

Enrolment No.....



Faculty of Management Studies
End Sem Examination Dec-2023
MS5CO21 Statistics for Decision Making
Programme: MBA Branch/Specialisation: Management

Duration: 3 Hrs.

Maximum Marks: 60

Note: 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. Assume suitable data if necessary. Notations and symbols have their usual meaning.

- Q.1 i. If $f(x) = x^2 + x + 1$, then the value of $f(2)$ is- 1
(a) 4 (b) 5 (c) 6 (d) 7
- ii. If $R(x)$ is revenue function and $C(x)$ is cost function, then at the break-even point- 1
(a) $R(x) = C(x)$ (b) $R(x) > C(x)$
(c) $R(x) < C(x)$ (d) None of these
- iii. The differentiation of $2x - 1$ with respect to x is- 1
(a) 1 (b) 2 (c) 3 (d) 0
- iv. The value of integral $\int (3x^2 + 2x + 1)dx$ is- 1
(a) $x^3 + x^2 + x + c$ (b) $x^3 - x^2 + x + c$
(c) $3x^3 + 2x^2 + x + c$ (d) None of these
- v. If S is a sample space of a population P , then- 1
(a) S is an infinite subset of P (b) S is a finite subset of P
(c) S is equivalent to P (d) None of these
- vi. Which of the following is a branch of statistics? 1
(a) Descriptive statistics (b) Inferential statistics
(c) Both (a) and (b) (d) None of these
- vii. If n is the number of trials, p is the probability of success and q is the probability of failure, then the mean of Binomial distribution is- 1
(a) np (b) npq
(c) nq (d) None of these
- viii. The normal distribution is symmetrical about- 1
(a) Mean (b) Median
(c) Mode (d) All of these

[2]

- ix. The strike of workers in a factory delaying production for some weeks is- 1

 - (a) Secular trend
 - (b) Cyclical trend
 - (c) Irregular trend
 - (d) Seasonal trend

x. The multiplicative model for time series is $Y = \dots$. 1

 - (a) $T + S + C + I$
 - (b) $T \times S \times C \times I$
 - (c) $TS \times C + I$
 - (d) None of these

0.2

- Attempt any two:

 - If $f(x) = \begin{cases} x^2, & x < 2 \\ 2x, & x \geq 2 \end{cases}$, then test the continuity of $f(x)$ at $x = 2$.
 - Define any two types of function with example.

Also evaluate $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x - 2}$.

 - A publisher house finds that the production of cost direct to each book is Rs. 30 and that the fixed cost are Rs. 100. If each book can be sold for Rs. 45 then determine:
 - The cost function
 - The revenue function
 - The break-even point

Q.3

- i. Discuss the applications of differentiation in economic and managerial problems. **4**

ii Evaluate the following: **6**

- $$(a) \int \frac{(2+x)^2}{x} dx \text{ and} \quad (b) \int (4x^2 + 5x + 6)dx$$

OR

- $$\text{iii} \quad \text{If } f(x) = \frac{3x+2}{x-1} \text{ and } g(x) = e^x(x^4 + 2x - 3)$$

Find the differentiation of $f(x)$ and $g(x)$ with respect to x .

0.4

- i. Define descriptive statistics with example.
 - ii. Explain any five applications of statistics.

OR

0.5

- i. If a die is thrown, then find the probability of getting a number greater than 3. 2

ii. Find the probability that a leap year will contain 53 Sundays. 3

[3]

OR

- A manufacturer knows that the razor blades he makes contains on the average 0.5% defectives, he packs them in packets of 5. What is the probability that a packet picked at random contains 3 or more faulty blades? (Given $e^{-0.025} = 0.9753$)

0.6

- Explain components of time series.
Determine 3-yearly moving averages for the following data:

Years	2001	2002	2003	2004	2005	2006	2007
Earning In (Lakhs)	8	10	12	9	14	15	13

iii Determine 4-yearly moving averages for the following data:

Years	2010	2011	2012	2013	2014	2015	2016
Earning In (Lakhs)	12	15	11	18	20	17	16

OR

- Find the trend line to the following data by least square method:

Years	2001	2002	2003	2004	2005	2006	2007
Production	4	6	3	5	8	7	2

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Enel Sem Examination Dec - 2023

Solution

MS5CO21

Statistics for Decision
Making.

