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MSTE-002

**POST GRADUATE DIPLOMA IN
APPLIED STATISTICS (PGDAST)**

Term-End Examination

December, 2024

MSTE-002 : INDUSTRIAL STATISTICS—II

Time : 3 Hours

Maximum Marks : 50

Note : (i) *Question No. 1 is compulsory.*

(ii) *Attempt any **four** questions from the remaining question nos. 2 to 7.*

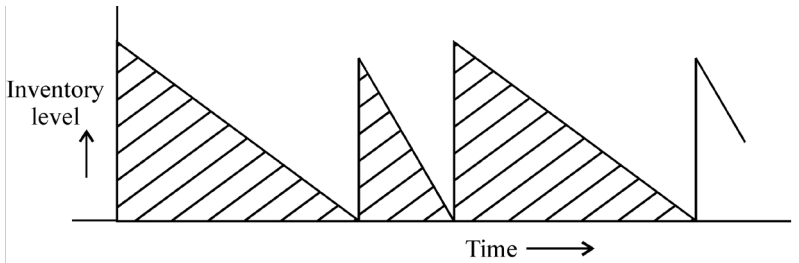
(iii) *Use of scientific calculator (non-programmable) is allowed.*

(iv) *Use of Formulae and Statistical Tables Booklet for PGDAST is allowed.*

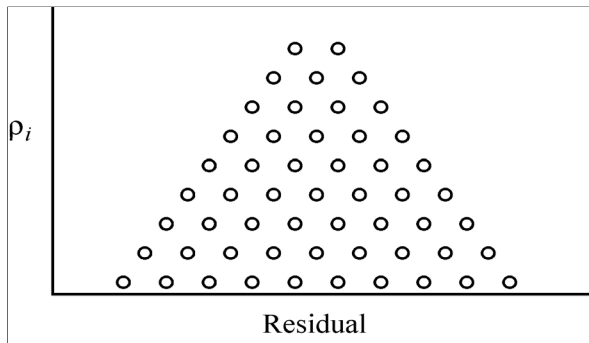
(v) *Symbols have their usual meanings.*

1. State whether the following statements are True or False. Give reasons in support of your answers : $5 \times 2 = 10$

- (a) The inventory model shown below indicates that the demand is uniform :



- (b) The solution of a transportation problem with 5 rows and 5 columns is feasible if number of possible allocations is 9.
- (c) If $(0, 1, -2)$, $(-2, 0, 1)$, $(2, 0, 1)$ are basic solutions for a system of equations, then only $(0, 1, -2)$, is feasible.
- (d) If a researcher obtained a normal probability plot of residuals as follows :



then we can say that the residuals are normally distributed.

- (e) In cyclic variation, the variations period is always less than one year.

2. Solve the following L. P. P. graphically : 10

Maximize :

$$Z = 5x + 7y$$

Subject to the constraints :

$$12x + 12y \leq 840$$

$$x + 2y \leq 100$$

$$2x + y \leq 120$$

$$x, y \geq 0.$$

3. (a) Four teachers (A, B, C and D) have to be assigned any one of four different topics. Preparation times (in hours) for different topics varies from teacher to teacher and are given as follows :

Teacher	A	B	C	D
Linear Programming	2	15	13	5
Queuing Theory	10	4	14	15
Time Series Analysis	9	14	16	13
Regression Analysis	7	8	11	9

Each teacher is assigned only one topic. Determine an assignment schedule as to minimize the total topics preparation time for all topics. 7

- (b) An office has only one typist. Since typing work varies in length (number of pages to be typed), the typing rate is randomly distributed as a Poisson distribution with a mean service rate of 8 letters per hour.

The letter arrives at a rate of 5 per hour during the entries 8-hour workday. Find :

- (i) Average time in the system.
- (ii) What is the probability that a letter have to wait for typing ? 3

4. A statistical analyst wants to find the linear relationship between sales (Y) and two independent variables advertisement cost (X_1) and promotional activities (X_2). For that he collected the data as follows :

Y	X_1	X_2
10	30	A
10	20	A
20	50	A
15	10	B
15	10	B
10	10	B
20	30	B
25	40	B
30	80	A
15	20	B
20	10	B
10	40	A

where A and B are two different types of promotional activities. Fit a multiple regression model and also obtain the regression equations for each promotional activity. 10

5. A company is interested in forecasting the demand of washing machine. The data on demand for the last 12 years are as follows :

Year	Demand (in 100 units)
2011	20
2012	19
2013	21
2014	22
2015	20
2016	23
2017	25
2018	27
2019	28
2020	30
2021	23
2022	27

- (i) Compute 4-yearly moving averages.

- (ii) Forecast the demand of washing machines for all years (2011 to 2022) using exponential smoothing technique for $\omega = 0.7$.
- (iii) Plot the original data along with the values computed in parts (i) and (ii). 10
6. (a) Write short notes on the following : 5
- (i) Testing of multiple regression coefficients
- (ii) Residual analysis
- (b) Find the sequence that minimises the total elapsed time required to complete the following tasks on two machines :

Task	Machine I	Machine II
1	5	2
2	7	6
3	3	7
4	4	5
5	6	9

Also calculate the idle time on Machine I and Machine II. 5

7. (a) Suppose a stationary time series has 8 successive observations as follows : 7
- 140, 120, 130, 150, 100, 120, 150, 130

Calculate :

- (i) Autocovariances C_0, C_1, C_2, C_3 and C_4 .
 - (ii) Autocorrelation coefficients r_1, r_2, r_3 and r_4 .
 - (iii) Plot the correlogram.
- (b) Explain the transportation problem with an example. 3

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