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MSTE-001

**POST GRADUATE DIPLOMA IN
APPLIED STATISTICS (PGDAST)**

Term-End Examination

June, 2026

MSTE-001 : INDUSTRIAL STATISTICS-I

Time : 3 Hours

Maximum Marks : 50

Note : *Question No. 1 is compulsory. Attempt any **four** questions from the remaining Question Nos. 2 to 7. Use of scientific calculator (non-programmable) is allowed. Use of Formulae and Statistical Tables Booklet for PGDAST is allowed. Symbols have their usual meanings.*

1. State whether the following statements are True or False. Give reasons in support of your answers : 5×2=10
 - (a) A k -out-of n -system is called a non-redundant system if $k \neq n$.

- (b) For controlling the number of defects per unit in a process we use C-chart.
 - (c) The probability of rejecting a lot of unsatisfactory quality 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 0.75 and 0.85 respectively, then the reliability of the system will be 0.96.
 - (e) For $N = 400$, $n = 15$ and $P_a = 0.95$, the average number of units inspected per lot will be 35.80.
2. (a) Twenty boxes of push buttons switches, each containing 25 switches were randomly selected from a lot of switch boxes. Each box is inspected for the number of defects per box and the following data of number of defects per box were obtained :
- 3, 3, 6, 8, 7, 5, 5, 7, 8, 3, 4, 4, 4, 7, 7, 8, 2, 4, 1, 1.

Draw a suitable control chart and state whether the process is under statistical control or not. 7

- (b) The following data give the payoff values (in thousand rupees) representing profits of a company :

State of Nature	Course of Action		
	A_1	A_2	A_3
N_1	1100	1100	1000
N_2	900	1400	1400
N_3	700	1200	1500

Identify the optimum course of action under optimistic criterion and pessimistic criterion. 3

3. 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 or not.

10

Sample No.	Observations				
	1	2	3	4	5
1	16	14	16	14	11
2	20	15	16	18	19
3	17	14	14	15	10
4	18	14	13	14	9
5	12	14	17	10	14
6	15	15	16	27	13
7	11	19	14	12	20
8	15	13	15	14	20
9	10	15	14	13	15
10	15	12	14	15	10
11	16	12	11	13	19
12	18	15	16	14	20
13	19	11	12	13	12
14	13	16	19	13	19

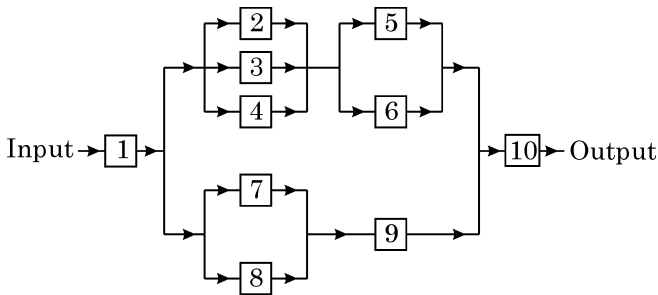
4. Evaluate the reliability of the system for which the reliability block diagram is given

in the figure below, for a mission of 100 hours. Assume that all components are independent and the reliability of each component is given as follows : 10

$$R_1 = 0.70, R_2 = 0.85, R_3 = 0.60, R_4 = 0.95$$

$$R_5 = 0.76, R_6 = 0.90, R_7 = 0.75, R_8 = 0.65$$

$R_9 = 0.80, R_{10} = 0.98$, where R_i denotes the reliability of component i , ($i = 1, 2, 3, \dots, 10$).



5. (a) Solve the two-person zero-sum game having the following pay-off matrix for player A : 8

		Player B			
		B ₁	B ₂	B ₃	B ₄
Player A	A ₁	2	1	4	3
	A ₂	5	0	6	4
	A ₃	0	3	1	2

- (b) Distinguish between series and parallel systems. 2
6. (a) The failure density function of the random variable T is given by :

$$f(t) = 0.3e^{-0.3t}; t \geq 0$$

Calculate :

- (i) Reliability of the system.
 - (ii) Hazard rate.
 - (iii) Mean time to failure.
 - (iv) Cumulative failure distribution function. 2+2+2+1
- (b) Describe OC curve and Average sample number. 3
7. A manufacturer of shoes produces lots of 400 shoes for shipment. A buyer uses a double sampling plan with $n_1 = 10$, $c_1 = 0$, $n_2 = 20$, $c_2 = 2$ to test the quality of the lots. 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 ?

Also, if the rejected lots are screened and all defective shoes are replaced by non-defective ones, calculate the average outgoing quality for this plan. 2+5+3

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