Roll No:
(To be filled in by the candidate)

PSGCOLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS,   APRIL 2018

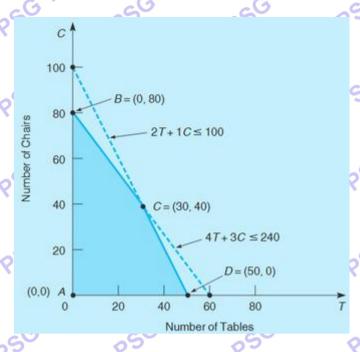### MSc - SOFTWARE SYSTEMS   Semester : 4

15XW43   OPTIMIZATION TECHNIQUES

Time : 3 Hours   **Maximum Marks : 100**

INSTRUCTIONS:

1. Answer **ALL** questions. Each question carries 20 Marks.
2. Subdivision (a) carries 3 marks each, subdivision (b) carries 7 marks and subdivision (c) carries 10 marks each.
3. Course Outcome: Table

Qn.1	CO1	Qn.2	CO2.	Qn.3	CO3.	Qn.4	CO4	Qn.5	CO5

1. a) What is a saddle point of a function of two variables? Check whether the function $f(x,y)=x^2 - y^2$ has a saddle point or not.

   b) (i) The Continuing Education Division at the Ozark Community College offers a total of 30 courses each semester. The courses offered are usually of two types: practical and humanistic. To satisfy the demands of the community, at least 10 courses of each type must be offered each semester. The division estimates that the revenues of offering practical and humanistic courses are approximately $1500 and $1000 per course, respectively. Frame the linear programming model. [3]

   (ii) Under what circumstances the following cases will arise in solving a linear programming problem using simplex/graphical method?

   - Degeneracy
   - Alternative optima
   - Unbounded solution
   - Infeasible solution [4]

   c) A cargo container (in the shape of a rectangular solid) must have a volume of 600 cubic feet. The bottom needs to be stronger, so it will cost $6 per square foot to construct, whereas the sides and top will cost $3 per square foot to construct. Find the dimensions of the container of this size that has minimum cost using Lagrange Multiplier method.

2. a) Compare revised simplex and simplex method.

   b) (i) A flair furniture production company wants to maximize their profit and the objective function is given as $Z = 70T + 50 C$, where T stands for number of tables and C stands for number of chairs. The graphical solution is shown in the following figure.

At which point the simplex iteration starts? Also identify the path to the optimal point C and find the optimal solution. [3]

(ii) In Two-Phase Simplex method, if one or more artificial variables are basic (at zero level) at the end of Phase I, then what steps are required to remove the artificial variables prior to the start of Phase I? [4]

c) A Company manufactures purses, Bags, and backpacks. The construction of the three products requires leather and synthetic material, with leather being the limiting raw material. The production process uses two types of skilled labor: sewing and finishing. The following table gives the availability of the resources, their usage of the three products, and the profits per unit.

Resource	Purse	Bags	Backpack	Availability
Leather	2	1	3	42
Sewing	2	1	2	40
Finishing	1	0.5	1	45
Selling Price	24	22	45	

Formulate the linear programming problem and find the optimum solution by Simplex method.

3. a) Find the dual for the following problem.

Max $Z = 5 X_1 + 6 X_2$
s.t.

$X_1 + 2 X_2 = 5$
$- X_1 + 5 X_2 \leq 3$
$4X_1 + 7X_2 \leq 8$
X_1 unrestricted, $X_2 \geq 0$

b) (i) TOYCO production model primal problem is given below.

Maximize daily profit $z = 3X_1 + 2X_2 + 5X_3$
subject to:
$x_1 + 2x_2 + x_3 \leq 430$ (operation 1)
$3x_1 + 2x_3 \leq 460$ (operation 2)
$x_1 + 4x_2 \leq 420$ (operation 3)
$x_1, x_2, x_3 >= 0$

The optimum simplex table for the above primal is given as follows.

