OR iii. Out of 800 families with 4 children each, what percentage would be expected to have: **5**

(a) 2 boys and 2 girls (b) At least one boy

(c) No girls (d) At least 2 girls.

Assume the equal probability for boy and girl.

Q.6 Attempt any two:

i. Explain the various components of Time Series by giving suitable examples. **5**

ii. Fit a straight line trend for the following data by method of least squares and calculate the expected demand for the year 1998. **5**

Years	1985	1986	1987	1988	1989	1990
Demand	200	250	275	340	410	500

iii. Construct a 4-yearly centred moving average from the following data: **5**

Years	1970	1975	1980	1985	1990	1995	2000
Imported cotton (in '000)	129	131	106	91	95	84	93

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Total No. of Questions: 6 Total No. of Printed Pages:4

Enrollment No......................................

Faculty of Management

End Sem (Odd) Examination Dec-2018

MS5CO05 Business Mathematics and Statistics for Managers

Programme: MBA Branch/Specialisation: Management

Duration: 3 Hrs. **Maximum Marks: 60**

Note: (a) All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

(b) Use of simple calculator is allowed. Scientific calculator is strictly prohibited.

Q.1 i. The value of $\lim_{x\to 0}(1+x)^{1/x}$ is **1**

(a) 1 (b) 0 (c) ∞ (d) e

ii. If $f(-x) = f(x)$ then $f(x)$ is called **1**

(a) Even function (b) Odd function

(c) Constant function (d) Linear function

iii. If $y = a^3$, then $\frac{dy}{dx}$ = ? is **1**

(a) $3a^2$ (b) 0 (c) 1 (d) None of these

iv. $\int xe^x\,dx = ?$ **1**

(a) $xe^x + c$ (b) $e^x + c$

(c) $xe^x + e^x + c$ (d) $xe^x - e^x + c$

v. For a sample to be truly representative of the population, it must truly be **1**

(a) Fixed (b) Random (c) Casual (d) Specific

vi. What is the first stage in statistics? **1**

(a) Organization of data (b) Collection of data

(c) Analysis of data (d) Interpretation

vii. If P(A) + P(B) = 1, then the events A and B are said to be **1**

(a) Sure (b) Null

(c) Mutually exclusive (d) None of these

viii. If the odds in favour of occurrence of an event are 5:13, then the probability that it will occur is **1**

(a) $^{5}/_{13}$ (b) $^{5}/_{18}$ (c) $^{13}/_{18}$ (d) None of these

ix. Time-series is used in **1**

(a) Sampling (b) Forecasting

(c) Probability (d) None of these

x. "Fire loss in a factory" is associated with which component of Time-series? **1**

(a) Random variation (b) Cyclic Variation

(c) Seasonal Variation (d) Secular Trend

Q.2 Attempt any two:

i. A shoe manufacturer is planning production of new varieties of shoes for the first year the fixed costs for setting up the new production line are Rs. 1.25 lakhs. Variable cost for producing each pair of shoes is Rs. 35. The sales department project that 1500 pairs can be sold in the first year at the rate of Rs 160 per pair. **5**

(a) Determine the profit function $P(x)$ for the profit from the sales of a pairs of shoes.

(b) If 1500 pairs are actually sold, what profit or loss the company would incur.

(c) Determine the Break Even point.

ii. Evaluate $\lim_{x\to 0}\frac{(\sqrt{1+x}-\sqrt{1-x})}{x}$. **5**

iii. A function is defined by $f(x) = \begin{cases} -2x^2+4\ ; & x<1 \\ 2\ ; & x=1 \\ x^2+1\ ; & x>1 \end{cases}$. Is the function continuous at $x = 1$? **5**

Q.3 Attempt any two:

i. (a) Differentiate $y = \frac{e^x}{1+x}$ with respect to x. **5**

(b) Evaluate $\int_1^2 (3x^2 + 4x^3)dx$

ii. A book publisher finds that the production cost of a book is Rs. 50 and fixed cost per year amounts to Rs. 50,000. If each book is sold at the rate of Rs. 75, find: **5**

