to 0}\frac{\left(3^x-1\right)-\left(2^x-1\right)}{x}$ $=\lim_{x\to 0}\frac{\left(3^x-1\right)}{x}-\lim_{x\to 0}\frac{\left(2^x-1\right)}{x}$ $= \log 3 - \log 2$ $= \log_e(\frac{3}{2})$	B	$\log_e(\frac{3}{2})$
26.	Given $A=\begin{pmatrix}x-2 & 4\\ 3 & 5\end{pmatrix}$ and $B=\begin{pmatrix}-1 & 4\\ 3 & 5\end{pmatrix}$ and A = B ⇨ x – 2 = -1 ⇨ x = 2 -1 = 1	D	1

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

27. Construct the truth table for p ⇔ q.

28. Two positive integers are such that the sum of first and twice the second is atmost 8 and their difference is atmost 2. Draw the graph of solution set.

29. Find $A_{2\times 3}$ when $a_{ij} = i + 2j$

30. The average cost function (AC) for certain commodity is AC = $2x - 1 + \frac{50}{x}$ in terms of output x. Find the Marginal Cost.

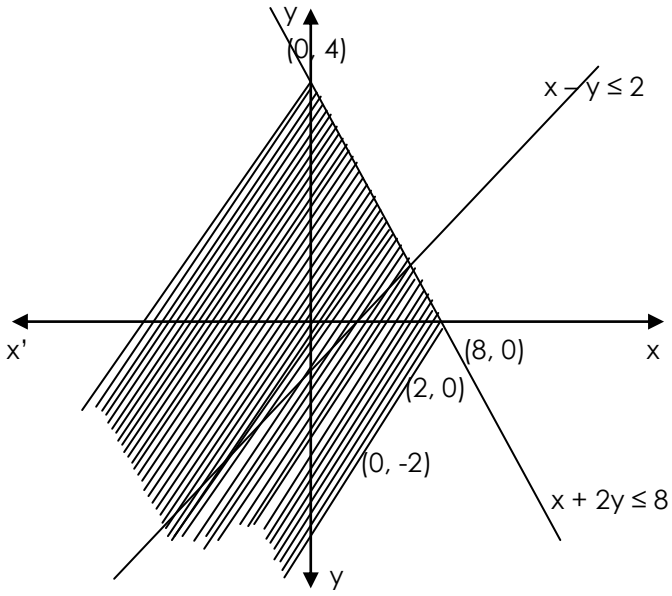
Answer:

27. The truth table for $p \Leftrightarrow q$

p	q	$p \Leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

28. Graph: Let x, y be two positive numbers.

$x + 2y \le 8$, $x - y \le 2$, $x \ge 0$, $y \ge 0$



29. Given $a_{ij} = i+2j$

$$A_{2\times3} = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \end{bmatrix}$$

$$= \begin{bmatrix} 3 & 5 & 7 \\ 4 & 6 & 8 \end{bmatrix}$$

30. Given the average cost function (AC) for certain commodity is

$AC = 2x - 1 + \frac{50}{x}$ x – output.

$\therefore$ Total Cost (TC) $= x\,(AC)$

$= x\,(2x - 1 + \frac{50}{x})$

$= 2x^2 - x + 50.$

$\therefore$ Marginal cost (MC) $= \frac{dc}{dx}$

$= 4x - 1.$

Section – B
(Fundamentals of Business Statistics)

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

1. **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
2. **The mean height of 8 students is 152 cm. Two more students of heights 143 cm and 156 cm join the group. New mean height is equal to**
   (a) 153
   (b) 152.5
   (c) 151.5
   (d) 151
3. **What is the HM of 1, ½, 1/3, …. 1/n?**
   (a) n
   (b) 2n
   (c) $\frac{2}{(n+1)}$
   (d) $\frac{n(n+1)}{2}$
4. **The variables x and y are related by 5x+6y=70 and median of x is 8. What is the median of y?**
   (a) 4
   (b) 4.5
   (c) 6
   (d) 5
5. **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
6. **If x and y are related as 4x + 3y + 11 = 0 and mean deviation of x is 2.70. What is mean deviation of y?**
   (a) 7.20
   (b) 14.40
   (c) 3.60
   (d) None of these
7. **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

