BUSINESS MATHEMATICS & STATISTICAL INFERENCE SEMESTER-2

Marks

Q.2 (a) Simplify $\frac{\sqrt{x^3y^5}}{\sqrt[4]{x^7y^2}}\frac{\sqrt{xy^3}}{\sqrt[4]{xy^6}}$

$= (x^{3/2}\, y^{5/2}\, x^{1/2}\, y^{3/2}) \div (x^{7/4}\, y^{2/4}\, x^{1/4}\, y^{6/4})$ **2.0**

$= (x^2\, y^4) \div (x^2\, y^2)$ **2.0**

$= y^2$ **1.0**

(b) Solve the following equation $\frac{x+6}{5} - \frac{2x-1}{2} = 3$

Multiply by 10 on both sides

$2(x+6) - 5(2x - 1) = 30$ **1.0**

$2x + 12 - 10x + 5 = 30$

$-\quad 8x + 17 = 30$ **1.0**

$-\quad 8x = 13$

$X = -13/8$ **1.0**

(c) $x + y + z = 400{,}000$ ----------(1) **1.0**

$0.1x + 0.07y + 0.08z = 32{,}000$ ----------(2) **1.0**

$y + z = 3x$ **1.0**

$-3x + y + z = 0$ ----------(3)

Multiply equation (1) by 0.1 and subtract equation (2)

$0.03y + 0.02z = 8{,}000$ ----------(4) **0.5**

Multiply equation (1) by 3 and add equation (3)

$y + z = = 300{,}000$ ----------(5) **0.5**

Multiply equation (5) by 0.03 and subtract equation (4)

$z = 100{,}000$ **1.0**

Put z in equation 5 we have:

$y = 200{,}000$ **1.0**

By putting y & z in equation (1) we have:

$x = 100{,}000$ **1.0**

Marks

Q. 3

(a)

$f(x) = x^2 + 5x + 6$

$f'(x) = 2x + 5$ **1.0**

$f'(x) = 0$ **1.0**

$2x + 5 = 0$

$x = -5/2$ **1.0**

$f''(x) = 2$ is positive **1.0**

hence at $x = -5/2$ is minima **1.0**

(b)

R = ? , Sn = 600,000 , n = 8 years = 32 quarters

I = 10% p.a. = 0.025 per qtr **2.0**

$Sn = R\{(1 + i)^n - 1\}/i$

$600,000 = R\{(1 + 0.025)^{32} - 1\}/0.025$ **1.0**

R= 12,460.98 **2.0**

(c) $f(x) = \dfrac{6x^2 + 3x - 5}{\ln (5x^2 + 4)}$

$f'(x) = \dfrac{vu' - uv'}{v^2}$ **1.0**

$f'(x) = \dfrac{\ln (5x^2 + 4)(12x + 3) - (6x^2 + 3x - 5)\{10x/(5x^2 + 4)\}}{\{\ln (5x^2 + 4)\}^2}$ **0.5+0.5 0.5**

$= \dfrac{(12x + 3)\ln (5x^2 + 4) - 10x (6x^2 + 3x - 5)/(5x^2 + 4)}{\{\ln (5x^2 + 4)\}^2}$

$= \dfrac{(5x^2 + 4)(12x + 3)\ln (5x^2 + 4) - 10x (6x^2 + 3x - 5)}{\{\ln (5x^2 + 4)\}^2(5x^2 + 4)}$ **0.5+0.5 0.5**

		Marks
(d)	P= 200,000 , A = 1,000,000 n = 8 Years = 32 Quarters , i = ?	**1.0**
	$A=P(1+i)^n$	**1.0**
	$1,000,000 = 200,000\ (1 + i)^{32}$	
	$5 = (1 + i)^{32}$	**1.0**
	$\text{Log } 5 = 32 \log (1 + i)$	**1.0**
	$0.69897 = 32 \log(1 + i)$	
	$0.02184 = \log (1 + i)$	**1.0**
	$1 + i = 1.051581$	
	i = 0.05158 or 5.158 % per quarter or 20.63% per annum	**1.0**

Marks

SECTION "B"

Q4 (a) Population: 2, 4, 6, 8 and 10

Population Size = N = 5

Sample Size = n= 2

Maximum no. of Samples can be drawn = ${}^{N}P_{n} = {}^{5}P_{2} = 20$

Sample	Sample Mean
(2, 4)	3
(2, 6)	4
(2, 8)	5
(2,10)	6
(4,2)	3
(4,6)	5
(4,8)	6
(4,10)	7
(6,2)	4
(6,4)	5
(6,8)	7
(6,10)	8
(8,2)	5
(8,4)	6
(8,6)	7
(8,10)	9
(10,2)	6
(10,4)	7
(10,6)	8
(10,8)	9

1.5

Sampling Distribution of Mean

X	3	4	5	6	7	8	9
F(x)	1/10	1/10	1/5	1/5	1/5	1/10	1/10
Marks	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**

3.5

(b) Min # = 10, Max # = 45, Range = 35 **0.5**

No. of Classes = 1 + 3.3 logn = 1 + 3.3 log 39 = 6.2 =6

Class Interval = Range/No. of Classes = 35/6 = 5.83 = 6

Class Interval	Tallies	Frequency	
10 – 15	𝍸	5	**0.75**
16 – 21	𝍸 I	6	**0.75**
22 – 27	𝍸 IIII	9	**0.75**
28 – 33	𝍸 II	7	**0.75**
34 – 39	𝍸 I	6	**0.75**
40 – 45	𝍸 I	6	**0.75**

Marks

(c)