Basic	x_1	x_2	x_3	x_4	x_5	x_6	solution
Z	4	0	0	1	2	0	1350
x_2	-1/4	1	0	½	-1/4	0	100
x_3	3/2	0	1	0	½	0	230
x_6	2	0	0	-2	1	1	20

Suppose that the daily capacity of operations 1,2 and 3 is increased to 600, 640 and 590 respectively. How would this change affect the total revenue?　　　[3]

(ii) Identify whether the following statements are true/false. Justify your answer.

- To balance a transportation model, it may be necessary to add both a dummy source and a dummy destination.

- The amounts shipped to a dummy destination represent surplus at the shipping source.

- The amounts shipped from a dummy resource represent shortages at the receiving destinations.

- Unbalanced transportation problems cannot be solved.　　　[4]

c) John Galt Shipping wishes to ship a product that is made at two different factories to three different warehouses. They produce 18 units at Plant A and 22 units at Plant B. They need 10 units in warehouse #1, 20 units in warehouse #2, and 10 units in warehouse #3. Per unit transportation costs are shown in the table below. Find the optimal solution starting with initial solution obtained by Least cost method.

	Warehouse #1	Warehouse #2	Warehouse #3
Plant A	$4	$2	$3
Plant B	$3	$2	$1

4. a) Can we solve an assignment problem as a regular transportation problem? Why or why not? Justify.

b) i) In decision making problems who are called as risk averse, risk seeker and risk neutral? How the utility function helps to identify the above types of decision makers?　　　[3]

ii) You have been invited to play the Fortune wheel game on Television. The wheel operates electronically with two buttons that produce hard (H) or soft (S) spin of the wheel. The wheel itself is divided into white (W) and red (R) half-circle regions. You have been told that the wheel is designed to stop with a probability of 0.3 in the white region and 0.7 in the red region. The payoff you get for the games is

-	W	R
H	$800	$200
S	-$2500	$1000

Draw the associated decision tree and specify a course of action.　　　[4]

c) (i) For the upcoming planting season, farmer Mccoy can plant corn (a1), plant wheart(a2), plant soya beans (a3) or use the land for grazing (a4). The payoffs associated witht the different actions are influenced by the amount of rain: heavy rainfall (S1), moderate rainfall (S2) , light rainfall (S3) or drough season (S4). The payoff matrix in thousands of dollars is estimated as

	s_1	s_2	s_3	s_4
a_1	−20	60	30	−5
a_2	40	50	35	0
a_3	−50	100	45	−10
a_4	12	15	15	10

(OR)

(ii) Joe Klyne's four children, John, Karen, Terri and Joe, want to earn some money to take care of personal expenses during a schoo! trip to the local zoo. Mr. Klyne has chosen four chores for his children: mowing the lawn, painting the garage door, washing the family cars and cleaning the house. To avoid anticipated sibling competition, he asks them to submit (secret) bids for what they feel is fair pay for each of the four chores. The understanding is that all four children will abide by their father's decision as to who gets which chore. The followng table summarizes the bids received. Based on this information, how should Mr. Klyne assign the chores?

	Mow	Paint	Washing	Cleaning
John	$1	$4	$6	$3
Karen	$9	$7	$10	$9
Terri	$4	$5	$11	$7
Joe	$8	$7	$8	$5

5. a) "Pattern direction method is superior to univariate method". Justify?

b) (i) What is dynamic programming? How is it solved?   [3]

(ii) Outline Random jumping method for unconstrained minimization problem   [4]

c) (i) A 4 ton vessel can be loaded with one or more of three items. The following table gives the unit weight w_i in tons and the unit revenue in thousands of dollars r_i for item i. How should the vessel be loaded to maximize the total return? Use backward recursion technique.

Item	Wieght(w_i)	Value(r_i)
1	2	31
2	3	47
3	1	14

(OR)

(ii) Use Cauchy's steepest descent method to minimize the following function $f(X_1, X_2) = X_1 − X_2 + 2 X_1^2 + 2 X_1 X_2 + X_2^2$ starting from the point $X_1 = (0,0)$. Perform 3 iterations only.

/END/

FD/RL