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MSTE-001

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

Term-End Examination

December, 2022

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.*

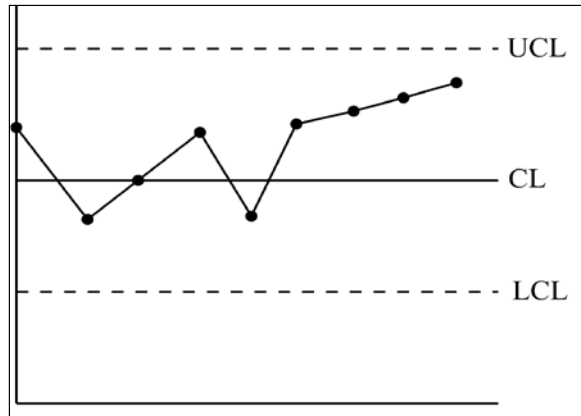
(v) *Symbols have their usual meanings.*

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

(a) If the probability of accepting a lot of satisfactory quality is 0.8124, then the producer's risk will be 0.8124.

P. T. O.

- (b) If the control chart of a process comes out as follows :



then the process is out-of-control.

- (c) If system has the following hazards rate :

$$\lambda(t) = 0.5; t \geq 0$$

then the cumulative failure distribution function will be $1 - e^{-0.5t}$.

- (d) If three strategies are available to a player in a two-person zero-sum game, then

$\left(\frac{1}{2}, 1, 0\right)$ is a pure optimal strategy for him.

- (e) The Average Total Inspection (ATI) is equal to the Average Sample Number (ASN), when the rejected lot is 100% inspected.

2. A company manufactures dry-cells. To test if the process is under statistical control, a sample of 4 cells was drawn on 6 consecutive days. The results life in hours, are shown in the following table :

10

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
20	25	15	20	20	20
24	20	15	25	10	24
20	40	20	28	16	26
26	30	18	30	20	20

- (i) Estimate the process mean and process variability.
- (ii) Construct the appropriate control chart to check the process mean and variability.
- (iii) If necessary, revise the control limits.
- (iv) If the specification limits of the process are 22 to 28 hours, then check the process capability.

3. A game has the following payoff matrix :

Player A	Player B			
	B ₁	B ₂	B ₃	B ₄
A ₁	3	2	4	0
A ₂	3	4	2	4
A ₃	4	2	4	0
A ₄	0	4	0	8

- (i) Check the saddle point.
- (ii) Use dominance rule to reduce the size of the payoff matrix to 2×2 .
- (iii) Find the optimal strategies and value of the game.
- (iv) Interpret the results.
4. (a) The failure density function of a random variable T is given by : 5

$$f(t) = 0.2e^{-0.2t}; t \geq 0$$

Calculate :

- (i) Reliability of the system
- (ii) Hazard rate
- (iii) Mean time to failure
- (iv) Median of the random variable 'T'.

(b) Consider the following payoff matrix : 5

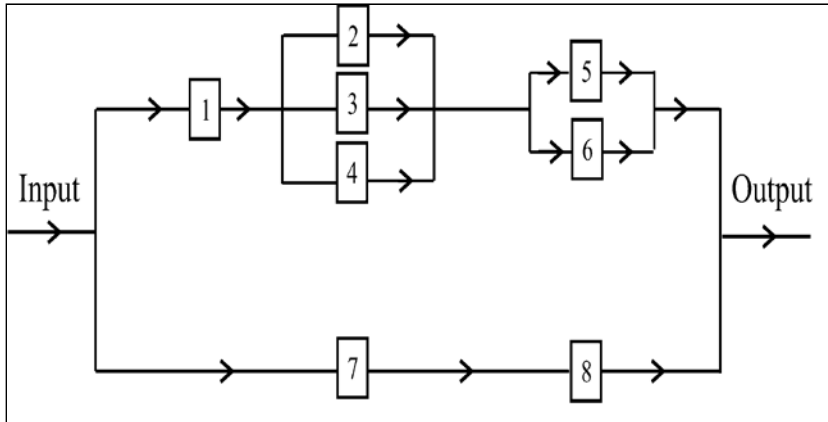
		Courses of Action			
		A ₁	A ₂	A ₃	A ₄
State of Nature	N ₁	400	900	900	1000
	N ₂	200	400	700	- 300
	N ₃	600	200	500	700

Identify the optimum course of action under :

- (i) Optimistic criterion
- (ii) Pessimistic criterion
- (iii) Regret criterion

5. Evaluate the reliability of the system for which the reliability block diagram is given in the figure below, for a mission of 100 hours. Assume that all components are independent and the reliability of each component is given as follows : 10

$$R_1 = 0.80, R_2 = 0.75, R_3 = 0.50, R_4 = 0.65, \\ R_5 = 0.76, R_6 = 0.60, R_7 = 0.95, R_8 = 0.90$$



where R_i denotes the reliability of component i ,
 $(i = 1, 2, \dots, 8)$. 10

6. An office supply company ordered a lot of 400 pens. When the lot arrives, the company inspector inspects 12 pens. If more than three pens are defective the lot will be rejected. If less than two pens are defective, the lot will be accepted. Otherwise a second lot of size 10 will be taken. Suppose the lot quality is 4% and the inspector finds two defective pens in the first sample and two in the second sample. Find probability of accepting the lot at the first sample and at the second sample. Also find ATI. 10

7. (a) A quality inspector inspects 10 samples of size 50 from the assembly line and records the number of defectives in each sample as follows :

Sample No.	No. of defective itmes
1	5
2	2
3	0
4	5
5	4
6	14
7	0
8	2
9	1
10	6

Plot an appropriate control chart for the process and draw the conclusion about the process after constructing the chart. 6

- (b) Differentiate between the following with examples : 4
- (i) Acceptance and Rectifying sampling plans
 - (ii) Single and Double sampling plans