8. The value of correlation coefficient lies between
(a) -1 and +1
(b) -1 and 0
(c) 0 and 1
(d) None

9. If the coefficient of correlation between two variables is -0.2, then the coefficient of determination is
(a) 0.4
(b) 0.02
(c) 0.04
(d) 0.16

10. A, B and C are three mutually exclusive and exhaustive events such that P(A)=2 P(B) = 3 P(C). What is P (B)?
(a) 6/11
(b) 6/22
(c) 1/6
(d) 1/3

11. If a card is drawn at random form a pack of 52 cards, what is the chance of getting a Spade or an ace?
(a) 4/13
(b) 5/13
(c) 0.25
(d) 0.20

12. Two dice are thrown together. The probability that 'the event the difference of nos. shown is 2' is
(a) 2/9
(b) 5/9
(c) 4/9
(d) 7/9

Answer:

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

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

1. For a moderately skewed distribution, arithmetic mean = 160, mode = 157 and standard deviation = 50, Find Karl Pearson coefficient of Skewness.

2. **If the first quartile is 104 and quartile deviation is 18. Find the third quartile.**
3. **A dice is rolled. What is the probability that a number 1 or 6 may appear on the upper face?**
4. **An aeroplane covers the four sides of a square at varying speeds of 500, 1000, 1500, 2000 km per hour respectively. What in the average speed of the plane around the square.**
5. **In a Moderately Asymmetrical Distribution. Compute M.D. and Q.D. Given S.D. = 50**
6. **Calculate S.D. for first 10 natural nos.**
7. **Given Mean = 50, C.V = 40%, Karl Pearson's Coefficient of Skewness = - 0.4. Find standard deviation and Mode.**
8. **If two regression coefficients b_{xy} = 0.87 and b_{yx} = 0.49, find 'r'.**
9. **Two cards are drawn from a well shuffled pack of playing cards. Determine the probability that both are aces.**
10. **The probability that A can solve a problem is 2/3 and that B can solve is 3/4. If both of them attempt the problem, what is the probability that the problem get solved?**
11. **Two dice are thrown at a time and the sum of the numbers on them is 6. Find the probability of getting the number 4 on anyone of the dice.**
12. **If three dice are thrown simultaneously, then the probability of getting a score of 5 is**

Answer:

1. Given Mean = 160
Mode = 157
S.D. = 50

Now Karl Pearson Coe. of Skewness = S_{KP}

$$S_{KP} = \frac{\bar{x} - z}{\sigma}$$

$$= \frac{160 - 157}{50}$$

$$= \frac{3}{50}$$

$$= 0.06.$$

2. Given $Q_1 = 104$
Quartile deviation = 18

Now $$\frac{Q_3 - Q_1}{2} = 18$$

$$\frac{Q_3 - 104}{2} = 18$$

$$Q_3 = 36 + 104$$

$$Q_3 = 140.$$

3. 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

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

$$= 2/6.$$

4. Given

x	1/x
500	0.002
1000	0.001
1500	0.0006
2000	0.0005
	0.0041

$$\text{H.M.} = \frac{N}{\sum \frac{1}{x}}$$

$$= \frac{4}{0.0041}$$

$$= 975.609.$$

5. Given S.D. = 50

We know that

$$\text{M.D.} = \frac{4}{5}\ (\text{S.D.})$$

$$= \frac{4}{5}\ (50)$$

$$\text{M.D.} = 40.$$

We know that

$$\text{Q.D.} = \frac{2}{3}\ (\text{S.D.})$$

$$= \frac{2}{3}\ (50)$$

$$\text{Q.D.} = 33.33.$$

6. We know that S.D. of first n natural nos. is

$$\sqrt{\frac{1}{12}\left(n^2-1\right)}$$

$\therefore$ Given n = 10.

