

405, 401, 403, 411, 417, 413, 303

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HARMATTAN SEMESTER EXAMINATION 2016/2017 SESSION

COURSE CODE/TITLE: ECO 413/OPERATIONS RESEARCH

INSTRUCTION: ANSWER QUESTION 1 AND ANY OTHER 2 QUESTIONS

TIME ALLOWED: 2 HOURS

1 (a) Write a short note on sensitivity analysis.

(b) From the view point of developing countries, what are those factors that limit Operations Research as a field of study?

(c) Use the graphical method to find the maximum value of

$$Z = x_1 + 2x_2$$

$$\text{Subject to: } x_1 - x_2 \leq -1$$

$$-0.5x_1 + x_2 \leq 2$$

$$x_1, x_2 \geq 0$$

(d) Use simplex method to solve the following problem

$$\text{Min } Z = 4y_1 + y_2$$

$$\text{Subject to: } 3y_1 + 4y_2 \geq 20$$

$$-y_1 - 5y_2 \leq -15$$

$$y_1, y_2 \geq 0$$

Depend on the sign of the inequality sign

$$\begin{aligned} x_1 - x_2 &= -1 \\ -0.5x_1 + x_2 &= 2 \\ x_1 + x_2 &= 0 \end{aligned}$$

Step 1: determine boundary point for each constraint

$$\begin{bmatrix} x_1 & x_2 \\ -1 & 0 \\ 0 & 2 \\ 0 & 0 \end{bmatrix}$$

$$\begin{aligned} \text{Min } Z &= 4y_1 + y_2 \\ 1Z - 4y_1 - y_2 + 0s_1 + 0s_2 + 0s_3 &= 0 \\ 0Z + 3y_1 + 4y_2 + s_1 + 0s_2 + 0s_3 &= 20 \end{aligned}$$

It should be noted that Simulation is applicable to problems that cannot be solved by Numerical or Analytical methods. Simulation is used to Address Complex Problems.

Simulation can be defined as the process of creating the essence of reality without actually attaining the reality. It involves duplicating or abstracting dynamic behaviour of a system without actually attaining reality.

2 (a) What is Simulation? Discuss the relevance of Simulation in decision making

process

Relevance:

- It is more flexible than analytical technique for simulation of the real world.
- It allows for the testing of assumptions as against what obtain in analytical technique.
- It can be applied where the practice of the operation is not known.

(b) A distributor stocks an item in which demand is uncertain. He wishes to

evaluate a re-ordering policy of 150 units at a re-order level of 150 to

determine how economical the policy is over a 10-day period. The following

information is available;

Possible demand	Probability	Cumulative Probability	Random number Allocation
40	0.10	0.10	00 - 09
50	0.15	0.25	10 - 24
60	0.25	0.50	25 - 49
70	0.30	0.80	50 - 79
80	0.20	1.00	80 - 99

Forecast Demand

Forecast Demand

Random Numbers

41
92
05
44

60
80
40
60
20

It should be noted that

opening stock = 170 units

lead time = 3 days

Carrying cost/holding = 15 per unit per day

100	66	70	30	-	450	-	300	450	Total Cost = Ordering cost + Holding cost + Stock out cost
30	07	40	-	-	-	10x30	300	300	
150	00	40	120	50	1,800	-	1,850	1,850	Ordering cost 150
120	00	40	80	per day (units)	4,200	-	1,200	1,200	Holding cost # 7,500
80	14	50	80	-	40	450	450	450	Stock out # 1,800
150	62	70	100	50	1,800	40x30	1,200	1,200	Total Cost # 9,450
				60				0.25	
				70				0.30	
				80				0.20	

The carrying cost is #15 per unit, ordering cost is #50 per order, and loss of goodwill for each unit out of stock is #30. The lead time is 3 days while the opening stock is 170 units. The probability distribution is to be based on the following random numbers: 41, 92, 05, 44, 66, 07, 00, 00, 14, and 62.

3 (a) Write short note on the following concepts:

- Queue length
- System length
- Waiting time in the queue
- Server idle time

(b) Arrivals at a telephone booth are considered to be Poisson, with an average time of 20 minutes between one arrival and the next. The length of a phone call is assumed to be distributed exponentially, with mean of 6 minutes. Find

- The probability that an arrival finds that four persons are waiting for their turn;
- The average number of persons waiting and making telephone calls.
- The average length of the queue that is formed from time to time.

4 (a) The critical path method (CPM) uses only one time estimate for each activity. As against this, PERT uses, three time estimates where there is an element of uncertainty in deciding upon the completion time of each activity and consequently the estimated project completion time. In view of this answer

- Discuss the three time estimates with a view to overcome the uncertainty in the project time estimates

- ii. State the two measures of variability of possible activity times with simplified formula.

(b) The supply in Kg from 4 sources, the demand in Kg from 4 destinations and the respective transportation costs in (#'00) of ABC product are as indicated in the table below. ABC PLC is interested in distributing the product. Advice the company on which of the 2 options, the Least Cost or North West Corner method it should adopt in its distribution so as to minimize the transportation cost.

SOURCE	DESTINATION				SUPPLY
	D1	D2	D3	D4	
S1	8	0	15	9	350
S2	0	5	7	15	350
S3	10	12	14	16	150
S4	7	5	9	16	200
DEMAND	150	250	350	300	