(Autonomous College Affiliated to University of Mumbai)

End Semester Exam

Nov – Dec 2021

(B.Tech) Program: IT and EXTC

Examination: LY Semester: VII

Course Code: 1UILC7055 and Course Name: Operation Research

Duration: 03 Hours **Max. Marks: 60**

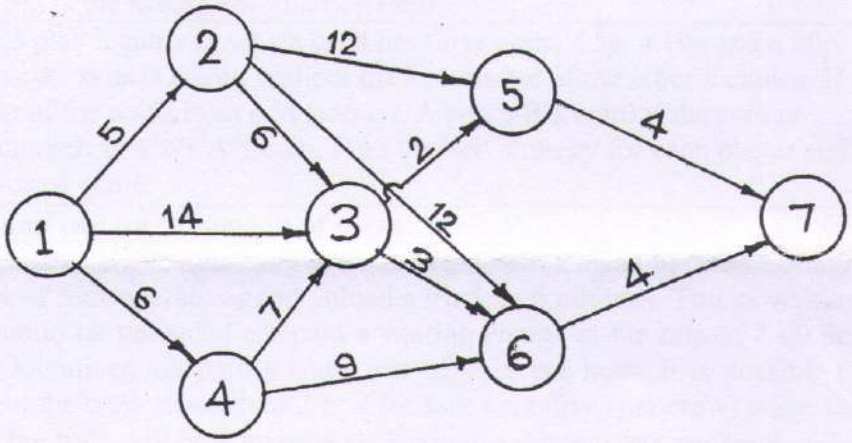
Instructions:

(1) All questions are compulsory.

(2) Draw neat diagrams wherever applicable.

(3) Assume suitable data, if necessary.

		Max. Marks	CO	BT level
Q.1	**Solve any six questions out of eight:**	**12**		
i)	Discuss the scope of Operation Research.	02	CO1	U
ii)	A company sells two different products A and B. The company makes a profit of ₹40 and ₹30 per unit respectively on the two products. The products are produced by a common production process and are sold in two different markets. The production process has a capacity of 30,000 man-hours. It takes 3 hours to produce a unit of product A and 1 hour to produce a unit of product B. The market has been surveyed and company officials has found out that the maximum units that can be sold for *product A and B are 8,000 and 12,000 respectively.* Formulate the above as a linear programming problem so as to maximize the profit.	02	CO1	U
iii)	Find the initial basic feasible solution to the following transportation problem by north – west corner rule. To / Supply From 2 7 4 — 5 3 3 1 — 8 5 4 7 — 7 1 6 2 — 14 Demand 7 9 18	02	CO1	U
iv)	Consider a situation in which the mean arrival rate is one customer every 4 minutes and the mean service time is 2½ minutes. If the waiting cost is ₹ 5 per unit per minute and the maximum cost of servicing one unit is ₹ 4, find the minimum cost service rate.	02	CO2	U
v)	Explain how random numbers are generated in simulation?	02	CO3	An
vi)	What are the applications of dynamic programming?	02	CO4	A
vii)	Define the following in context to game theory: 1. Optimal Strategy 2. Zero – sum Game	02	CO5	A
viii)	The demand for a commodity is 100 units per day. Every time an order is placed, a fixed cost of Rs 400/- is incurred. Holding cost is ₹ 0.08 per unit per day. If the lead time is 13 days, determine the economic lot size and the reorder point.	02	CO6	U

		Marks	CO	level
Q.2	**Solve any four questions out of six.**	**16**		
i)	Solve the following problem graphically: Max $Z = -X_1 + 2X_2$ Subject to $X_1 - X_2 \leq -1$, $-0.5X_1 + X_2 \leq 2$, $X_1, X_2 \geq 0$.	04	CO1	U
ii)	A tax consulting firm has three counters in its office to receive people who have problems concerning their income, wealth and sales taxes. On an average 48 persons arrive in an 8 hour day. Each tax adviser spends 15 minutes on an average on an arrival. If the arrivals are poissonly distributed and service times are according to exponential distribution, find: 1. Average number of customers in the system. 2. The number of hours each week a tax adviser spends performing his job. 3. Probability that a customer has to wait.	04	CO2	U
iii)	Western Travel agents have a touring van that requires a special grade of fuel. During the past few months the van's use has varied so much that the amount of fuel necessary for keeping the van operating has varied considerably. A study of the past 200 days reveals that demand for the van has fluctuated between 0 to 5 trips/week. Trips/week: 0 | 1 | 2 | 3 | 4 | 5 Frequency: 16 | 24 | 30 | 60 | 40 | 30 Using the following random numbers, simulate the demand for a ten – week period: 26, 84, 21, 38, 36, 73, 16, 81, 59, 83.	04	CO3	An
iv)	For the network shown, it is desired to determine the shortest route between cities 1 to 7 using backward recursion method.  	04	CO4	A
v)	Reduce the following game by dominance and find the game value: 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)	04	CO5	A