$$= \sqrt{\frac{1}{12}\left(10^2-1\right)}$$

$$= \sqrt{\frac{1}{12}(99)}$$

$$= \sqrt{8.25}$$

$$= 2.87.$$

7. Given $\bar{x} = 50$

C.V. = 40%

$S_{kp} = -0.4.$

Now

$$\text{C.V.} = \frac{\sigma}{\bar{x}} \times 100$$

$$40 = \frac{a}{50} \times 100$$

$$\alpha = \frac{40 \times 50}{100}$$

$$\alpha = 20.$$

Now

$$S_{kp} = \frac{\bar{x} - z}{a}$$

$$-0.4 = \frac{50 - z}{20}$$

$$(-0.4)(20) = 50 - z$$

$$-8 = 50 - z$$

$$Z = 58$$

8. Given byx = 0.49

bxy = 0.87

Now $r = \sqrt{bxy \times byx}$

$$= \sqrt{(0.87) \times (0.49)}$$

$$= \sqrt{0.4361}$$

$$= 0.66.$$

9. Given n(s) = 52.

The probability of getting drawn two cards are aces is $\frac{4c_2}{52c_2}$

$$= \frac{6}{1326}$$

$$= \frac{1}{221}$$

10. Given

The probability of A solving problem is P(A)

$$P(A) = \frac{2}{3}$$

The probability of B solving problem is P(B)

$$P(B) = \frac{3}{4}$$

The probability of A not solving problem is $P(\bar{A})$

$$= 1 - P(A) = 1 - \frac{2}{3} = \frac{1}{3}$$

The probability of B not solving problem is $P(\bar{B})$

$$= 1 - P(B) = 1 - \frac{3}{4} = \frac{1}{4}$$

Now, the probability if both attempts the problem get solved is $1 - P(\bar{A})\,P(\bar{B})$

$$= 1 - \frac{1}{4} \times \frac{1}{3} = 1 - \frac{1}{12} = \frac{11}{12}.$$

11. Two dices are rolled => $n(s) = 6^2 = 36$.
The probability of getting number 4 on anyone of die along with condition that sum of numbers on dices must be 6 is P(A).

$$P(A) = \frac{2}{36}$$

$$P(A) = \frac{1}{18}$$

12. Three dices are rolled => $n(s) = 6^3 = 216$.
The probability of getting a score of 5 is P(A)

$$P(A) = \frac{6}{216}$$

$$P(A) = \frac{1}{36}.$$

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

1. Draw Pie diagram to represent the data

Item	Food	Rent	Clothing	Fuel	Education	Miscellanies
Expenditure	240	125	66	57	42	198

2. Compute coefficient of Mean Deviation from Mean for following data:

X	0-4	4-8	8-12	12-16	16-20	20-24	24-28	28-32
F	4	9	23	55	62	30	12	5

3. Compute rank correlation from the following table

X	415	434	420	430	424	428
Y	330	332	328	331	327	325

4. Find Quantity Index No. from following data i) Laspeyre's, ii) Paasche's iii) Dorbish and Bowley's

	2001		2005	
Commodity	Quantity	Value	Quantity	Value
A	5	40	6	60
B	5	30	5	40
C	6	24	6	30
D	5	10	10	40

5. Find the trend values by using 3 yearly moving averages method

Year	2007	2008	2009	2010	2011	2012	2013
Sales (₹'000)	33	35	60	67	68	82	90

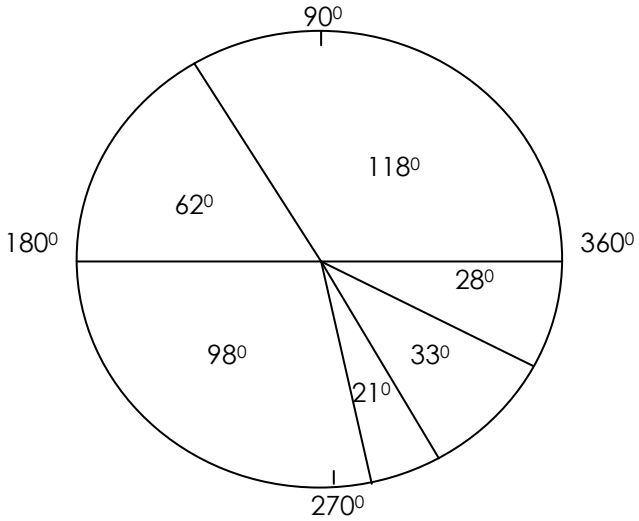
6. What is the chance that a leap year, selected at random will contain 53 Sundays?

