No. of Printed Pages : 7

MSTE-001

POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination

01447

December, 2016

MSTE-001 : INDUSTRIAL STATISTICS I

Time : 3 hours *Maximum Marks : 50*

Note :

(i) *All questions are **compulsory**. Questions no. 2 to 5 have internal choices.*

(ii) *Use of scientific calculator is allowed.*

(iii) *Use of Formulae and Statistical Tables Booklet for PGDAST is allowed.*

(iv) *Symbols have their usual meaning.*

---

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

(a) For controlling the number of defective items in the production process, we use c-chart.

(b) The specification limits and natural tolerance limits are the same in Statistical Quality Control.

(c) Three independent components of a system are connected in series configuration. If the reliabilities of these components are 0·1, 0·2 and 0·3, respectively, the reliability of the system will be 0·006.

(d) If a lot of 200 hockey balls has 10 defective balls, then the lot quality will be 0·45.

(e) A saddle point exists in a game when Maximax value is equal to Minimin value.

2. A factory produces LED bulbs. Ten samples of 3 bulbs each are drawn at regular intervals. The life of each sampled bulb is measured and is given below :

Sample Number	Life of Bulbs (in thousand hours)		
1	25	22	24
2	19	20	22
3	21	24	20
4	28	26	22
5	24	24	20
6	15	16	14
7	26	24	23
8	28	25	24
9	22	24	25
10	24	20	22

Test whether the process is under statistical control with respect to the average life of LED bulbs. If the process is out-of-control, calculate the revised centre line and control limits to bring the process under statistical control. *10*

OR

(a) To check the process of manufacturing cricket balls, a quality control inspector takes a sample of 30 balls from the manufacturing process up to 15 days. Each ball is inspected and classified as defective or non-defective on the basis of certain criterion. The proportion of defectives in each sample is calculated and is given below :

Days	*Proportion of Defectives*
1	0·03
2	0·04
3	0·06
4	0·03
5	0·08
6	0·2
7	0·09
8	0·06
9	0·03
10	0·05
11	0·04
12	0·05
13	0·12
14	0·02
15	0·03

Draw a suitable control chart and comment on the state of control. *7*

(b) A control chart for number of defects per mobile phone is to be formed. Twenty-five mobile phones are inspected and 30 defects are found. Obtain the centre line and control limits for the chart. *3*

3. (a) A computer manufacturer purchases computer chips from a company in lots of 200 chips. Ten computer chips are sampled from each lot at random and are inspected for defects. A lot is accepted only if the inspected sample contains at most one defective chip. It is decided that AQL = 0·05 and LTPD = 0·10. If there are 3% defective chips in each lot, compute the

(i) probability of accepting the lot,

(ii) producer's risk,

(iii) consumer's risk,

(iv) Average Outgoing Quality (AOQ), if the rejected lots are screened and all the defective chips are replaced by non-defective ones.

(v) Average Total Inspection (ATI). *2+2+1+1+1*

(b) Define Average Sample Number (ASN) and Average Total Inspection (ATI). *3*

OR

(a) Differentiate between the following : *3+2*

(i) Single sampling plan and Double sampling plan

(ii) Acceptance sampling plan and Rectifying sampling plan

(b) A school receives chalks in lots of 100. A single sampling plan with n = 8 and c = 0 is being used for inspection. Construct the Operating Characteristic (OC) curve for this plan. *5*

4. The profits of a milk booth of a particular brand under small, medium and large orders subject to low, moderate and high demands, respectively are shown in the following table :

Order for Milk	Demand of Milk at the Booth		
	Low	Moderate	High
Small	1000	1000	1000
Medium	800	1300	1300
Large	600	1100	1600

Specify the courses of action along with the states of nature and express these in the payoff table. Also take a decision as to which order is more beneficial for the owner under

(a) Optimistic criterion,

(b) Pessimistic criterion, and

(c) Hurwitz criterion (for $\alpha = 0{\cdot}6$). *10*

OR

(a) Find the maximin and minimax values for the game having the payoff matrix given below :

		Player B		
		B_1	B_2	B_3
Player A	A_1	4	3	5
	A_2	2	4	7
	A_3	6	1	– 1

Does the game have a saddle point ? If yes, solve it. *3*

(b) Solve the two-person zero-sum game having the following payoff matrix for Player A : *7*

		Player B	
		B_1	B_2
Player A	A_1	4	2
	A_2	1	5

5. The failure density function of a component defined by a random variable T is

$$f(t) = \begin{cases} 0{\cdot}01\, e^{-0{\cdot}01t}, & t \geq 0 \\ 0, & \text{otherwise} \end{cases}$$

Calculate

(a) Reliability of the component,

(b) Reliability of the component for a 100 hour mission time,

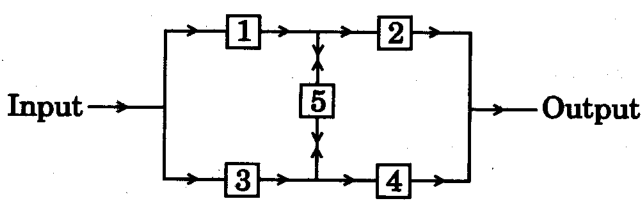
(c) Mean Time To Failure (MTTF),

(d) Median of the random variable T.

(e) What is the life of the component, if a reliability of 0·90 is desired ? *2+1+2+3+2*

OR

Evaluate the reliability of the system for which the reliability block diagram is given below for a mission of 1 year :



It is given that the components of the system are independent and each component has a reliability of 0·90 for a mission of 1 year. *10*