[24/A-9] SEAT No._____ No. of Printed Pages : 4

Sardar Patel University

B.Sc. Semester-III Examination

Friday, 30th November, 2018

Time:- (02:00 P.M. to 4:00 P.M.) US03ESTA01 M.Marks:70

(Operation Research- I)

Note:- (i) Simple/ Scientific calculator is allowed. (ii) Graph paper will provided on request.

Q.1. Multiple Choice Questions:- [10]

(1) The solution to the linear programming problem in terms of the respective quantities of X and Y to be produced, if objective function z= 2 X + 3Y ..... are to be maximized.

a) X = 4, Y = 1 b) X = 2, Y = 4 c) X = 2, Y = 3 d) X = 5, Y = 0

(2) The following constraints ..... is not linear.

a)7a – 6b ≤ 45 b)x+y+ 3z = 35 c) 2x + 10y ≥ 60 d) 2xy + z ≥ 15

(3) If a negative value appears in the solution values (x_B) column of the simplex table, then the .....

a)solution is optimal b)solution is infeasible c)solution is unbounded d)All of above

(4) The dual of the primal maximization LP problem having m constraints and n non-negative variables should .....

a)have n constraints & m-non negative variables b)be a minimization LP problem c)both (a) and (b) d) none of these

(5) The right hand side constant of constraints in a primal problem appears in the corresponding dual as .....

a)a coefficient in the objective function b)a right hand side constant of a constant c)an input output coefficient d)none of these

(6) While applying Vogel's approximation method for obtaining IBFS the penalties is the .....

a)difference between smallest and next smallest cost. b) difference between largest and next largest cost. c) difference between largest and smallest cost. d) none of these

(7) While applying North-West Corner method for obtaining IBFS the first allocation is made in .....

a)x_{11}= min(a_1 , b_1) b)x_{11}=max(a_1, b_1) c) x_{22}= max(a_2,b_2) d) none of these

(8) In a transportation problem with total demand equal to 500 and total supply equal to 900, we should add a ..... with a quantity equal to ..... to convert it to a balanced problem.

a)Dummy supply, 1400. b)Dummy supply, 400. c)Dummy demand ,400 d)Dummy demand ,1400

(9) While applying MODI for obtaining OBFS of T.P. if all dij≥ 0, the current basic feasible solution is .....

a) degenerate b) an optimum c)select that variable to enter in a basis d) none of these

(10) Degeneracy occur in the T.P. having m-origins and n-destination whenever

number of occupied cell is . m+n− 1.

a) greater than b) equal to c) less than d) none of these

Q.2. Short Type Questions:- (Attempt Any Ten) [20]

(1) How will you decide feasible region when solving LPP by graphical method?

(2) When solving LPP by graphical method, when the solution is Unbounded?

(3) Give the illustration of slack variables and surplus variables.

(4) What is a Simplex?

(5) State the conditions for the Optimality test.

(6) Prove that the dual of the dual is the primal problem with illustration.

(7) Define Transportation Problem (T.P.)?

(8) Give the mathematical formulation of T.P. List the various methods that can be used for obtaining an initial basic feasible solution for a T.P.

(9) With the reference to a T.P. define the following terms:
(i) Feasible solution (ii) Optimal solution .

(10) State the working rule to obtain leaving variable and improved basic feasible solution in T.P.

(11) What is unbalanced T.P.?

(12) What is degeneracy In T.P.?

Q.3. (a) Solve the following linear program by Graphical method : [05]

Maximize $z = 3x + 2y$

subject to: $2x + y \leq 18$

$2x + 3y \leq 42$

$3x + y \leq 24$

$x \geq 0 , y \geq 0.$

(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; where as 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. Formulate the Linear programming problem that manufacturer to allocate his production capacity to the two types of models, so that he makes maximum profit in a week? [05]

OR

Q.3. A Scrap metal dealer has received a bulk order from a customer for a supply of at least 2000 kg of scrap metal. The consumer has specified that at least 1000 kgs of the order must be high quality copper that can be melted easily and can be used to produce tubes. Further, the customer has specified that the order should not contain more than 200 kgs of scrap which are unfit for commercial purposes. The scrap metal dealer purchases the scrap from two different sources in an unlimited quantity with the following percentages (by weight) of high quality of copper and unfit scrap. [10]

	Source A	Source B
Copper	40%	75%
Unfit Scrap	7.5%	10%

The cost of metal purchased from source A and source B are Rs.12.50 and Rs.14.50 per kg respectively. Determine the optimum quantities of metal to be purchased from the two sources by the metal scrap dealer so as to minimize the total cost using graphical method.