Answer:

1.

Food :	240	=> angles = 240/728 × 360 = 118^0 (app)
Rent :	125	=> angles = 125/728 × 360 = 62^0 (app)
Clothing :	66	=> angles = 66/728 × 360 = 33^0 (app)
Fuel :	57	=> angles = 57/728 × 360 = 28^0 (app)
Education :	42	=> angles = 42/728 × 360 = 21^0 (app)
Miscellaneous :	198	=> angles = 198/728 × 360 = 98^0 (app)
	728	

PIE CHART:



118^0 = Food
62^0 = Rent
33^0 = Cloth
28^0 = Fuel
21^0 = Education
98^0 = Miscellaneous

2.

x	f	m	fm	$\lvert D\rvert = \lvert M - \bar{A}\rvert$	$f\lvert D\rvert$
0 - 4	4	2	8	14.5	58
4 – 8	9	6	54	10.5	94.5
8 – 12	23	10	230	6.5	149.5
12 – 16	55	14	770	2.5	137.5
16 – 20	62	18	1116	1.5	93
20 – 24	30	22	660	5.5	165
24 – 28	12	26	312	9.5	114
28 - 32	5	30	150	13.5	67.5
	200		3300		879

Mean = $\frac{\sum fm}{\sum f} = \frac{3300}{200} = 16.5.$

M.D. from mean = $\frac{\sum f(D)}{\sum f} = \frac{879}{200} = 4.395.$

Coe. of M.D. = $\frac{M.D.}{\bar{x}}$

$= \frac{4.395}{16.5}$

$= 0.266.$

3.

X	R_1	Y	R_2	$(R_1 - RR_2) = D$	D^2
415	6	330	3	3	9
434	1	332	1	0	0
420	5	328	4	1	1
430	2	331	2	0	0
424	4	327	5	-1	1
428	3	325	6	-3	9

$$r_k = 1 - \frac{6\sum D^2}{N(N^2 - 1)}$$

$$= 1 - \frac{1(20)}{6(6^2 - 1)} = 1 - \frac{120}{210} = \frac{210 - 120}{210} = \frac{90}{210} = \frac{3}{7} = 0.429$$

4. Quantity Index

p_0	q_0	v	p_1	q_1	v	$p_0 q_1$	$p_1 q_0$
8	5	40	10	6	60	48	50
6	5	30	8	5	40	30	40
4	6	24	5	6	30	24	30
2	5	10	4	10	40	20	20
		104			170	122	140

$$\text{Laspeyre's} = \frac{\sum p_0 q_1}{\sum p_0 q_0} \times 100$$

$$= \frac{122}{104} \times 100$$

$$= 117.31$$

$$\text{Pasche's} = \frac{\sum p_1 q_1}{\sum p_1 q_0} \times 100$$

$$= \frac{170}{140} \times 100$$

$$= 121.43$$

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

$$= \frac{117.31 + 121.43}{2}$$

$$= \frac{238.74}{2}$$

$$= 119.37.$$

5.

Year	Sales	3 – y Month Total	3 – y Month Average ($\frac{\text{Month Total}}{3}$)
2007	33	--	--
08	35	128	42.67
09	60	162	54
10	67	195	55
11	68	217	72.33
12	82	240	80
13	90	--	--

6. As a leap year consist of 366 days it contains 52 complete weeks and two more days. The two consecutive days make the following combinations:

(a) Monday and Tuesday
(b) Tuesday and Wednesday
(c) Wednesday and Thursday
(d) Thursday and Friday
(e) Friday and Saturday
(f) Saturday and Sunday, and
(g) Sunday and Monday

If *(f)* or (g) occur, then the year consists of 53 Sundays.

Therefore the number of favourable cases = 2

Total number of cases = 7

The probability = $\frac{2}{7}$