Marks obtained	No. of Students f	x	fx	Class Boundaries	<CF
10 – 24	10	17	170		10
25 – 39	16	32	512		26
40 – 54	23	47	1081		49
55 – 69	29	62	1798		78
70 – 84	16	77	1232		94
85 – 99	6	92	552		100
Σ	**N = 100**		**5345**		

0+1.0

Arithmetic Mean = Σ fx /N = 53.45 **0.5+0.5**

Median Class = N/2 th observation = 50 th Observation **1.0**

Median = l+ h/f(N/2 – C) **1.0**

= 54.5 + 15/29(50 – 49)

= 55.01 = 55 **1.0**

(d)

μ = 15, n = 10, σ^2 = 50

$\sum x$= 150, **0.5**

$\sum x$ (Corrected) = 150 -12 + 18 = 156 **0.5**

μ (Corrected) = 15.6 **0.5**

$\sigma^2 = \sum x^2/n - \mu^2$ **0.5**

$50 = \sum x^2/10 - 15^2$

$50 + 225 = \sum x^2/10$

$\sum x^2 = 2750$ **1.0**

$\sum x^2$ (Corrected) = 2930 **1.0**

σ^2(Corrected) =2930/10 – 15.6^2 = 293 – 243.36 = 49.64 **1.0**

Marks

Q5 (a) (i)

	X	y	xy	x^2
	48	380		
	22	420		
	25	395		
	20	465		
	30	475		
	50	440		
	40	490		
	55	565		
	45	515		
	335	**4045**	**154,755**	**13,863**
Marks	**0.5**	**0.5**	**0.5**	**0.5**

2.0

n = 9 $\sum x$ = 335 $\sum y$ = 4045 $\sum x^2$ = 13,863 , $\sum xy$ = 154,755

Where b = $\dfrac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$ **0.5**

$= \dfrac{9x154,755 - 335x4045}{9x13,863 - 335^2}$

= 3.0075 **1.0**

a = $\dfrac{\sum y}{n}$ - b $\dfrac{\sum x}{n}$ **0.5**

$= \dfrac{4045}{9}$ - 3.0075 x $\dfrac{335}{9}$

= 337.498 **1.0**

Equation of the Regression line is:

y = a + b x **0.5**

= 337.498 + 3.0075 x **0.5**

(ii) y = 337.498 + 3.0075 x

= 337.498 + 3.0075 (60) **1.0**

= 337.498 + 180.45

= 517.948 **1.0**

Marks

(b)

Com	pn	po	qn	qo	pnqo	poqo	pnqn	poqn
A	12.50	15.00	125	150	1875	2250	1562.5	1875
B	30.00	40.00	160	185	5550	7400	4800	6400
C	75.00	85.10	140	165	12375	14041.5	10500	11914
D	95.15	105.00	78	85	8087.75	8925	7421.7	8190
					27887.75	32616.5	24284.2	28379
				Marks	**1.0**	**1.0**	**1.0**	**1.0**

4.0

Fisher's Ideal Index Number (2005) = $\sqrt{\sum pnqo}\ \sqrt{\sum pnqn} \times 100$ **1.0**
$\sqrt{\sum poqo}\ \sqrt{\sum poqn}$

$= \frac{\sqrt{27887.75} \times \sqrt{24284.2}}{\sqrt{32616.5} \times \sqrt{28379}} \times 100$ **1.0**

= 85.53 **2.0**

(c) Weight: n = 10, Mean = 278 grams S.D= 9.64 grams

Coefficient of Variance = SD/Mean x 100

= 9.64/278 x 100

= 3.46% **1.0**

Prices: n = 10, Mean = $ 1.29, S.D = $ 0.09

Coefficient of Variance = SD/Mean x 100

= 0.09/1.29 x 100

= 6.97% **1.0**

CV of Weight are less than CV of Prices **1.0**

So weights are relatively homogenous w.r.t. prices. **1.0**

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Q.6 (a) (i) The different moving averages produce different forecast. **0.5**

(ii) The greater the number of periods in the moving average, the greater the smoothing effect. **0.5**

(iii) If the underlying trend of the past data is thought to be fairly constant with substantial randomness, then a greater number of periods should be chosen. **1.0**

(iv) Alternatively, if there is thought to be some change in the underlying state of the data, more responsiveness is needed, therefore fewer periods should be included in the moving average. **1.0**

(b) N= 52, n = 5 P(x ≥ 2) =?

Total Possible Outcomes =52C5 = 2,598,960 **1.0**

Favorable Outcomes = N (A = 2) or N (A = 1) or N (A = 0)

= 4C2 x 48C3 + 4C1 x 48C4 + 4C0 x 48C5 **0.5+0.5+0.5**

= 6 x 17296 +4 x 194580 + 1 x 1712304

= 103776 + 778320 + 1712304 = 2594400 **0.5+0.5+0.5+0.5**

Probability = Favorable Outcomes/ Total Possible Outcomes **0.5**

= 2594400/ 2598960

= 0.9982 **1.0**

(c) n=17, Sample Mean x = 50, s^2 = 36 Find 95% Confidence Interval for μ

α = 100 – 95 = 5% = 0.05, $t_{\alpha/2} = t_{0.025,16} = 2.120$

Confidence Interval for μ

$x \pm t_{\alpha/2}\, s/\sqrt{n}$ **1.0**

$x - t_{\alpha/2}\, s/\sqrt{n} = 50 - 2.120 \times 6/\sqrt{17}$ **0.5**

$= 50 - 3.085$ **0.5**

= 46.9 **1.0**

$x + t_{\alpha/2}\, s/\sqrt{n} = 50 + 2.120 \times 6/\sqrt{17}$ **0.5**

$= 50 + 3.085$ **0.5**

= 53.085 **1.0**

$46.9 < \mu < 53.085$ **1.0**

THE END