(a) The total cost

(b) The Revenue function

(c) Marginal cost

(d) Marginal revenue and

(e) Minimum number of books to be sold per year in order that there is no loss.

iii. If the marginal cost is given by the function (in rupees) $MC = f'(x) = 3x^2 + 2x - 1$ where x being the units produced. Determine the cost function, given that $f(0) = 0$. Also determine the production cost of four units. **5**

Q.4 Attempt any two:

i. Explain the role and application of Statistics in business and management. Give two suitable examples. **5**

ii. "Statistics may be defined as science of collection, presentation, analysis, comparison and interpretation of numerical data." Discuss the statement. **5**

iii. Write short note on concept of population and sample with suitable examples. **5**

Q.5 Attempt any two:

i. Two dice are thrown simultaneously. Find the probability of getting: **5**

(a) The sum as prime number.

(b) The number on the second die is greater than the number on the first die.

ii. In a bolt factory, the machines M_1, M_2, M_3 manufacture respectively 25, 35 and 40 percent of the total product. Of their output 5, 4 and 2 percent respectively are defective bolts. One bolt is drawn at random from the product and is found to be defective. What is the probability that it was manufactured by machine M_3? **5**

Faculty of Management
End-Sem (Odd) Exam Dec. 2018
MS5C005
Business Mathematics & Statistics for Managers
Scheme & Solution

Q.1 i. (d) e +1
ii. (a) even function +1
iii. (b) 0 +1
iv. (d) $xe^x - e^x + c$ +1
v. (b) Random +1
vi. (b) collection of data +1
vii. (c) mutually exclusive +1
viii. (b) 5/18 +1
ix. (b) Forecasting +1
x. (a) Random variation +1

Q.2 (i) $C(x) = 125000 + 35x$ +1
$R(x) = 160x$ +1

(a) $P(x) = R(x) - C(x)$
$= 125x - 125000$ +1

(b) $P(1500) = 187500 - 125000$
$=$ Rs. 62500 +1

(c) $R(x) = C(x)$ (B.E.P.)
$\Rightarrow 125x = 125000$
$\Rightarrow x = 1000$ shoes. +1

(ii) By rationalising
$$\lim_{x\to 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{x} \times \frac{\sqrt{1+x} + \sqrt{1-x}}{\sqrt{1+x} + \sqrt{1-x}}$$ +2

$$= \lim_{x \to 0} \frac{(1+x)-(1-x)}{x\left[\sqrt{1+x}+\sqrt{1-x}\right]}$$ +1

$$= \lim_{x \to 0} \frac{2\cancel{x}}{\cancel{x}\left[\sqrt{1+x}+\sqrt{1-x}\right]}$$ +1

$$= \frac{2}{\sqrt{1+0}+\sqrt{1-0}} = 1$$ +1

Q.2 (iii) $LHL = \lim_{x \to 1^-} f(x) = \lim_{h \to 0} f(1-h)$

$$= \lim_{h \to 0} \left[-2(1-h)^2 + 4\right]$$

$$= \lim_{h \to 0} \left[-2(1-2h+h^2) + 4\right]$$

$$= -2+4 = 2$$ +2

$RHL = \lim_{x \to 1^+} f(x) = \lim_{h \to 0} f(1+h)$

$$= \lim_{h \to 0} \left[(1+h)^2 + 1\right]$$

$$= 2$$ +2

$f(1) = 2$ (given)

$\because f(1) = R.H.L = L.H.L$ +1

$\therefore$ given funch is cont. at $x = 1$

Q.3. (i) (a) Formula (Quotient rule) +1

$$\frac{dy}{dx} = \frac{(1+x)\frac{d}{dx}e^x - e^x \frac{d}{dx}(1+x)}{(1+x)^2}$$ +1

$$= \frac{(1+x)e^x - e^x(1)}{(1+x)^2} = \frac{e^x \cdot x}{(1+x)^2}$$ +0.5

Ans

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Q.3 (i) (b) $\int_1^2 (3x^2 + 4x^3)\, dx$