Q1 MCQ:

- i) d) 7
- ii) a) $R(x) = C(x)$
- iii) b) (2)
- iv) a) $x^3 + x^2 + x + c$
- v) b) S is a finite subset of P
- vi) c) Both a) and b)
- vii) a) ... or b)
- viii) d) All of the above.
- ix) c) Irregular Tend
- x) ~~b)~~ b) TXSXCXI

$$Q. 2 i) f(x) = \begin{cases} x^2, & x < 2 \\ 2x, & x \geq 2 \end{cases} \quad \text{continuity of function } x=2$$

Sol: LHL : $x=2$.

$$\lim_{x \rightarrow 2^-} f(x) = \lim_{x \rightarrow 2^-} x^2$$

$$\lim_{h \rightarrow 0} f(2-h) = \lim_{h \rightarrow 0} (2-h)^2$$

$$= \lim_{h \rightarrow 0} 4 - 4h + h^2 = 4.$$

2.5

RHL : $x=2$.

$$\lim_{x \rightarrow 2^+} f(x) = \lim_{x \rightarrow 2^+} 2x$$

$$\lim_{h \rightarrow 0} f(2+h) = \lim_{h \rightarrow 0} 2(2+h)$$

$$= \lim_{h \rightarrow 0} 4 + 2h = 4$$

2.5

$$\therefore LHL = RHL = f(2)$$

\therefore function is continuous at $x=2$.

ii) Types of function (any two)

- 1) Explicit function
- 2) Implicit function
- 3) Odd function

1.

- 4) Even function
- 5) Polynomial functions
- 6) Constant functions etc
- a) Odd function : A function is said to be an odd function if $f(-x) = -f(x)$.
- b) Even function : A function is said to be an even function if $f(-x) = f(x)$

Evaluate $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x - 2}$

using formula $a^2 - b^2 = (a+b)(a-b)$,

$$\lim_{x \rightarrow 2} \frac{(x-2)(x+2)}{(x-2)}$$

$$= \lim_{x \rightarrow 2} (x+2)$$

$$= 2+2 = 4.$$

ii) a) Total cost = Fixed cost + Variable cost

The cost of producing x books is given by.

$$C(x) = 30x + 15000$$

Q) On selling x book at Rs 45 per book,
the Revenue obtained is given by .

$$R(x) = 45x.$$

c) At break even point

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

$$\Rightarrow 45x = 30x + 15000$$

$$\Rightarrow 15x = 15000$$

$$\Rightarrow x = 1000 \text{ book.}$$

Break even point in Rs. :- (1000×45)

$$\Rightarrow \text{Rs } 45000$$

$$BEP = 6(1000, 45000)$$

Q3) Applications of differentiation in Economic and Managerial problems .

i) Differentiation is extensively used in Economic research to study functional relationships between economic variables

ii) It is helpful to compute the level of output at which the total revenue is the highest, the profit is highest and lowest marginal cost

- 3) Optimization : Differentiation is used to find the maximum or minimum value of functions .
- 4) It helps in determining the incremental costs / revenues and marginal product of factors employed in the production process .
- 5) In economics differential calculus is used to compute maxima and minima , elasticities , partial elasticities in a specific conditions .
6. and many more .

ii) Evaluate the following.

a) $\int \frac{(2+xe)^2}{xe} dx$.

$\Rightarrow \int \frac{4+4xe+x^2e^2}{xe} dx$.

$\Rightarrow \int \frac{4}{xe} + \frac{4xe}{x^2} + \frac{xe^2}{x^2} dx$.

$\Rightarrow 4\log xe + 4xe + \frac{xe^2}{2} + C$.

b) $\int (4xe^2 + 5xe + 6) dx$.

$\Rightarrow \int 4xe^2 dx + \int 5xe dx + \int 6 dx$.

$\Rightarrow \frac{4xe^3}{3} + \frac{5xe^2}{2} + 6x + C$.

2.

OR iii) Find

a) $f(x) = \frac{3xe+2}{xe-1}$

b) $g(x) = e^{2x} (2x^4 + 2x^2 - 3)$

a). $f(x) = \frac{3xe+2}{xe-1} = \frac{u}{v}$

formula $\frac{d}{dx} \frac{u}{v} = \frac{vu' - uv'}{v^2}$

$\frac{d}{dx} f(x) = \frac{(xe-1)(3) - (3xe+2)(1)}{(xe-1)^2}$.

