MSTE-001

POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

01464

Term-End Examination

December, 2015

MSTE - 001 : INDUSTRIAL STATISTICS - I

Time : 3 hours *Maximum Marks : 50*

Note : (i) ***All*** *questions are* ***compulsory.*** *Question Nos. 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 reason in support of your answer. **5x2=10**

(a) The variation due to assignable causes in the quality of cricket balls cannot be removed.

(b) The C-chart is used to control the number of defectives in a process.

(c) The probability of rejecting a lot of Acceptance Quality Level (AQL) is known as consumer's risk.

(d) Two independent components of a system are connected in parallel configuration. If the reliabilities of these components are 0.2 and 0.3 respectively, reliability of the system will be 0.44.

(e) If the value of a game is 4, the game is fair.

2. A milk company uses automatic machines to fill 500 mL milk packets. A quality control inspector inspected four packets for each sample at given time-intervals and measured the weight of each filled packet. **10**

Averages ($\overline{X}$) and Ranges (R) of 10 samples are shown in the following table :

Sample No.	$\overline{X}$	R
1	506.67	20
2	503.33	40
3	536.67	80
4	510.00	20
5	493.33	30
6	513.33	20
7	520.00	20
8	513.00	40
9	500.00	20
10	510.00	30

Using $\overline{X}$ and R - charts, draw conclusion about the process by assuming assignable causes for any out-of-control points. If the process is out-of-control, calculate the revised centre line and control limits to bring the process under statistical control.

OR

(a) To monitor the manufacturing process of laptops, a quality control engineer randomly selects 40 laptops from the production line each day over a period of 10 days. The laptops are inspected for certain defects and the numbers of defective laptops found each day are recorded in the following table : 5

Day	1	2	3	4	5	6	7	8	9	10
Number of Defective Laptops	3	7	6	10	2	5	3	6	7	1

Construct the appropriate control chart and state whether the process is under control.

(b) From a transistor production line, 12 transistors are chosen randomly. The number of defects in each transistor are given below : 3+2

Transistor number	1	2	3	4	5	6	7	8	9	10	11	12
Number of Defects	4	5	3	0	12	4	6	3	1	4	1	5

(i) Which control chart should be used in this case ? Calculate the control limits for this chart.

(ii) Are these data from a controlled process ?

3. A shirt manufacturing company supplies shirts in lots of size 150 to a buyer. A single sampling plan with $n = 10$ and $c = 1$ is being used for the lot inspection. The company and the buyer decide that AQL $= 0.08$ and LTPD $= 0.16$. **2+4+2+2**

If there are 15 defective shirts in each lot, compute the :

(a) Probability of accepting the lot.

(b) Producer's risk and consumer's risk.

(c) Average Outgoing Quality (AOQ), if the rejected lots are screened and all defective shirts are replaced by non-defectives.

(d) Average Total Inspection (ATI).

OR

(a) Differentiate between : **2+2**

(i) Single sampling plan and Double sampling plan

(ii) Average Sample Number (ASN) and Average Total Inspection (ATI)

(b) 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 probabilities of accepting the lot on the **6**

(i) first sample, and

(ii) second sample

4. Consider the following payoff table : **2+2+3+3**

States of Nature	Courses of Action			
	A_1	A_2	A_3	A_4
N_1	400	900	900	1000
N_2	200	400	700	–300
N_3	600	200	500	700

Identify the optimum course of action under :

(a) Optimistic criterion (assume that payoff values represent profits)

(b) Pessimistic criterion

(c) Hurwicz criterion

(d) Regret criterion (assume that payoff values represent losses)

OR

(a) A game has the following payoff matrix : **4**

		Player B		
		B_1	B_2	B_3
Player A	A_1	5	7	4
	A_2	4	3	0
	A_3	6	1	3

Obtain the :

(i) Optimal strategy for player A,

(ii) Optimal strategy for player B, and

(iii) Value of the game.

Is the game fair ?

(b) Solve the two-person zero-sum game having the following payoff matrix for player A : **6**

<table>
<tr><td colspan="2"></td><td colspan="2">Player B</td></tr>
<tr><td colspan="2"></td><td>B_1</td><td>B_2</td></tr>
<tr><td rowspan="2">Player A</td><td>A_1</td><td>-2</td><td>-1</td></tr>
<tr><td>A_2</td><td>4</td><td>-3</td></tr>
</table>

5. The failure data for 1000 electronic components are shown in the table given below : **10**

Operating time (in hours)	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of failures	207	175	148	120	105	67	50	74	35	19

Estimate :

(a) Reliability,

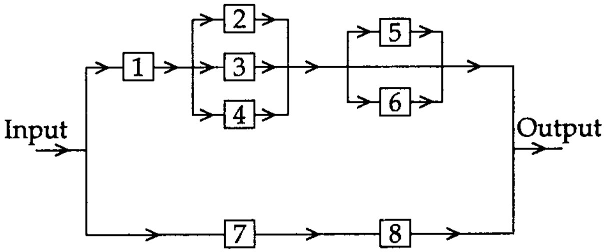
(b) Cumulative failure distribution,

(c) Failure density, and

(d) Hazard function

OR

Evaluate reliability of the system for which the reliability block diagram is shown in the figure given below : **10**



Assume that all components are independent and reliability of each component is given as follows :

$R_1 = 0.80$, $R_2 = 0.75$, $R_3 = 0.50$, $R_4 = 0.65$,

$R_5 = 0.76$, $R_6 = 0.60$, $R_7 = 0.95$, $R_8 = 0.92$

where R_i $(i = 1, 2, ..., 8)$ denotes reliability of component i.