Formula $\int x^n = \dfrac{x^{n+1}}{n+1}$ +1

$= \left[3\dfrac{x^3}{3} + 4\dfrac{x^4}{4} \right]_1^2$

$= (x^3 + x^4)_1^2$ +1

$= [2^3 + 2^4] - [1^3 + 1^4]$

$= 8 + 16 - 2$

$= 24 - 2$

$= 22$ +0.5

Q.3 (ii) (a) $C(x) = \text{Fixedcost} + V.C$

$= 50{,}000 + 50x$ +1

(b) $R(x) = p \times x = 75x$ +1

(c) $M.C = \dfrac{d\,C(x)}{dx} = \dfrac{d}{dx}(50{,}000 + 50x)$

$= 50$ +1

(d) $M.R = \dfrac{d\,R(x)}{dx}$

$= 75$ +1

(e) $R(x) = C(x)$

$75x = 50x + 50000$

$\Rightarrow x = 2000$ books. +1

Q.3 (iii) Given, $MC = f'(x) = 3x^2 + 2x - 1$

$\Rightarrow C(x) = \int MC\, dx + k$ — +1

$= \int (3x^2 + 2x - 1)\, dx + k$

$= x^3 + x^2 - x + k$ — +1

$\because f(0) = 0$ i.e. $C(0) = 0$

$\Rightarrow k = 0$

$\therefore C(x) = x^3 + x^2 - x$ — +1

Thus

$C(4) = 4^3 + 4^2 - 4$

$= 64 + 16 - 4$

$= 76$ units — +2

Q.5 (i) (a) $S = \{(1,1), (1,2), (1,3) \cdots (6,5), (6,6)\}$

$n(S) = 36$. — +1

(i) Let $A = \{(1,1), (1,2), (2,1), (1,4), (2,3), (3,2), (4,1), (1,6), (2,5), (3,4), (4,3), (5,2), (6,1), (5,6), (6,5)\}$

$P(A) = \frac{n(A)}{n(S)} = \frac{15}{36}$ or $\frac{5}{12}$ — +2

(ii) Let $B = \{(1,2), (1,3), (1,4), (1,5), (1,6), (2,3), (2,4), (2,5), (2,6), (3,4), (3,5), (3,6), (4,5), (4,6), (5,6)\}$

$P(B) = \frac{n(B)}{n(S)} = \frac{15}{36}$ or $\frac{5}{12}$ — +2

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Q.5 (ii) Let A, B, C be the events of drawing an item from M_1, M_2, M_3 resp. & Let D be the event of drawing a defective item

Since the drawn item is found to be defective, we have to find that it is manuf. from M_3 is $P\left(\frac{C}{D}\right)$

Now $P(A) = \frac{25}{100}$, $P(B) = \frac{35}{100}$, $P(C) = \frac{40}{100}$

Also, $P\left(\frac{D}{A}\right) = \frac{5}{100}$, $P\left(\frac{D}{B}\right) = \frac{4}{100}$, $P\left(\frac{D}{C}\right) = \frac{2}{100}$ +1

By Baye's theorem,

$$P\left(\frac{C}{D}\right) = \frac{P(C)\cdot P(D/C)}{P(A)\cdot P\left(\frac{D}{A}\right) + P(B)\cdot P\left(\frac{D}{B}\right) + P(C)\cdot P\left(\frac{D}{C}\right)}$$ +2

$$= \frac{\frac{40}{100} \times \frac{2}{100}}{\frac{25}{100}\times\frac{5}{100} + \frac{35}{100}\times\frac{4}{100} + \frac{40}{100}\times\frac{2}{100}}$$ +1

$$= \frac{80}{125+140+80} = \frac{\cancel{80}^{16}}{\cancel{345}_{69}} = \frac{16}{69}$$

or 0.23 +1

Q.5 (iii) $N = 800$,

$n = 4$

$p = \frac{1}{2}$, $q = \frac{1}{2}$

p – prob. of getting a boy

& q – " " " a girl.