Q.4. (a) Solve the given LPP by Simplex method :- [05]

$$\text{Max } z = 5x_1 + 3x_2$$
$$\text{s.t. } 3x_1 + 5x_2 \le 15$$
$$5x_1 + 2x_2 \le 10$$
$$x_1, x_2 \ge 0.$$

(b) Solve the LPP by Simplex method. [05]

$$\text{Max } z = 30x_1 + 23x_2 + 29x_3$$
$$\text{s.t. } 6x_1 + 5x_2 + 3x_3 \le 26$$
$$4x_1 + 2x_2 + 6x_3 \le 7$$
$$x_1, x_2, x_3 \ge 0.$$

OR

Q.4. (a) Solve the given problem by Simplex method. [06]

$$\text{Min } z = 60x_1 + 50x_2$$
$$\text{s.t. } 2x_1 + x_2 \ge 80$$
$$x_1 + 2x_2 \ge 60$$
$$x_1, x_2 \ge 0$$

(b) Write the dual of the problem and also write the solution of the dual problem from the LPP given in the Q.4.(a). [04]

Q.5. (a) Apply Vogel's method for obtaining initial basic feasible solution to the following T.P. [05]

Destination

Origin	D_1	D_2	D_3	D_4	Supply
O_1	21	16	15	13	11
O_2	17	18	14	23	13
O_3	32	27	18	41	19
Demand	6	10	12	15	

(b) Three fertilizer factories X, Y and Z located at different places of the country produce 6, 4 and 5 lakh tones of urea respectively. Under the directive of the Central government, they are to be distributed to 3 states A,B and C as 5,3 and 7 lakh tones respectively. The transportation cost per tone in rupees is given below: [05]

	A	B	C
X	1	7	6
Y	5	2	4
Z	2	2	5

Obtain the initial basic feasible solution by North west corner method .

OR

Q.5. (a) Write the steps for solving T.P. by North west method. [05]

(b) Obtain an initial basic feasible solution of the given Transportation Problem by Least Cost Method . [05]

	D1	D2	D3	D4	Supply
O1	1	2	1	4	30
O2	3	3	2	1	50
O3	4	2	5	9	20
Demand	20	40	30	10	100

Q.6. (a) The following table gives the cost of transporting material from supply points A,B,C and D to demand points E,F,G,H and I. [04]

The present allocations is as follows:

A to E 90; A to F 10; B to F 150; C to F 10; C to G 50; C to I 120; D to H 210; D to

170.Check if this allocation is optimal. If not, find an optimum schedule.

From\To	E	F	G	H	I
A	18	20	22	27	25
B	25	23	28	21	19
C	24	30	16	20	23
D	13	19	7	5	22

(b) A company has three plants A, B and C and three warehouses X,Y and Z number of units available at the plants is 60, 70 and 80 respectively. Demands at X,Y and Z are 50,80 and 80 respectively. Unit cost of transportation are as follows: [06]

	X	Y	Z
A	8	7	3
B	3	8	9
C	11	3	5

Obtain the OBFS for the given problem.

OR

Q.6. (a) Write the steps for solving Transportation Problem by MODI method or UV-method. [04]

(b) For the given Transportation Problem obtain optimal basic feasible solution. [06]

Source	Destination				Supply
	D1	D2	D3	D4	
S1	21	16	15	3	11
S2	17	18	14	23	13
S3	32	27	18	41	19
Demand	6	10	12	15	