$= \frac{3xe-3 - 3xe-2}{(xe-1)^2}$

~~$\frac{d}{dx} f(x) = \frac{-5}{(xe-1)^2}$~~ . $\frac{-5}{(xe-1)^2}$

3.

$$b) g(x) = e^x (4x^2 + 5x - 3)$$

formula $u \cdot v = uv' + vu'$

$$u = e^x$$

$$v = 4x^2 + 5x - 3$$

$$\Rightarrow e^x (8x^2 + 2) + (8x^2 + 5x - 3)e^x \Rightarrow e^x (8x^2 + 5 + 4x^2 + 5x - 3) e^x$$

$$\Rightarrow e^x (13x^2 + 2x - 2) \Rightarrow e^x (4x^2 + 13x + 8)$$

$$\Rightarrow e^x (4x^2 + 13x + 8)$$

Q4:

Descriptive Statistics: It refers to the branch of statistics

that involves: Summarizing

• Organising and

• Presenting data

meaningfully and concisely. It focuses on describing and analysing a data set's main features without making any generalization or inferences to a larger population.

Examples of descriptive statistics:

Descriptive statistics is used for measuring central tendency i.e

- i) Mean
- ii) Mode
- iii) Median

ii) Applications of (5) Statistics

- 1) Marketing : Statistical analysis is frequently used in providing information for making decisions in the field of marketing. It is necessary first to find out what can be sold & what is suitable strategy.
- 2) Production : In the field of production data & methods play a very important role. The decision about to produce, how, when & for whom is based on statistical analysis.
- 3) Finance : Financial organization uses their finance function effectively. It is depended on very heavy statistical data.
- 4) Accounting : Statistical data are also the part in accounting particularly in auditing functions the technique of sampling is frequently used.
- 5) Control : The management control process combines statistical and accounting method in making the overall budget for coming year.

OR " ")

- a) **Population:** In Statistics, a population is a representative sample of larger group of people (or even things) with one or more characteristics in common.
The Population is a complete set of people with a specialized set of characteristics.

- b) **Sample:** Sample refers to smaller manageable version of larger group. It is a subset containing the characteristics of larger population

4 limitations of Statistics

- 1) heterogeneous data in statistics cannot be implemented
- 2) In gathering, analysing and interpreting the data statistical finding can be misleading.
- 3) In statistical judgements, certain errors are possible
- 4) Only deals with quantitative data not qualitative.

- 5) Inferential statistics, in particular, includes such errors
- 6) Statistical results are true only on an average.
- D) Statistics can be misused.
(write any four)

Q5(i)

formula: $P = \frac{\text{favourable outcomes}}{\text{Total number of outcomes}}$

Total no. of outcomes = (1, 2, 3, 4, 5, 6)
= 6.

No. greater than 3 = (4, 5, 6)

So. favourable outcomes = 3.

$$P = \frac{3}{6} = \frac{1}{2}$$

ii) Number of days in leap year = 366

We have. 52 weeks and 2 days.

Leap year has Sundays = 52.

The remaining 2 days can be.

(Sunday, Monday) (Monday, Tuesday)

(Tuesday, Wednesday) (Wednesday, Thursday)

(Thursday, Friday) (Friday, Saturday)

(Saturday, Sunday)

i.e Total outcomes = 7

favourable outcomes (possibility of two Sundays)
= 2

$$\text{So } P = \frac{2}{7}$$

Q5. iii)

No. of Trials (n) = 4

Probability of getting head (p) = $\frac{1}{2}$

Probability of getting not head (q) = $1 - \frac{1}{2} = \frac{1}{2}$

formula: $P(\sigma) = {}^n C_{\sigma} (p)^{\sigma} (q)^{n-\sigma}$

i) Probability of no head $\sigma=0$

$$P = {}^4 C_0 \left(\frac{1}{2}\right)^0 \left(\frac{1}{2}\right)^{4-0} = 1 \times 1 \times \frac{1}{16} = \frac{1}{16}$$

ii) Probability of one head. $\sigma=1$

$$P = {}^4 C_1 \left(\frac{1}{2}\right)^1 \left(\frac{1}{2}\right)^{4-1} = 4 \times \frac{1}{2} \times \frac{1}{8} = \frac{1}{4}$$

