Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Operation Research and Optimization **Semester: VI**
Program: B.Tech(CSE+BAO) **Time 03 hrs.**
Course Code: CSEG 389 **Max. Marks: 100**

Instructions:

SECTION A

S. No.		Marks	CO
Q 1	What do you understand by deterministic and probabilistic models?	4	CO1
Q 2	What is degeneracy in transportation problems? How is it resolved?	4	CO3
Q 3	How do you identify the presence of multiple optima in the simplex method?	4	CO1
Q 4	Discuss the relevance and applications of inventory management in business situations. A chemical company produces two products, X and Y. Each unit of product X requires 3 hours on operation I and 4 hours on operation II, while each unit of product Y requires 4 hours on operation I and 5 hours on operation II. Total available time for operations I and II is 20 hours and 26 hours respectively. The production of each unit of product Y also results in two units of a by-product Z at no extra cost. Product X sells at profit of ` 10/unit, while Y sells at profit of ` 20/unit. By-product Z brings a unit profit of ` 6 if sold; in case it cannot be sold, the destruction cost is ` 4/unit. Forecasts indicate that not more than 5 units of Z can be sold. Formulate the L.P. model to determine the quantities of X and Y to be produced, keeping Z in mind.	4	CO2
Q 5	Discuss the relevance and applications of inventory management in business situations	4	CO4

SECTION B

Q 6	A company sells two different products A and B. The company makes a profit of 40 and ` 30 on the two products respectively. They 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 A and 1 hour to produce a unit of B. The maximum number of units of A and B that can be sold in the market are 8,000 and 12,000 respectively. Formulate the above as a linear	10	CO2

	programming problem and Solve it.		
Q 7	Derive the solution of following Game Firm A / Firm B: 20, 15, 12, 35 / 25, 14, 8, 10 / 40, 2, 19, 5 / 5, 4, 11, 0	**10**	**CO5**
Q 8	On the average 96 patients per 24-hour day require the service of an emergency clinic. Also on the average, a patient requires 10 minutes of active attention. Assume that the facility can handle only one emergency at a time. Suppose that it costs the clinic 100 per patient treated to obtain an average servicing time of 10 minutes, and that each minute of decrease in this average time would cost the clinic 10 per patient treated. Calculate ,How much would have to be budgeted by the clinic to decrease the average size of the queue from $1\frac{1}{3}$patients to $\frac{1}{2}$ patient?	**10**	**CO4**
Q 9	A stockist has to supply 400 units of a product every Monday to his customers. He gets the product at 50 per unit from the manufacturer. The cost of ordering and transportation from the manufacturer is 75 per order. The cost of carrying inventory is 7.5% per year of the cost of the product. Calculate (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 55 per unit. OR A manufacturing company of microwave ovens uses 75,000 worth of LED readout circuits annually in its production process. Cost per order is 45 and the carrying charges assessed against this classification of inventory are 25% of the average balance per year. This company follows an E.O.Q. purchasing system and to date has not been offered any discounts on these circuits. Now the supplier has indicated that if the company would buy its circuits four times a year in equal quantities, a discount of 1.5% off the list price would be given in return. Would you advise this company to accept this offer? In order to maintain the present total cost, derive the minimum discount acceptable to the company if four orders of equal sizes are placed in a year?	**10** **10**	**CO4** **CO4**
	SECTION-C		
Q 10	A manufacturer want to ship 22 load of his product as given below . Matrix gives the kilometers from source to destination	**20**	**CO3**

	D1	D2	D3	D4	D5	Supply
S1	5	8	6	6	3	8
S2	4	7	7	6	5	5

S3	8	4	6	6	4	9
Demand	4	4	5	4	8	

Shipping cost is Rs 10 per load . Solve this transportation problem to minimize cost.

Q 11

A construction company has requested bids for subcontracts on five different projects. Five company has responded their bids are represented below

Bidders	I	II	III	IV	V
1	41	72	39	52	25
2	22	29	49	65	81
3	27	39	60	51	40
4	45	50	48	52	37
5	29	40	45	26	30

Determine the minimum cost assignment of subcontracts assuming the each bidder can receive only one contract.

