

No. of Printed Pages : 7

MSTE-001

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

Term-End Examination

June, 2023

MSTE-001 : INDUSTRIAL STATISTICS—I

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.*

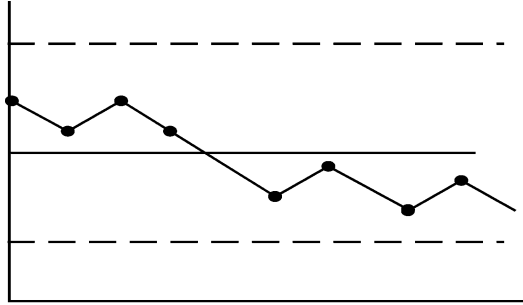
(v) *Symbols have their usual meanings.*

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

- (a) The process capability of a manufacturing process of a certain type of ball bearing with mean diameter 2 inches and standard deviation 0.05 inches, will be 0.10.

P. T. O.

- (b) If the control chart of a manufacturing process is as shown in the following figure :



then the process is said to be under statistical control.

- (c) If a component has the following hazard rate :

$$\lambda(t) = 0.5t, \quad t \geq 0$$

then the reliability of the component will be $e^{-t^2/4}$.

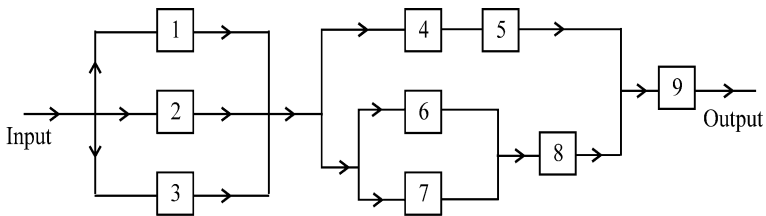
- (d) If a two-person zero-sum game has the following payoff matrix for Player A :

		Player B		
		B ₁	B ₂	B ₃
Player A	A ₁	- 2	- 4	6
	A ₂	5	4	1
	A ₃	3	2	8

then there exist a saddle point.

- (e) A system has three components connected in series having reliabilities 0.4, 0.7, 0.90, respectively, for a mission of 100 hours. To improve the reliability of the system, we should increase the reliability of the best component.

2. (a) The configuration of a system is shown in the following block diagram :



components 1, 2 and 3 are not identical and at least two components of this group must be available for system success. The remaining components are independent. The reliability of each component is given below for a mission of 500 hours :

$$R_1 = 0.40, R_2 = 0.30, R_3 = 0.60, R_4 = 0.80,$$

$$R_5 = 0.85, R_6 = 0.60, R_7 = 0.70, R_8 = 0.95,$$

$$R_9 = 0.90.$$

Evaluate the reliability of the system. 7

- (b) A standby system has three components 1, 2 and 3, where component 1 is normally operating and components 2, 3 are standby components. The reliability of component 1 is 0.95. The reliability of component 2 given that component 1 has failed is 0.96 and that of component 3 given that components 1 and 2 have failed is 0.98. Evaluate the reliability of the system under the assumption that the switch is perfect. 3
3. (a) A company produces dry cells. The cells will be considered satisfactory if their life is 25 hours. To test for the process to be under statistical control, a sample of 4 cells was drawn on 7 consecutive days. The results are as follows : 8

Day	Day	Day	Day	Day	Day	Day
1	2	3	4	5	6	7
24	16	20	26	20	21	26
20	18	25	25	22	40	24
25	15	28	26	24	20	20
20	12	30	24	26	20	25

- (i) Estimate the process mean and variability.

- (ii) Determine the appropriate centre line and control limits of the control chart for controlling the process mean.
- (iii) Plot the control chart for mean. Comment on the status of the process in respect of the process mean.
- (iv) If necessary, compute revised control limits.
- (b) Differentiate between variable and attribute control charts. 2
4. The probabilities of the demand of lorries to be hired on any day in a given district are as follows :

No. of Lorries Demanded	Probability
0	0.1
1	0.2
2	0.3
3	0.2
4	0.2

Lorries have a fixed cost of ₹ 90 each day. The net variable cost is ₹ 200. If the company is about to go into business and currently has no lorries, how many lorries should it buy ? 10

5. A computer manufacturing company purchases RAM from a company in lots of 2000. Twelve RAMs are sampled and inspected for certain

defects. The manufacturing company accepts the lot if the inspected sample contains at most one defective RAM. Otherwise it rejects the lot. 10

- (i) Find the probability of accepting the lot if the incoming lot quality is 0.04.
 - (ii) If $AOQ = 0.03$ and $LTPD = 0.06$, find producer's risk and consumer's risk.
 - (iii) If all defectives are replaced by non-defectives, calculate AOQ and ATI .
 - (iv) Draw OC curve.
6. (a) The failure data of 10 electronic components are shown in the following table :

Failure No.	Operating time (in hours)
1	2
2	6
3	31
4	51
5	76
6	116
7	140
8	182
9	250
10	302

Estimate the reliability and hazard rate. 6

- (b) Solve the game for which the payoff matrix is given as : 4

		Player B		
		B ₁	B ₂	B ₃
Player A	A ₁	2	4	3
	A ₂	1	- 2	- 3
	A ₃	0	6	1

7. (a) Describe double sampling plan with an example. 3
- (b) As a part of an overall quality improvement programme, a textile manufacturer decides to monitor the number of defects found in each inspected bolt of cloth. The data from 10 inspections are recorded in the following table :

Bolt of Cloth	No. of Defects
1	10
2	19
3	5
4	9
5	2
6	8
7	7
8	3
9	2
10	9

Which control chart should be used in this case ? Construct the suitable control chart and interpret the results. 7