iii) Probability of getting at least two heads

($\sigma = 2, 3, 4$ mode) / or $P(\sigma \geq 2) = 1 - P(\sigma < 2)$

$$P(\sigma=2) + P(\sigma=3) + P(\sigma=4)$$

$$P = {}^4 C_2 \left(\frac{1}{2}\right)^2 \left(\frac{1}{2}\right)^{4-2} + {}^4 C_3 \left(\frac{1}{2}\right)^3 \left(\frac{1}{2}\right)^{4-3} + {}^4 C_4 \left(\frac{1}{2}\right)^4 \left(\frac{1}{2}\right)^{4-4}$$

$$= \left(6 \times \frac{1}{4} \times \frac{1}{4}\right) + \left(4 \times \frac{1}{8} \times \frac{1}{2}\right) + \left(1 \times \frac{1}{16} \times 1\right)$$

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

OR IV) Here $n=5$

The probability that blade is defective

$$(p) = \frac{0.5}{100} = 0.005$$

Average no. of defective blades (\bar{m}) = np

$$m = 5 \times 0.005 = 0.025$$

$$\bar{e}^m = e^{-0.025} = 0.9753.$$

Let σ denote the no. of defective blades in packet of 5

$$P(\sigma=x) = \frac{\bar{e}^m m^x}{x!}$$

Probability of 3 or more faulty blades $P=(\sigma=3 \text{ or more})$

$$1 - [P(\sigma=0) + P(\sigma=1) + P(\sigma=2)]$$

$$P = 1 - \left[\frac{\bar{e}^{-0.025} (0.025)^0}{0!} + \frac{\bar{e}^{-0.025} (0.025)^1}{1!} + \frac{\bar{e}^{-0.025} (0.025)^2}{2!} \right]$$

$$\underline{P = 1 - (0.09753)}$$

$$P = 1 - \bar{e}^{-0.025} [1 + 0.025 + 0.0003125]$$

$$P = 0.00001279. \quad \text{Ans.}$$

Q6 i). Components of Time Series

- a) Secular Trend → long Term
- b) Cyclical Variation
- c) Seasonal Variation → short Term.
- d) Irregular Trend

- a) Secular Trend: Tendency of time series data to increase or decrease or stagnate during a long period of time is called Secular Trend. 0.5
- b) Seasonal variation: Seasonal variation represent aperiodic movement where the period is not longer than one year. 0.5
- c) Cyclic Variation: It is a type of periodic movement with a period more than one year. 0.5
- d) Irregular Trend: Irregular variation are such variation which are unpredictable 0.5

ii) 3 yearly moving average

Years	Earnings	3 yearly Total	3 yearly moving average
2001	8	-	-
2002	10	30	10
2003	12	31	10.333
2004	09	35	11.666
2005	14	38	12.666
2006	15	42	14
2007	13.	-	-

3

11.

110)

4 yearly moving average.

Years	Earnings	4 yearly moving total	4 yearly moving average	centred moving average
2010	12	-	-	
2011	15	-	-	
2012	11	56	14	15
2013	18	64	-16	16.25
2014	20	66	16.5	17.1
2015	17	71	17.75	
2016	16	-	-	

 $\checkmark \text{ } x^2$ $\checkmark \text{ } \bar{x}^2$

(F) mark

Q4 iv)

Least square method

YEARS	PRODUCTION (py)	$x = t - 2004$	\bar{x}^2	\bar{xy}
2001	4	-3	9	-12
2002	6	-2	4	-12
2003	3	-1	1	-3
2004	5	0	0	0
2005	8	1	1	8
2006	7	2	4	14
2007	2	3	9	6

$\Sigma y = 35$

$\Sigma x = 0$

$\Sigma x^2 = 28$

$\Sigma xy = 1$

12.

linear trend is given by $y = a + bxe$

$$\Sigma y = na + b \sum xe$$

$$35 = 7a + 0$$

$$a = \frac{35}{7} = 5$$

$$\Sigma xe y = a \Sigma xe + b \Sigma x e^2$$

$$14 = 5(0) + b(28)$$

$$\frac{14}{28} = b = 0.35$$

The required equation of the best-fitted straight line is,

$$y = a + bxe$$

$$y = 5 + 0.35xe \quad \text{with } x=0$$