Date - 26/11/19

B.E. (Mechanical) (Sem -VII) (CBSGS) (R-2012)

Time :-3 HRS   **Marks : - 80**

Instructions   1. **Question No 1 is compulsory.**
                   2. **Attempt any Three out of remaining Five Questions.**
                   3. **Assume suitable data wherever necessary**
                   4. **Figures to the right indicate full marks.**

Q.1   Explain **Any 4**   20
        a.   Prove that the dual of the dual of given primal is primal.
        b.   State the assumptions made in determination of economic order quantity for inventory management.
        c.   Explain Monte Carlo simulation technique for solving
        d.   Discuss Bellman's principle of optimality and Dynamic programming as a multistage problem
        e.   State the assumptions made in game theory.

Q.2   a   A boat company makes three different kinds of boats. All boats can be made profitably but the company's monthly production is constrained by limited amount of labour, wood and screws available each month. The director will choose the combination of the boats that maximizes his revenue in view of the information given in the following table:

Input	Row Boat	Canoe	Keyak	Monthly Availability
Labour (Hrs)	12	7	9	1,260 Hrs.
Wood (Board Feet)	22	18	16	19,008 Board Feet
Screws (KG)	2	4	3	396 KG
Selling Price	4, 000	2, 000	5,000	

                 1) Formulate the problem as LPP   (05)
                 2) Write the dual of the LPP.   (05)

        b   Solve the following problem by Dual simplex method   10
                 Maximize $Z= -3 X_1 -2 X_2$

                                $X_1 + X_2 \geq 1$

                                $X_1 + X_2 \leq 7$

                                $X_1 + 2 X_2 \geq 10$

                                $X_1, X_2 \geq 0$

Q.3   a   There are seven jobs, each of which has to go through the machined A and B in the   10
                 order AB. Processing times in hours are given as

Job no.	1	2	3	4	5	6	7
Machine A	3	12	15	6	10	11	9
Machine B	8	10	10	6	12	1	3

                 Determine the sequence of these jobs that will minimize total elapsed time T and idle time for a machine if any.

b
The DREAM - DRINK Company has to work out a minimum cost transportation **10** schedule to distribute crates of drinks from three of its factories X, Y, and Z to its three warehouses A, B, and C. The required particulars are given below. Find the least cost transportation schedule. Transportation cost in Rs per crate.

From/To	A	B	C	Crates Available
X	75	50	50	1040
Y	50	25	75	975
Z	25	125	25	715
Crates required	1300	910	520	2730

Q.4 a.
An educational institute is contemplating to replace zeroxing machine with a heavy **10** duty printer or a cyclostyling machine. Supplier has submitted the quotation for the same for both printer and cyclostyling machine and is as follows

Printer has the cost price of Rs. 1,25,500/- plus 18% GST. The annual maintenance cost is Rs. 5000 per year. The warranty covers repair or replacement of spare parts for first two years and beyond two years it will be charged and it will be at an average of ten percent of the AMC cost per year.

Cyclostyling machine has the cost price of Rs. 1,75,500/- plus 18% GST. The annual maintenance cost is Rs. 2000 per year. The warranty covers repair or replacement of spare parts for first three years and beyond three years it will be charged and it will be at an average of twenty percent of the AMC cost per year.

The specifications of the machines satisfy requirements of the institute. As a head of the institute, you have to advice management which machine should be purchased by giving justification. Assume the life of both machines is six years and resale value at the end of life is Rs 10,000 for printer and Rs 18000 for cyclostyling machine. Take discount rate of money as 10%.

b.
A receptionist attends customer querries regarding connectivity problems in a front **10** office of telecom operator company. The arrival as well as service times are at random and estimated probability distribution is given below

Inter arrival time in time units	1	2	3	4	5
Probability	0.1	0.2	0.35	0.3	0.05
Service time in time units	1	2	3	4	
Probability	0.1	0.3	0.4	0.2	

For next ten arrivals, simulate the system by Monte Carlo Simulation and find the proportion of the time the receptionist is idle and average waiting time for the customers.
Use following random numbers.

Arrival	7884	5611	6517	8468	9495	4436	8589	3899	3712	4949
Service	5218	5441	4741	2264	6377	9517	6164	3582	8081	7537

Q.5 a. Use dynamic programming approach to solve the following problem **10**

Maximize $Z = 8X_1 + 7X_2$

$$2X_1 + X_2 \leq 8$$
$$5X_1 + 2X_2 \leq 15$$

$X_1, X_2 \geq 0$ and integer.

b. Customers arrive at a video game centre at the rate of 5/hour (Poisson) and spend **10** on an average 30 minutes (exponential).

1) How many terminals should the shop have such that the expected number in the queue is less than or equal to 1.

2) Compute the probability that a person enters immediately gets a terminal to play.

Q.6 a. A stockiest has to supply 400 units of a product every Monday to his customers. He **10** gets the product at Rs. 50/- per unit from the manufacturer. The cost of ordering and transportation from the manufacturer is Rs. 75 per order. The cost of carrying inventory is 7.5% per year of the cost of the product. Find (*i*) Economic lot size, (*ii*) The total optimal cost (including the capital cost).

b. I. Solve the following problem graphically. The pay off is for player A **05**

	B_1	B_2
A_1	6	9
A_2	7	6
A_3	6	8

II. Find the optimum value of the following two person zero sum game. **05**

	B_1	B_2	B_3
A_1	10	40	40
A_2	5	5	5
A_3	20	5	20

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