GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (OLD) EXAMINATION – WINTER 2018

Subject Code:161601 **Date: 15/12/2018**

Subject Name: Modelling Simulation And Operations Research

Time: 02:30 PM TO 05:00 PM **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)** State the definition of Operation Research. Also explain the applications of Operation Research. **07**

(b) A manufacturer produces two types of models M1 and M2. Each model of the type M1 requires 4 hours of grinding and 2 hours of polishing; whereas each model of M2 requires 2 hours of grinding and 5 hours of polishing. The manufacturer has 2 grinders and 3 polishers. Each grinder works for 40 hours a week and each polisher works 60 hours a week. Profit on M1 model is Rs.3.00 and on model M2 is Rs.4.00. Whatever produced in a week is sold in the market. How should the manufacturer allocate his production capacity to the two types of models, so that he makes maximum profit in a week? **07**

Q.2 **(a)** Solve the following LPP by graphical method **07**

Maximize $Z = 5X1 + 3X2$ Subject to constraints

$2X1 + X2 \leq 1000$

$X1 \leq 400$

$X1 \leq 700$ where $X1, X2 \geq 0$

(b) Solve following LPP using Simplex Method:

$5X_1 + 10X_2 + 8X_3 = Z$ (Z is the total profit per day) which is to be maximized

Constraints $3X_1 + 4X_2 + 5X_3 \leq 60$

$5X_1 + 4X_2 + 4X_3 \leq 72$

$2X_1 + 4X_2 + 5X_3 \leq 100$

$X_1, X_2, X_3 \geq 0$……………….Non negativity constraint

OR

(b) Solve following LPP by Big-M method. **07**

$60X1 + 80X2 = G$ (G is the total cost per day which is to be minimized)

Constraints: $20X_1 + 30X_2 \geq 900$

$40X_1 + 30X_2 \geq 1200$

$X_1, X_2 \geq 0$……………….Non-negativity constraint

Q.3 **(a)** Explain primal and dual relationship. **07**

(b) Solve blow example using North West Corner rule, the Least Cost method and the Vogel's Approximation Method of obtaining an initial feasible solution for a transportation problem. **07**

Plants	Markets W_1	W_2	W_3	Plant capacities
P_1	3	4	2	30
P_2	2	1	5	25
P_3	4	3	3	20
Market requirements	20	20	35	

OR

Q.3 **(a)** A company has three production facilities S_1, S_2 and S_3 with production capacity of 7, 9 and 18 units (in 100s) per week of a product, respectively. These units are to be shipped to four warehouses D_1, D_2, D_3 and D_4 with requirement of 5, 6, 7 and 14 units (in 100s) per week, respectively. The transportation costs (in rupees) per unit between factories to warehouses are given in the table below. **07**

	D1	D2	D3	D4	Capacity
S_1	19	30	50	10	7
S_2	70	30	40	60	9
S_3	40	8	70	20	18
Demand	5	8	7	14	34

Formulate this transportation problem as an LP model to minimize the total transportation cost.

(b) Consider the following transportation cost table. The costs are given in Rupees, the supply and demand are in units. Determine an optimal solution. **07**

Destination / *Source*	*1*	*2*	*3*	*4*	*5*	*Supply*
I	*40*	*36*	*26*	*38*	*30*	*160*
II	*38*	*28*	*34*	*34*	*198*	*280*
III	*36*	*38*	*24*	*28*	*30*	*240*
Demand	*160*	*160*	*200*	*120*	*240*	

Q.4 **(a)** Explain HAM method in detail **07**

(b) Draw a network **07**

Activity	Immediate Predecessor(s)	Activity	Immediate Predecessor(s)
A	-	H	F
B	-	I	C,D,G,H
C	-	J	I
D	-	K	I
E	A	L	J,K
F	B	M	J,K
G	E	N	M

OR

Q.4 **(a)** Solve the assignment optimal solution using HAM. **07**

Time Taken (in minutes) by 4 worker

Worker	Job			
	A	B	C	D
1	45	40	51	67
2	57	42	63	55
3	49	52	48	64
4	41	45	60	55

(b) Given the following information on a small project: A is the first activity of the project and precedes the activity B and C. The activity D succeeds both B and C whereas only C is required to start activity E. D precedes F while G succeeds E. H is the last activity of the project and succeeds F and G. Draw a network based on this information. **07**

Q.5 **(a)** What is queuing theory? Explain operating characteristics of the queuing system. **07**

(b) What is Replacement? Explain Group and individual replacement policies giving by example. **07**

OR

Q.5 **(a)** A confectioner sells confectionery items past data of demand per week in 100 kg with frequency is given below. **07**

Demand per week	0	5	10	15	20	25
Frequency	2	11	8	21	5	3

Using the following sequence of random number generate the demand for next 15 weeks, also find average demand per week Random : 35,52,90,13,23,73,34,57,83,94,56,67,66,60

(b) A TV repairman finds that the time spent on his job has an exponential distribution with mean 30 minutes. If he repairs set in the order in which they come and if the arrival of sets is approximately Poisson with an average rate of 10 per 8-hour day, what is his expected idle time each day? How many jobs are ahead of the set just brought in? **07**

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