Con.4499-12. (REVISED COURSE0 (3Hours) GN-8477 [Total Marks 100

O.R Mech

BE - VII / 20 Mech / Operation Research

30.05.12

N.B: 1) Question No. 1 is compulsory
2) Attempt any FOUR questions from remaining
3) Figures to the right indicate full marks
4) Answers to questions should be grouped & written together.

Q.1) Attempt the following:

A) What is linear programming? Discuss the applications of linear programming to managerial decision making?

B) Explain Bellman's principle of optimality.

C) Explain different behavior of customers in a queue.

D) Briefly explain the Monte – Carlo Simulation with suitable example.

Q.2) A) An Air Force is experimenting with three types of bombs P, Q and R in which three kinds of explosives, viz. A, B and C will be used. Taking the various factors into account, it has been decided to use the maximum 600 kg of explosive A, atleast 480 kg of explosive B and exactly 540 kg of explosive C. Bomb P requires 3, 2, 2 kg, bomb Q requires 1, 4, 3 kg and bomb R requires 4, 2, 3 kg of explosives A, B and C respectively. Bomb P is estimated to give the equivalent of a 2 ton explosion, bomb Q, a 3 ton explosion and bomb R, a 4 ton explosion respectively. Under what production schedule can the Air Force make the biggest bang? 12

B) Customers arrive at a service facility to get the required service. The interarrival and service times are constant and are 1.8 minutes and 4 minutes respectively. Simulate the system for 14 minutes. Determine the average waiting time of a customer and idle time of the service facility. 8

Q.3) A) Use two phase simplex method to solve the problem. 10

Minimize $Z = 7.5x_1 - 3x_2$

subject to $3x_1 - x_2 - x_3 \geq 3$

$x_1 - x_2 + x_3 \geq 2$

$x_1, x_2, x_3 \geq 0$

B) Use graphical method to minimize the time required to process the following jobs on the machines. For each machine specify the job which should be done first. Also calculate the total elapsed time to complete both jobs. 10

		Machine				
Job 1	Sequence	A	B	C	D	E
	Time (hr)	2	3	4	6	2
Job 2	Sequence	B	C	A	D	E
	Time (hr)	4	5	3	2	6

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Q.4) A) Solve the following problem: 10

Maximize $Z = 1000x_1 + 4000x_2 + 5000x_3$,

Subject to: $3x_1 + 3x_3 \leq 22$,

$x_1 + 2x_2 + 3x_3 \leq 20$,

$3x_1 + 2x_2 \leq 10$,

$x_1, x_2, x_3, \geq 0$

B) The data collected in running a machine, the cost of which is Rs. 60,000 are given below: 10

Year	1	2	3	4	5
Resale value (Rs.)	42,000	30,000	20,400	14,400	9,650
Cost of spares (Rs.)	4,000	4,270	4,880	5,700	6,800
Cost of labour (Rs.)	14,000	16,000	18,000	21,000	25,000

Determine the optimum period for replacement of the machine.

Q.5 A) Find the optimal transportation plan for the following transportation problem: 10

	1	2	3	4	5	Available
A	7	6	4	5	9	40
B	8	5	6	7	8	30
C	6	8	9	6	5	20
D	5	7	7	8	6	10
Required	30	30	15	20	5	100 (Total)

B) Use the relation of dominance to solve the rectangular game whose payoff matrix to A is given in the following table. 10

		Player B			
		I	II	III	IV
Player A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

Q.6 A) A firm has a single machinist in a repair shop. He works eight hours a day, and on an average four machines break each day. It takes on the average one hour to repair the machine. Using Poisson-exponential model, determine: 10

i) The expected number of machines in the repair shop.
ii) The expected number of machines in the shop on which the mechanist has not started to work.
iii) The average down time (waiting for repairs or undergoing repairs) per machine.
iv) The average time a machine waits for service.

B) A stockist has to supply 400 units of a product every Monday to his customers. He 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: 10

i) The economic lot size,
ii) The total optimal cost (including the capital cost),
iii) The total weekly profit if the item is sold for Rs. 55 per unit.

Q.7 A) Use dynamic programming to solve the L.P.P. 10

Maximize $z = 2x_1 + 5x_2$,
subject to $2x_1 + x_2 \leq 430$,
$2x_2 \leq 460$,
$x_1, x_2 \geq 0$

B) A manufacturing company uses an EOQ (Economic order quantity) approach in planning its production of gears. The following information is available. Each gear costs Rs. 250 per unit, annual demand is 60,000 gears, set up costs are Rs. 4,000 per setup and the inventory carrying cost per month is established at 2 percent of the average inventory value. When in production, these gears can be produced at the rate of 400 units per day and this company works only for 300 days a year. Determine the economic lot size, the number of production runs per year and the total inventory cost. 10
