Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – WINTER 2015

Subject Code: 171901 **Date:12/12/2015**

Subject Name: Operations Research

Time: 10:30am to 1:00pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Operations Research is the art of giving bad answers to the problems which otherwise would have been worst. Justify this statement. Also discuss the scope of Operations Research. **07**

(b) Write the dual of **07**

i)

Maximize $Z = 3X_1 + 2X_2$

Subject to $X_1 + X_2 \geq 1$

$X_1 + X_2 \leq 7$

$X_1 + 2X_2 \leq 10$

$X_2 \leq 3$

$X_1, X_2 \geq 0$

ii)

Maximize $Z = 5X_1 - 6X_2 + 4X_3$

Subject To $3X_1 + 4X_2 + 6X_3 \geq 9$

$X_1 + 3X_2 + 2X_3 \geq 5$

$-7X_1 + 2X_2 + X_3 \geq -10$

$X_1 - 2X_2 + 4X_3 \geq 4$

$X_1, X_2, X_3 \geq 0$

Q.2 **(a)** Solve by simplex method **07**

Maximize $Z = 100X_1 + 50X_2 + 50X_3$

Subject To $4X_1 + 3X_2 + 2X_3 \leq 1000$

$3X_1 + 8X_2 + X_3 \leq 800$

$4X_1 + 2X_2 + X_3 \leq 600$

$X_1, X_2, X_3 \geq 0$

(b) A company has to appoint grade A and grade B types of inspectors in the QC dept. Grade A inspector can check 40 pieces /hour with 95 % accuracy, while Grade B inspector can check 30 pieces /hour with 98 % accuracy. At least 4500 pieces are required to be checked in an 8 hour shift per day. Inspectors of Grade A and Grade B are paid Rs 100 and Rs 120 per hour respectively. An error made by inspector cost Rs 15/per error to the company. Formulate the problem of assigning inspectors to minimize the overall cost per day considering that 20 grade A and 30 grade B inspectors are available to undertake inspection. **07**

OR

(b) What are the advantages and limitations of graphical method in solving LPP? Obtain the solution graphically for the following LPP **07**

Maximize $Z = 3X_1 + 4X_2$

Subject to $5X_1 + 4X_2 \leq 200$

$3X_1 + 5X_2 \leq 150$

$5X_1 + 4X_2 \geq 100$

$8X_1 + 4X_2 \geq 80$

$X_1, X_2 \geq 0$

Q.3 **(a)** There are 1000 bulbs installed in a complex. It cost Rs 3/bulb for individual replacement and Rs 0.7/bulb if replaced in group. It has been decided to go for the group replacement of the bulbs (policy being replacing all bulbs at decided period as well as individual replacement of bulbs failing in this period). The table below gives the mortality rate for the bulb at the end of each month **07**

End of month	1	2	3	4	5	6
Cumulative Probability of failure to date	0.09	0.25	0.49	0.85	0.97	1.0

Find the best interval period for group replacement.

(b) Discuss Travelling Salesman problem in brief. **07**

The matrix below shows the cost in rupees of processing 3 jobs X, Y and Z on machines A, B and C.

		Machine		
Job		A	B	C
	X	35	25	32
	Y	41	30	29
	Z	45	34	27

If all jobs can be processed on all machines, assign the jobs to the machines and find the minimum total cost of processing.

OR

Q.3 **(a)** What is the need for Replacement of any machine? **07**

A machine was purchased with initial investment of Rs 40000. The following is the data available

Year	1	2	3	4	5	6
Operating & Maintenance cost per year in Rs	1400	1450	1510	1600	1720	1900
Salvage Value in Rs	35000	34000	32500	30500	28000	25000

What will be the expected life as per optimum replacement policy and the average annual cost during this period?

(b) Following is the data collected by the company for one of the item having annual demand of 1000 units: **07**

Interest on the capital locked for inventory = 15%, pilferage of inventory=5% of total inventory cost, other holding cost= 20% of inventory cost, order processing cost/order= Rs 150, order follow up cost/order= Rs 125, inspection and other procurement cost/order= Rs 125.

If the cost per item is Rs 10 and discount offered is 10% for minimum order quantity of 500 items, Should the order be placed without discount for EOQ or with discount for quantity of 500 items? What will be saving by selected option?

Q.4 **(a)** The following is the pay off matrix between player X and player Y. Find the optimal strategies, their frequencies and the value of the game. Use rule of dominance and oddment in calculations **07**

		Player Y			
		A	B	C	D
Player X	I	0.25	0.20	0.14	0.30
	II	0.27	0.16	0.12	0.14
	III	0.35	0.08	0.15	0.19
	IV	-0.02	0.08	0.13	0.00

(b) i) From the simplex table how will you identify the cases of infeasible solution, unbound solution and alternate optimal solutions? **07**

ii) Differentiate between PERT and CPM.

iii) What is a two person zero sum game?

OR

Q.4 **(a)** When is dummy required in transportation problem? **07**

Find the basic feasible solution and its cost by i) northwest corner method, ii) Least cost method and iii) Vogel's approximation method for the following transportation table which shows cost in rupees for transporting 1 unit from factories to warehouses

		Warehouses				
		A	B	C	D	Supply
Factories	X	2	3	11	7	6
	Y	1	0	6	1	1
	Z	5	8	15	9	10
Requirement		7	5	3	2	

(b) Derive the equation for economic order quantity and total inventory cost for the classical EOQ model, where demand rate (r) is uniform replenishment rate (d) is instantaneous. C1 is the Holding cost Rs/unit/unit time, C2 is the order cost in Rs/order. **07**

Q.5 **(a)** The following table gives the duration in days and the predecessor for the various tasks. **07**

Task	A	B	C	D	E	F	G	H	I
Time(days)	8	10	8	10	16	17	18	14	9
predecessor	-	-	-	A	A	B,D	C	C	E,G

Draw the EON diagram and find the minimum time for completion of the project. Also find the total float for each activity.

(b) Define Simulation, explain methodology of simulation in brief and give its advantages and disadvantages. **07**

OR

Q.5 **(a)** Explain the terms w.r.t. queuing theory i) Balking ii) Reneging iii) Jockeying **07**

At a reservation counter, 20 customers arrive on average every 10 minutes. The clerk can serve 22 customers in 10 minutes. Find i) average number of customers in the system ,ii) average queue length and iii) average time a customer waits before being served. State assumption made for the probability distribution.

(b) What is dynamic programming? How dynamic programming differs from the routine linear programming? Is solution of LPP possible by dynamic programming? If yes, How? **07**

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