		Max. Marks	CO	BT level
vi)	A newspaper boy buys papers for 30 paise and sells them for 70 paise each. He cannot return unsold newspapers. Daily demand has the following distribution: No of customers: 23, 24, 25, 26, 27, 28, 29, 30, 31, 32 Probability: 0.01, 0.03, 0.06, 0.10, 0.20, 0.25, 0.15, 0.10, 0.05, 0.05 If each's day demand is independent of the previous day's, how many papers should he order each day?	04	CO6	U
Q.3	**Solve any two questions out of three.**	**16**		
i)	Use the two phase simplex method to Maximize $Z = X_1 + 1.5X_2 + 5X_3 + 2X_4$, Subject to $3X_1 + 2X_2 + X_3 + 4X_4 \leq 6$, $2X_1 + X_2 + 5X_3 + X_4 \leq 4$, $2X_1 + 6X_2 - 4X_3 + 8X_4 = 0$, $X_1 + 3X_2 - 2X_3 + 4X_4 = 0$, $X_1, X_2, X_3, X_4 \geq 0$	08	CO1	U
ii)	Two persons X and Y work on a two station assembly line. The distributions of activity times at their stations are: Time in Secs: 10, 20, 30, 40, 50, 60, 70, 80 Time frequency for X: 4, 7, 10, 15, 35, 18, 8, 3 Time frequency for Y: 2, 3, 6, 8, 12, 9, 7, 3 a. Simulate operation of the line for eight items. b. Assuming Y must wait until X completes the first item before starting work, will he have to wait to process any of the other seven items? What is the average waiting time of items for Y. Use the following random numbers: For X: 83, 70, 02, 12, 59, 46, 54 and 03. For Y: 51, 99, 84, 81, 15, 36, 12 and 54. c. Determine the inventory of items between the two stations. d. What is the average production rate?	08	CO3	An
iii)	A and B play a game in which each has three coins a 5p, a 10p and a 20p. Each player selects a coin without the knowledge of the other's choice. If the sum of the coins is an odd amount, A win's B's coin: if the sum is even number, B win's A's coin. Find the best strategy for each player and the value of game.	08	CO5	A
Q.4	**Solve any two questions out of three.**	**16**		
i)	Goods trucks arrive randomly at a stockyard with a mean of 8 trucks/hour. A crew of four operatives can unload a truck in 6 minutes. Trucks waiting in queue to be unloaded are paid a waiting charge at the rate of ₹ 60 per hour. Operatives are paid a wage rate of ₹ 20 per hour. It is possible to augment the crew strength to 2 or 3 (of four operatives per crew) when the unloading time will be 4 minutes or 3 minutes respectively per truck. Find the optimal crew size.	08	CO2	U
ii)	An oil company has 8 units of money available for exploration of three sites. If oil is present at a site, the probability of finding it depends upon the amount allocated for exploiting the site, as given below. Units of money allocated Site 1: 0.0, 0.0, 0.1, 0.2, 0.3, 0.5, 0.7, 0.9, 1.0 Site 2: 0.0, 0.1, 0.2, 0.3, 0.4, 0.6, 0.7, 0.8, 1.0 Site 3: 0.0, 0.1, 0.1, 0.2, 0.3, 0.5, 0.8, 0.9, 1.0 The probability that the oil exists at sited 1, 2 and 3 is 0.4, 0.3 and 0.2 respectively. Find the optimum allocation of money.	08	CO4	A

		Max. Marks	CO	BT level
iii)	Find the optimal order quantity for a product when the annual demand for the product is 500 units, the cost of storage per unit per year is 10% of the unit cost and ordering cost per order is ₹ 180. The unit costs are given below: Quantity — Unit cost $0 \leq q_1 < 500$ — ₹ 25.00 $500 \leq q_2 < 1500$ — ₹ 24.80 $1500 \leq q_3 < 3000$ — ₹ 24.60 $3000 \leq q_4$ — ₹ 24.40	08	CO6	U