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MSTE-001

POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination

December, 2021

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) *Formulae and Statistical Tables Booklet for PGDAST is allowed.*

(v) *Symbols have their usual meanings.*

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

(a) Decision-making in situations where decisions are taken by applying scientific tools or techniques rather than on the basis of experiences of an individual is known as an art.

(b) Courses of action are related to future outcomes, conditions or situations which are not under the control of the decision maker.

(c) In the cut set method, reliability of the system is given by :

$$R_s = P(C_1 \cup C_2 \cup C_3 \cup ..... \cup C_k)$$

(d) Statistical process control means to control the products in such a way that these are free from defects.

(e) For N = 500, $n = 20$, $p = 0.02$ and $p_a = 0.94$, the AOQ will be 0.018.

2. (a) A bangle seller gets the following offer :

   • The cost of a pack of 10 dozen bangles is ₹ 150.

   • The bangle seller can either accept the offer or reject it.

   • Each pack of 10 dozen bangles may have 40%, 30%, 20% or 10% defective bangles. Defective bangles cannot be returned by the bangle seller. Thus, defective bangles in a pack mean a direct loss to the bangle seller.

The bangle seller sells them at the rate of ₹ 20 per dozen. Assume that if he/she accepts the offer, all the bangles are sold out. On the basis of this information :

(i) Identify the course of action.

(ii) Identify states of nature.

(iii) Obtain the payoff table.

Also obtain the opportunity loss table.   5

(b) A vendor buys cards at the rate of ₹ 3 per card and sells at the rate of ₹ 4 per card. Assume that a card which is not sold on the same day goes to scrap and pays him ₹ 0.50 as regret value. The information for the past 200 days about the sale is shown as :

Number of cards demanded	Number of days
200	40
204	100
206	40
208	20

On the basis of this information, how many cards should be bought by the vendor so that his profit is maximum ? 5

3. (a) Using cut set method, evaluate the reliability of the system having reliability block diagram given as follows for a mission of 1000 hours. It is given that components are independent and each component has reliability of 0.95 for a mission of 1000 hours. 8
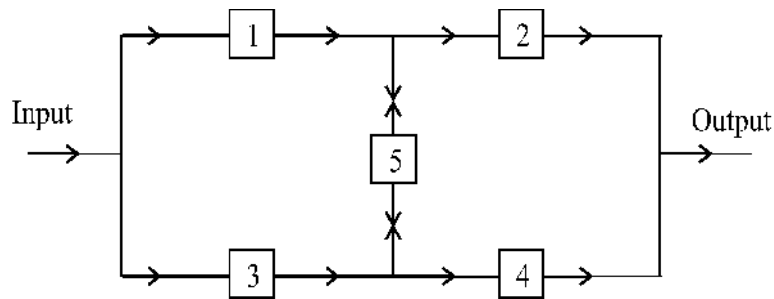
 (b) Distinguish between series and parallel systems. 2

4. (a) A system has three components connected in series having reliabilities 0.40, 0.70, 0.80 respectively, for mission of 400 hours. What is the percentage increase in the reliability of the system in each of the following cases ?

  (i) Reliability of the first component is increased by 0.1 and that of the second and third components remains the same. 5

  (ii) Reliability of the third component is increased by 0.1 and that of the first and second components remains the same.

  Comment on the different percentage obtained in (i) and (ii). 5

(b) Solve the two-person zero-sum game having the following payoff matrix for player A : 　　　5

Player B

$$B_1 \quad B_2 \quad B_3$$

Player A

	B_1	B_2	B_3
A_1	1	2	7
A_2	6	4	2

5. (a) 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

(b) 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, calculate the revised control limits. 5

6. (a) Suppose a shirt manufacture company supplies shirts in lots of size 500 to the buyer. A sampling plan with $n = 10$, $c = 1$ is being used for the lot inspection. The company and the buyer's quality control inspector decides that P = 0.02, AQL = 0.04 and LTPD = 0.10.

Find :

(i)   the probability of accepting a lot

(ii) the producer's risk and consumer's risk

(iii) ASN

(iv) ATI

for this sampling plan.   8

(b) Describe OC curve.   2

P. T. O.

7. Construct a suitable control chart for average and variability for the following data. Samples of 5 being taken every hour. Comment on whether the production seems to be under control :   10

Sample No.	1	2	3	4	5
1	42	65	75	78	87
2	42	45	68	72	90
3	19	24	80	81	81
4	36	54	69	77	84
5	42	51	57	59	78
6	51	74	75	78	132
7	60	60	72	95	138
8	18	20	27	42	60
9	15	30	39	62	84
10	69	109	113	118	153
11	64	90	93	109	112
12	61	78	94	109	136

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