6

Using Binomial distribution,

$$P(r) = {}^{n}C_{r}\, p^{r} q^{n-r}$$ +1

(a) P (2 boys & 2girls)

$= P(r = 2)$

$= {}^{4}C_{2} \left(\frac{1}{2}\right)^{2} \left(\frac{1}{2}\right)^{2} = \frac{6}{16} = \frac{3}{8}$

In %, $\frac{3}{8} \times 100 = 37.5\%$ +1

(b) P (atleast one boy)

$= P(r = 1$ or more$)$

$= P(r=1) + P(r=2) + P(r=3) + P(r=4)$

$= 1 - P(r=0)$

$= 1 - \left[{}^{4}C_{0} \left(\frac{1}{2}\right)^{0} \left(\frac{1}{2}\right)^{4-0} \right]$

$= 1 - \frac{1}{16} = \frac{15}{16}$ +1

In % $\frac{15}{16} \times 100 = 93.75\%$

(c) P (no girls) $= P(r = 4)$

$= {}^{4}C_{4} \left(\frac{1}{2}\right)^{4} \left(\frac{1}{2}\right)^{4-4} = \frac{1}{16}$

In % $\frac{1}{16} \times 100 = 6.25\%$ +1

(d) P (atleast 2 girls) = P (atmost 2 boys)

$= P(r=2) + P(r=1) + P(r=0)$

$= \frac{6}{16} + \frac{4}{16} + \frac{1}{16} = \frac{11}{16}$

In % $\frac{11}{16} \times 100 = 68.75\%$ +1

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Q.6 (i) writing name of 4 components +1
(a) Secular trend (Linear & non-linear) +1
(b) Cyclic trend +1
(c) Seasonal var +1
(d) Irregular or random +1
Explain each with example

(ii) Here $n = 6$ (even)
$x = t - 1987.5$

Year t	demand y	$x = t - 1987.5$	x^2	xy
1985	200	-2.5	6.25	-500
1986	250	-1.5	2.25	-375
1987	275	-0.5	0.25	-137.5
1988	340	0.5	0.25	170
1989	410	1.5	2.25	615
1990	500	2.5	6.25	1250
	1975	0	17.50	1022.5

+2

$\Sigma y = 1975,\ \Sigma x = 0,\ \Sigma x^2 = 17.50,\ \Sigma xy = 1022.5$

Let the trend be $y = a + bx$
& normal eqns are

$$\Sigma y = na + b\Sigma x$$
$$\Sigma xy = a\Sigma x + b\Sigma x^2$$ +1

putting all values,

$$1975 = 6a + b \times 0 \Rightarrow a = 329.17$$
$$\& \quad 1022.5 = 0 + 17.50b \Rightarrow b = 58.42$$ +1

Thus $\boxed{y = 329.17 + 58.42x}$ +1

Q. 6 (iii)

Year	Imp. cotton (in'000)	4 yearly moving total	÷4 4 yearly moving avg.	÷2 Centred moving avg.
1970	129	–	–	–
1975	131	–	–	–
	–	457	114.25	–
1980	106	–	–	110
	–	423	105.75	–
1985	91	–	–	99.875
	–	376	94.00	–
1990	95	–	–	92.375
	–	363	90.75	
1995	84	–	–	
2000	93	–	–	
		+1	+2	+2

+5

OR

Year	Imp. cotton	4 yearly moving total	Centred moving total	÷8 4 year moving average
1970	129	–	–	–
1975	131	–	–	–
		457	–	–
1980	106	–	880	110.
		423	–	–
1985	91	–	799	99.875
		376	–	–
1990	95	–	739	92.375
		363	–	–
1995	84	–	–	–
2000	93	–	–	–
~~2000~~	~~93~~			
		+1	+2	+2

Or

+5

9) Q.4 (i)	Students are required to explain <u>any</u> <u>three</u> applications of statistics in business management (+1 for each)	+3
	writing two examples	+2
(ii)	Students are required to discuss this defⁿ at each stage.	
	collection	+1
	presentation	+1
	comparison (analysis)	+1
	Interpretation	+1
	& give example in each	+1
(iii)	Explaining concept of population with example	+2.5
	Explaining concept of sample with example.	+2.5

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