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MSTE-001

POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination

02592

June, 2017

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 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) The sampling plan in which 100% inspection is carried out for rejected lots is called the acceptance sampling plan.

(b) For controlling the process variability, we use a p-chart.

(c) If the reliability of two independent components (connected in parallel configuration) of a system are 0·1 and 0·5 respectively, then the reliability of the system will be 0·55.

(d) If the value of a game is 100, it is fair.

(e) Through Statistical Quality Control, we control only the process.

2. A factory produces steel pipes. The quality control inspector wants to control the length of the pipes and takes a sample of 5 pipes every hour. He notes the average length ($\bar{X}$) and range (R) for each sample. The results are given below :

Sample No.	Average Length ($\bar{X}$)	Range (R)
1	25	0·7
2	25·4	0·5
3	25·3	0·6
4	25	0·5
5	24·8	0·4
6	25·2	0·7
7	25·8	0·4
8	25·4	0·8
9	25·2	0·2
10	24·9	0·4

(a) Which control chart should be used to control the average length of the pipes ?

(b) Determine the centre line and control limits of the chart.

(c) Construct the control chart and draw a conclusion about the process.

(d) Calculate the revised centre line and control limits, if the process is out-of-control. *1+3+3+3*

OR

(a) Random samples of 100 pens daily were taken from the daily production of a factory and the number of defective pens from each sample was noted. On the basis of the information given below, prepare a control chart for fraction defective :

Day	No. of Defective Pens
1	4
2	5
3	8
4	5
5	10
6	7
7	6
8	15
9	8
10	6
11	9
12	7

What conclusion do you draw from the control chart ? *6*

(b) For overall quality improvement of cloth, a textile manufacturer decides to monitor the number of defects in each bolt of cloth. The data from 10 inspections are reported in the following table :

Bolt of Cloth	Number of Defects
1	8
2	19
3	5
4	11
5	2
6	8
7	7
8	13
9	3
10	2

(i) Which control chart should be used ?

(ii) Calculate the centre line and control limits for this chart.

(iii) Is the process under statistical control ? *4*

3. (a) A car tyre manufacturing company supplies tyres in lots of size 200. A single sampling plan with n = 12 and c = 1 is being used for the lot inspection. It is decided that the Acceptance Quality Level (AQL) and the Lot Tolerance Percent Defective (LTPD) are 4% and 12%, respectively. If there are 5% defective tyres in each lot, calculate 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 defective tyres are replaced by non-defectives, and

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

(b) Define Acceptance sampling plan with example. *3*

OR

(a) A tennis ball manufacturing company formed lots of 200 balls. To check the quality of lots, the buyer uses a double sampling plan with $n_1 = 10$, $c_1 = 0$, $n_2 = 15$, $c_2 = 1$. Given that the incoming quality of the lot is 0·04, what is the probability of accepting the lot on

(i) the first sample ?

(ii) the second sample ? *2+4*

(b) Define with examples : *2+2*

(i) Producer's risk

(ii) Consumer's risk

4. A vendor buys newspapers at the rate of ₹ 3 per newspaper and sells them at the rate of ₹ 4 per newspaper. Assume that a newspaper which is not sold on the same day goes to scrap and gets ₹ 0·50 as regret value. The information for the past 100 days is shown in the following table :

No. of Newspapers Demanded	No. of Days
200	20
204	30
206	40
208	10
Total	100

On the basis of this information, how many newspapers should be bought by the vendor so as to maximize his profit ? *10*

OR

A two-person zero-sum game having the following pay-off matrix for Player A and Player B is as follows :

		Player B			
		B_1	B_2	B_3	B_4
Player A	A_1	5	4	2	1
	A_2	8	3	5	1
	A_3	2	2	1	2

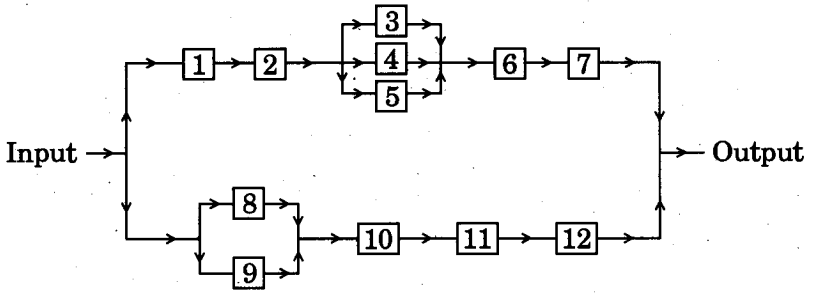
Obtain the

(a) Optimal strategy for player A,

(b) Optimal strategy for player B, and

(c) Value of the game. *10*

5. Evaluate the reliability of the system for which the reliability block diagram is given below for a mission of 200 hours :



Assume that all components are independent and the reliability of each component is given for a mission of 200 hours as follows : *10*

$R_1 = R_3 = R_5 = R_7 = R_9 = R_{11} = 0{\cdot}80$

$R_2 = R_4 = R_6 = R_8 = R_{10} = R_{12} = 0{\cdot}70$

OR

(a) In a piping system, 3 pipes are connected in the parallel configuration. These pipes are independent but not identical. The reliability of smooth flow of the liquid for a mission of 1000 hours are $R_1 = 0{\cdot}50$, $R_2 = 0{\cdot}70$ and $R_3 = 0{\cdot}80$, respectively. The system is said to work successfully, if at least 2 pipes perform their intended function successfully. Evaluate the reliability of the system. *6*

(b) A component has the following hazard rate :

$\lambda(t) = 0{\cdot}4t,\ t \geq 0,$

where t is in years. Calculate the reliability of the component for the first 2 years. *4*