No. of Printed Pages : 8

# MSTE-001

## POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

## Term-End Examination

## June, 2020

### MSTE-001 : INDUSTRIAL STATISTICS—I

*Time : 3 Hours* *Maximum Marks : 50*

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

*(ii) Attempt any **four** questions from 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 : 2 each

   (a) If a process is under statistical control, then it contains both assignable and chance causes.

(b) For controlling the number of defects in a process we use $p$-chart.

(c) If three strategies are available to a player in a two-person zero-sum game, then $(\frac{1}{3}, \frac{1}{3}, \frac{1}{3})$ is a pure optimal strategy in the game for him/her.

(d) A house gets electric power from a generator or solar panels which are connected in parallel configuration. The reliability of the generator is 0.70 and solar panel is 0.80. The probability that the house has power on any given day will be 0.9.

(e) In a single sampling plan, the average sample number (ASN) changes with quality of the lot.

2. A tomato sauce manufacturing company uses automatic machines to fill 500 ml tomato sauce bottles. A quality control inspector at the company collects 10 samples each of four

observations at different times and measure the volume of each filled bottle. The data are given

10

| Sample | Volume of juice per bottle (in ml) | | | |
|---|---|---|---|---|
| | Obs. 1 | Obs. 2 | Obs. 3 | Obs. 4 |
| 1 | 497 | 500 | 501 | 499 |
| 2 | 504 | 510 | 506 | 510 |
| 3 | 499 | 500 | 510 | 505 |
| 4 | 520 | 530 | 525 | 520 |
| 5 | 500 | 501 | 505 | 507 |
| 6 | 501 | 500 | 501 | 500 |
| 7 | 505 | 505 | 507 | 503 |
| 8 | 510 | 510 | 510 | 510 |
| 9 | 505 | 510 | 501 | 505 |
| 10 | 515 | 510 | 505 | 505 |

(i) Which control chart will be used to control the mean ?

(ii) Calculate the control limits of the chart.

(iii) Check whether the process is under statistical control or not.

(iv) If it is out of control, obtain the revised control limits.

3. (a) A pen drive manufacturing company supplies per drives in lots of size 250 to the buyer. A single sampling plan with $n = 15$, $C = 1$ is being used for the lot inspection. The company and the buyer decide that AQL = 0.01 and LTPD = 0.10. If the incoming lots contain 3% defective pen drive, calculate :

(i) Probability of accepting the lot 2

(ii) Producer's risk 2

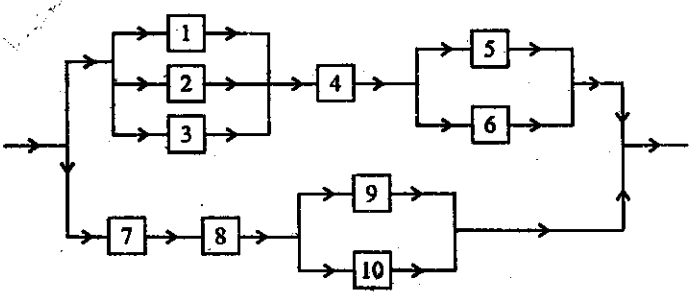
(iii) Consumer's risk 1

(iv) ADQ if rejected lots are screened and all defective pen drives are replaced by non-defectives 1

(v) ATI 1

(b) What are the differences between control charts for variables and attributes ? 3

4. (a) The configuration of a system is shown in the following diagram : 5




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

$R_1 = 0.50$, $R_2 = 0.60$, $R_3 = 0.70$, $R_4 = 0.80$, $R_5 = 0.50$, $R_6 = 0.70$, $R_7 = 0.50$, $R_8 = 0.80$, $R_9 = 0.50$ $R_{10} = 0.50$.

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

(b) A fruitseller buys apples at the rate of ₹ 50 per kg and sells them at the rate of ₹ 60 per kg. Assume that an apple not sold during the day is treated as rotten and thrown away. The daily sales of apples in

the past has never been less than 48 kg and more than 50 kg. 5

(i) State courses of action, states of nature and payoff matrix in this situation.

(ii) Identify the optimum course of action under :

(I) Optimistic criterion

(II) Pessimistic criterion

5. (a) Use dominance rules to reduce the size of the following payoff matrix to (2 × 2) size and hence, find the optimal strategies and values of the game : 7

| | | Player B | | | |
|---|---|---|---|---|---|
| | | $B_1$ | $B_2$ | $B_3$ | $B_4$ |
| Player A | $A_1$ | 5 | 2 | 4 | 6 |
| | $A_2$ | 3 | 4 | 4 | 4 |
| | $A_3$ | 4 | 2 | 4 | 0 |
| | $A_4$ | 0 | 4 | 0 | 4 |

(b) Differentiate between pure and mixed strategies in game theory. 3

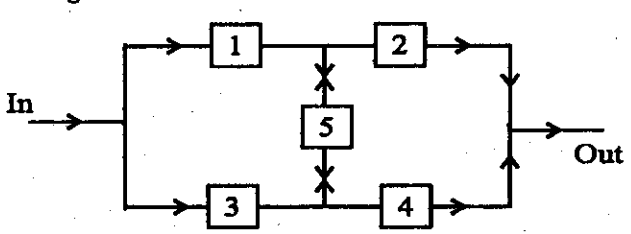
6. (a) A quality control technician has recorded the number of defects per 10 square metre

on the wall papers. The data from 10 inspections are shown in the following table :

| Sample No. | Number of Defects |
|---|---|
| 1 | 6 |
| 2 | 8 |
| 3 | 12 |
| 4 | 5 |
| 5 | 10 |
| 6 | 7 |
| 7 | 6 |
| 8 | 18 |
| 9 | 4 |
| 10 | 2 |

Draw a suitable control chart. What conclusion do you draw from the control chart ? 5

(b) A system has five independents components, each has reliability 0.80 for a mission of 200 hours. The system configuration is shown below :



Evaluate the reliability of the system using decomposition method or conditional probability approach. 5

7. A hospital receives disposable injection syringes in lots of 1000. A double sampling plan with $n_1 = 10, c_1 = 0, n_2 = 25, c_2 = 1$ is being used to test the quality of the lots. If the incoming lot quality is 0.04, calculate the probability of accepting the lot on the basis of : 10

   (i) first sample

   (ii) second sample.