20 **CO3**

OR

A company has four market segments open and four salesmen are to be assigned one to each segment to maximize the expected total sales. The salesmen differ in their ability and the segments also differ in their sales potential. The details regarding the expected sales in each segment by a typical salesman under most favorable condition are given below. Segment A = Rs. 60,000, Segment B = Rs. 50,000, Segment C = Rs. 40,000 and Segment D = Rs. 30,000. It is estimated that working under same condition, the ability of salesmen in terms of proportional yearly sales would be as below: Salesman W = 7, Salesman X = 5, Salesman Y = 5 and Salesman Z = 4.
Apply Hungarian method to find segments to salesmen for maximizing the total expected sales.

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Instructions:

SECTION A

S. No.		Marks	CO
Q 1	What is OR? What are the characteristics and limitations of OR techniques?	**4**	**CO1**
Q 2	Explain simplex method of solving linear programming problem.	**4**	**CO2**
Q 3	Show that the assignment model is a special case of the transportation model.	**4**	**CO3**
Q 4	A firm manufactures three products A, B and C. Time to manufacture product A is twice that for B and thrice that for C and if the entire labour is engaged in making product A, 1,600 units of this product can be produced. These products are to be produced in the ratio 3: 4: 5. There is demand for at least 300, 250 and 200 units of products A, B and C and the profit earned per unit is 90, 40 and 30 respectively. Formulate the problem as a linear programming problem.	**4**	**CO1**
Q 5	Discuss the relevance and applications of inventory management in business situations	**4**	**CO4**

SECTION B

Q 6	Use dual simplex method to derive the solution of the following Minimize $Z=2x_1+x_2$ Subject to $3x_1+x_2 \geq 3.\ \ 4x_1+3x_2 \geq 6.\ \ x_1+2x_2 \geq 2$ $x_1, x_2 \geq 0$	**10**	**CO2**
Q 7	Derive the solution of following Game	**10**	**CO5**

	A	B					
		3	-1	4	6	7	
		-1	8	2	4	12	
		16	8	6	14	12	
		1	11	-4	2	1	
Q 8	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. Derive optimal crew size.						**10**	**CO4**
Q 9	ABC manufacturing company purchases 9,000 parts of a machine for its annual requirement, ordering one month's usage at a time. Each part costs 20. The ordering cost per order is 15, and the carrying charges are 15% of the average inventory per year. You have been asked to suggest a more economical purchasing policy for the company. What advice would you offer and how much would it save the company per year? OR A manufacturing company of microwave ovens uses 75,000 worth of LED readout circuits annually in its production process. Cost per order is 45 and the carrying charges assessed against this classification of inventory are 25% of the average balance per year. This company follows an E.O.Q. purchasing system and to date has not been offered any discounts on these circuits. Now the supplier has indicated that if the company would buy its circuits four times a year in equal quantities, a discount of 1.5% off the list price would be given in return. Would you advise this company to accept this offer? In order to maintain the present total cost, what should be the minimum discount acceptable to the company if four orders of equal sizes are placed in a year?						**10** **10**	**CO4** **CO4**
	SECTION-C							
Q 10	A departmental store wishes to purchase following quantities of sarees. Type of Saree A B C D E Quantity 150 100 75 250 200 Tenders are submitted by four different manufacturers who undertake to supply not						**20**	**CO3**

	more than the quantities given below Manufacturer W X Y Z Total Quantity 300 250 150 200 Manufactures Sarees A B C D E W 275 350 425 225 150 X 300 325 450 175 100 Y 250 350 475 200 125 Z 325 275 400 250 175 How the orders should be placed? Apply MODI Method.		
Q 11	A construction company has requested bids for subcontracts on five different projects. Five company has responded their bids are represented below I II III IV V Bidders 1 41 72 39 52 25 2 22 29 49 65 81 3 27 39 60 51 40 4 45 50 48 52 37 5 29 40 45 26 30 Apply Hungarian method to find minimum cost assignment of subcontracts assuming the each bidder can receive only one contract. OR A company has four market segments open and four salesmen are to be assigned one to each segment to maximize the expected total sales. The salesmen differ in their ability and the segments also differ in their sales potential. The details regarding the expected sales in each segment by a typical salesman under most favorable condition are given below. Segment A = Rs. 60,000, Segment B = Rs. 50,000, Segment C = Rs. 40,000 and Segment D = Rs. 30,000. It is estimated that working under same condition, the ability of salesmen in terms of proportional yearly sales would be as below: Salesman W = 7, Salesman X = 5, Salesman Y = 5 and Salesman Z = 4. Apply Hungarian method to find segments to salesmen for maximizing the total	**20**	**CO3**

	expected sales.		