No. of Printed Pages : 8

MSTE–001

POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination

December, 2024

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 no.* ***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 three strategies are available to a player in a game between two players, the strategy $\left(\frac{1}{3}, \frac{1}{3}, \frac{1}{3}\right)$ is a pure strategy.

(b) A k-out-of-n system is said to be a partially redundant system, if $k > n$.

(c) For a single sampling plan :

$$N = 500,\ n = 10,\ p = 0.02,\ P_a = 0.94$$

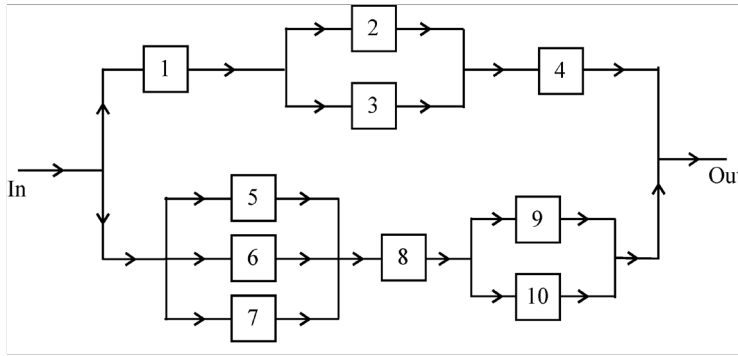
the AOQ will be 0.018 approximately.

(d) A process manufacturing bolt of certain diameter is under statistical control but the control chart of the process shows some variation. This variation is due to assignable causes.

(e) If a lot is accepted on the basis of the rectifying sampling plan, then :

$$ATI < ASN$$

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



Assume that all components are independent and reliability of each component is given for a mission of 100 hours as follows :

$R_1 = 0.60$ $R_2 = 0.80$ $R_3 = 0.90$

$R_4 = 0.50$ $R_5 = 0.70$ $R_6 = 0.90$

$R_7 = 0.40$ $R_8 = 0.50$ $R_9 = 0.70$

$R_{10} = 0.50$

Find the reliability of the system for a mission of 100 hours. 6

(b) A fruitseller buys bananas at the rate of ₹ 50 per dozen and sells them at the rate of ₹ 60 per dozen. Assume that a banana not sold during the day is treated as rotten and thrown away. The daily sales of bananas in the past has never been less than 48 dozen and more than 50 dozen. 4

(i) State course of action, states of nature and pay-off matrix in this situation.

(ii) Identify the optimum course of action under optimistic and pessimistic criteria.

3. (a) To monitor the manufacturing process of bolt, a quality control manager randomly selected 160 bolts from the production line

each day over 15 days. The selected bolts were inspected and the number of defective bolts was counted. The data obtained are given as follows :

Day	No. of Defective Bolts
1	3
2	6
3	4
4	6
5	20
6	2
7	6
8	7
9	3
10	0
11	6
12	15
13	5
14	7
15	6

Check whether the process is under statistical control or not using suitable control chart. 7

(b) Differentiate between R-chart and S-chart. 3

4. A shirt manufacturing company supplies shirts in lots of size 150 to a buyer. A single sampling plan with $n = 10$ and $c = 1$ is being used for the lot inspection. The company and the buyer decide AQL = 0.04 and LTPD = 0.10. If there are 5% defective shirt in each lot, compute : 10

   (i) Probability of accepting the lot.

   (ii) Producer's risk and consumer's risk

   (iii) AOQ, if the rejected lots are screened and all defective shirts are replaced by non-defectives.

   (iv) ATI

5. A company makes iron plates weighing 500 grams each. It has installed a new machine for speeding up production. The company's quality control officer has taken a random sample of 4 plates after every hour for checking the efficiency of the new machine. In this manner, a total of 12 samples of size 4 each are taken and

the weights of the plates are recorded. The data are given as follows :

Sample No.	Weight of Iron Plates (in grams)			
1	500	510	515	510
2	502	510	520	510
3	510	515	520	510
4	502	505	510	506
5	503	504	504	502
6	505	506	508	502
7	510	515	512	502
8	505	508	510	506
9	510	507	510	508
10	505	502	503	498
11	504	510	505	508
12	502	505	502	504

Construct the suitable control charts for process mean and process variability. State whether the process in under statistical control. If necessary, compute revised control limits. 10

6. The following table presents the failure data for 500 LED bulbs :

Operating Time (in days)	No. of Failures
0—100	124
100—200	96
200—300	40
300—400	35
400—500	27
500—600	42
600—700	52
700—800	84

Estimate : 10

(i) Reliability function

(ii) Cumulative failure distribution function

(iii) Failure density function

(iv) Hazard function

7. (a) Solve the two-person zero-sum game having the following pay-off matrix for player A : 8

		Player B			
		B_1	B_2	B_3	B_4
Player A	A_1	14	13	12	11
	A_2	16	14	15	10
	A_3	11	12	10	13

(b) Describe course of action with an example. 2

× × × × × × ×