POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination

December, 2019
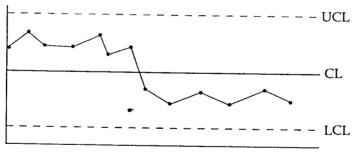
MSTE-001 : INDUSTRIAL STATISTICS - I

Time : 3 hours   *Maximum Marks : 50*

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

        (ii)   *Attempt any four questions from the remaining questions 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.

                                                             5x2=10

    (a) The control chart shown below indicates that, the process is under statistical control.

Sample No.

    (b) In rectifying sampling inspection plan, the outgoing quality remain same as the incoming quality.

    (c) In a double sampling plan, $N = 400$, $n_1 = 15$, $c_1 = 1$, $n_2 = 30$, $c_2 = 3$, the probability of making a decision about acceptance or rejection of the lot on first sample is 0.8345. Then Average Sample Number (ASN) of this plan will be 20.

    (d) If hazard rate of a component is λ, then reliability of the component will be $e^{-\lambda t}$.

    (e) A saddle point exists in a game when Maximin value is not equal to Minimax value.

2. A toy manufacturing company has been given a large order for small plastic whistles   10
that will be given away by fast-food hamburger chain with its kid's meal. Seven random
samples of four whistles have been taken and weight of each whistle is measured. The
data are shown as :

Sample No.	Weight (in gram)			
1	4.1	5.2	3.9	5.0
2	3.6	4.3	3.9	4.6
3	4.0	4.8	5.1	5.3
4	5.6	5.8	5.7	5.7
5	3.9	3.8	4.6	4.9
6	5.1	4.7	4.8	4.3
7	4.6	4.4	4.0	4.5

(a) Estimate the process mean.

(b) Is the process under statistical control ? If necessary, compute revised control
limits.

3. (a) Mention the advantages of double sampling plan over single sampling plan.   3

(b) A memory card manufacturing company formed lots of 500 memory cards. To   7
check the quality of lots, the buyer uses a double sampling plan with $n_1 = 10$,
$c_1 = 0$, $n_2 = 25$, $c_2 = 1$. If the incoming lot quality is 0.04, what is the probability of
accepting the lot on,

   (i)   the first sample ?

   (ii) the second sample ?

4. The manager of a Flower Shop purchases roses for ₹ 10 per dozen and sells them for   10
₹ 30 per dozen. All unsold roses are donated to a local hospital. The information of
demand for roses for the past 100 days is as follows :

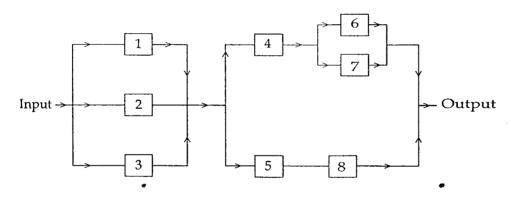| Dozens of roses	70	80	90	100
No. of days	10	20	40	30

How many dozens of roses should be purchased to maximise its profits ?

5. (a) A two-person zero-sum game having the following pay-off matrix for Player A 4 and Player B is as follows :

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

Obtain the :

(i) Optimal strategy for Player A,

(ii) Optimal strategy for Player B,

(iii) Value of the game,

(b) Find the system reliability of the following series-parallel configurations. Assume 6 that all components are independent but components 1, 2 and 3 are not identical and at least two components work successfully for system functioning, given :

$R_1 = 0.80$, $R_2 = 0.50$, $R_3 = 0.70$, $R_4 = 0.80$, $R_5 = 0.90$, $R_6 = 0.70$, $R_7 = 0.70$, $R_8 = 0.90$.

6. (a) The life of a turbine follows the following failure density function : 7

$$f(t) = \frac{3t^2}{10^9} ; 0 \le t \le 1000 \text{ hours}$$

Calculate :

(i) Reliability of the turbine,

(ii) Reliability of the turbine for a 100 hour mission time,

(iii) Mean time of failure, and

(iv) Median life of the turbine.

(b) A manufacturing process produces a certain type of chocolate with a weight 3 of 50 grams and a standard deviation 0.10 grams. The specification limits of the process are 50 ± 2 grams. Is the process capable of meeting the specification requirements ?

7. (a) A computer manufacturer purchases motherboards in lots of 500. The computer manufacturer uses single sampling plan with $n = 20$, $c = 1$. Suppose, the Acceptance Quality Level (AQL) and Lot Tolerance Percent Defective (LTPD) are 0.04 and 0.10 respectively. If the incoming lot quality is 5%, then calculate the,

   (i) Probability of accepting the lot, 2+1+1+1

   (ii) Consumer's risk,

   (iii) Average Outgoing Quality (AOQ), if rejected lots are screened and all defective motherboards are replaced by non-defectives, and

   (iv) Average Total Inspection (ATI).

   (b) The number of defective switches in 10 samples each of size 100 are shown in the following table. Construct a suitable control chart for the given data. 5

Sample Number	Number of Defective Switches
1	8
2	1
3	3
4	2
5	2
6	4
7	3
8	1
9	5
10	6

Does the process appear to be in statistical control ?