

No. of Printed Pages : 8

MSTE-001

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

Term-End Examination

June, 2019

MSTE-001 : INDUSTRIAL STATISTICS—I

Time : 3 Hours

Maximum Marks : 50

Note : Question No. 1 is compulsory. Attempt any four questions from the remaining Question Nos. 2 to 7. *Use of Scientific Calculator (Non-programmable) is allowed. Use formulae and Statistical Tables Booklet for PGDAST is allowed. Symbols have their usual meanings.*

1. State whether the following statements are True or False. Give reasons in support of your answers : 5×2
- (a) If the average fraction defective in a random sample of size 20 is 0.20, the centre line of chart will be 40.

- (b) If the probability of making a decision about acceptance or rejection of a lot on the basis of first random sample of size 20 is 0.7, the average sample number for the double sampling plan will be 30, if size of second random sample is 29.
- (c) Two independent components of a system are connected in series configuration. If the reliabilities of these components are 0.4 and 0.3 respectively, the reliability of the system will be 0.7.
- (d) If the maximin value = minimax value of a game, it has no saddle point.
- (e) If a lot of 500 cricket balls has 50 defective balls, then the lot quality will be 0.45.
2. (a) In a recently started process of producing containers, their volume is subject to a quality control. The \bar{X} and S values for 15 random samples of size 5 are given as follows :

Sample No.	\bar{X}	S
1	62.34	0.05
2	62.29	0.06

3	62.32	0.08
4	62.30	0.04
5	62.32	0.05
6	62.30	0.04
7	62.30	0.03
8	62.33	0.02
9	62.33	0.01
10	62.30	0.01
11	62.32	0.02
12	62.30	0.01
13	62.30	0.04
14	62.30	0.03
15	62.34	0.04

Construct the suitable control charts and state whether the process is under control. If not, compute revised control limits. 8

(b) Differentiate between Single sampling plan and Double sampling plan. 2

3. (a) A mobile manufacturing company supplies mobiles in lots of size 250 to the buyer. A single sampling plan with $n = 20$ and $c = 1$ is being used for the lot inspection. The company and the buyer decide that $AQL = 0.04$ and $LTPD = 0.10$. If there are 15 defectives in each lot, compute : 8

(i) probability of accepting the lot.

- (ii) producer's risk and consumer's risk.
- (iii) average outgoing quality (AOQ), if the rejected lots are screened and all defective mobiles are replaced by non-defectives
- (iv) average total inspection (ATI).
- (b) Differentiate between Average Sample Number (ASN) and Average Total Inspection (ATI). 2
4. A toy company is bringing out a new type of toy. It is attempting to decide whether to bring out a full, partial or minimal product line. The company has three levels of product acceptance. Management will make its decision on the basis of expected profit from the first year of production. The relevant data and given in the following table :

Product Acceptance	Anticipated Profit (₹ '000)		
	Full	Partial	Minimal
Good	80	70	50
Fair	50	45	40
Poor	-25	-10	0

Take optimal decision under each of the following decision criteria : 10

- (i) Maximax

- (ii) Maximin
- (iii) Laplace
- (iv) Minimax regret

5. (a) The failure data of 10 electronic components are reported in the table given below :

5

Failure Number	Operating Time (in hrs.)
1	3
2	5
3	31
4	51
5	76
6	116
7	140
8	182
9	250
10	302

Estimate :

- (i) Reliability
- (ii) Cumulative failure distribution
- (iii) Failure density

- (b) A manufacturer of silicon chips produces lots of 100 chips for shipment. A buyer uses a double sampling plan with $n_1 = 5$, $c_1 = 0$, $n_2 = 15$, $c_2 = 1$ to test the quality of the lots. Given that the incoming quality of a lot is 0.02, calculate the probability of accepting the lot on the second sample. 5
6. (a) Fifteen samples of 100 tubes are drawn from the output of a process that produces several thousand units daily. Sample tubes are inspected for quality and defective tubes are rejected. The results are shown below :

Sample No.	No. of Defective Tubes
1	8
2	10
3	13
4	9
5	8
6	10
7	14

8	6
9	10
10	13
11	18
12	15
13	12
14	14
15	9

On the basis of information given above, prepare a suitable control chart to check the process of tubes manufacturing and state whether the process is under control ? If not, draw the revised control chart.

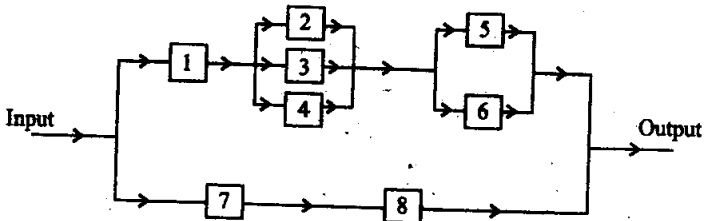
5

- (b) Solve the two-person zero-sum game having the following payoff matrix for player A :

5

		Player B				
		B ₁	B ₂	B ₃	B ₄	B ₅
Player A	A ₁	3	4	5	-2	3
	A ₂	1	6	-3	3	7

7. (a) Evaluate reliability of the system for which the reliability block diagram is shown in the figure given below :



Assume that all components are independent and reliabilities of these components are given as follows :

$R_1 = 0.80$, $R_2 = 0.75$, $R_3 = 0.50$, $R_4 = 0.65$,
 $R_5 = 0.76$, $R_6 = 0.60$, $R_7 = 0.95$, $R_8 = 0.92$,
 where $R_i = (i = 1, 2, \dots, 8)$ denotes the reliability of component i . 6

- (b) Write short notes on any *two* of the following : 4

- (i) Courses of Action
- (ii) States of Nature
- (iii) Payoff values