No of Pages : 5 **Course Code : 15XW43**

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

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS, APRIL 2019

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) Classify the stationary points of the function $f(x) = 12x^5 – 45x^4 + 40x^3 + 5$ as maxima, minima and point of inflection.

   b) (i) While solving the LPP problem using Graphical method the following situations arises. Identify the nature of solution.

   - Objective is to maximize and one or more decision variables can be increased indefinitely without violating the constraints.
   - There are no points that satisfy all constraints.
   - The objective function line is parallel to a boundary constraint in the direction of optimization [3]

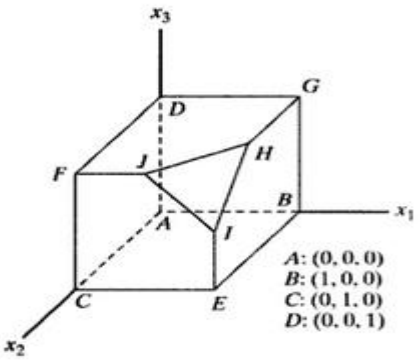
   (ii) A company manufactures two products (A and B) and the profit per unit sold is Rs.3 and Rs.5 respectively. Each product has to be assembled on a particular machine, each unit of product A taking 12 minutes of assembly time and each unit of product B taking 25 minutes of assembly time. The company estimates that the machine used for assembly has an effective working week of only 30 hours (due to maintenance/breakdown). Technological constraints states that for every five units of product A produced at least two units of product B must be produced. Formulate the problem as a linear program. (No need to solve). [4]

   c) Find the dimensions of a cylindrical function (with top and bottom) made up of sheet metal to maximize its volume such that the total surface area is equal to 24, using Lagrange Multiplier method.

2. a) What is degeneracy in simplex method?

   b) (i) Consider the three dimensional LP solution space in the following figure, whose feasible extreme points are A,B,C…J.

No of Pages : 5 **Course Code : 15XW43**



Suppose that the simplex iteration starts at A and the optimal point occurs at H, indicate whether the following paths are legitimate or not for the simplex algorithm, and state the reason.

A -> B -> G -> H

A -> E -> I -> H

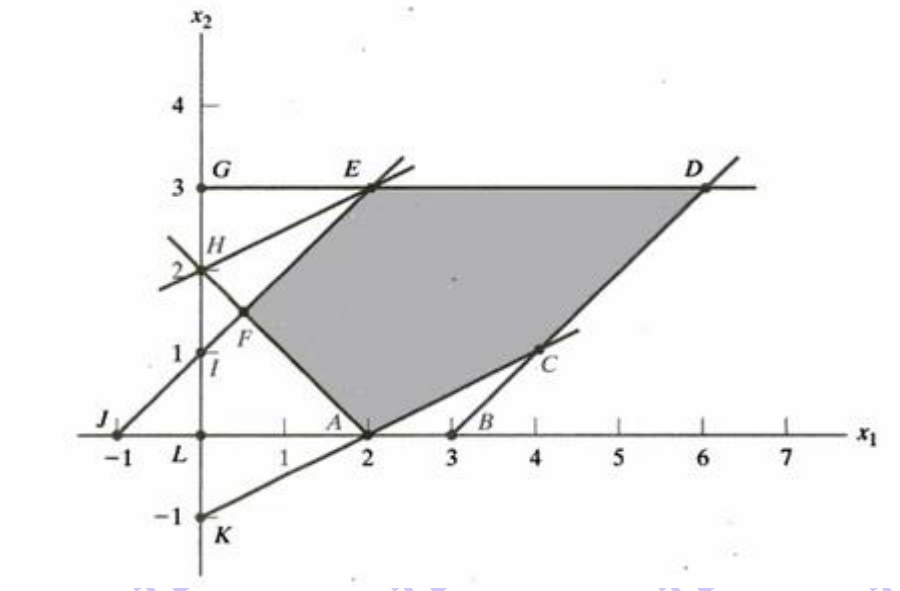
A->C->E-> B -> A -> D-> G-> H [3]

(ii) Outline the steps involved in Phase I of Two-Phase Simplex method. Under what conditions we will proceed to Phase II? [4]

c) A company produces two types of cowboy hats. A type 1 hat requires twice as much labor time as a type 2. If the all available labor time is dedicated to Type 2 alone, the company can produce a total of 400 Type 2 hats a day. The respective market limits for the two types are 150 and 200 hats per day. The profit is Rs.8 per Type 1 hat and Rs.5 per Type 2 hat. Determine the number of hats of each type that would maximize profit. Formulate the linear programming problem and find the optimum solution by Simplex method.

3. a) What is revised simplex method? How the computations are efficient than the simplex method?

b) (i) Consider the solution space in the following figure, where it is desired to find the optimum point that uses the dual simplex method to minimize $z = 2x_1 + x_2$. The optimal solution occurs at point F = (0.5, 1.5) on the graph.



- Can the dual simplex start at point G? Why or Why not?
- If the starting solution starts at the point L, identify a possible path of the dual simplex method that leads to the optimum point F.
- Is it possible for the dual simplex method to follow the path G-E-F? Justify. [3]

(ii) In a 3 x 3 transportation problem, let x_{ij} be the amount shipped from source *i* to destination *j*, and let c_{ij} be the corresponding transportation cost per unit. The amounts of supply at sources 1, 2, and 3 are 15, 30, and 85 units, respectively, and the demands at destinations 1, 2, and 3 are 20, 30, and 80 units respectively. Assume that the starting northwest-corner solution is optimal and that the associated values of the multipliers are given as $u_1 = -2$, $u2 = 3$, $u3 = 5$, $v_1 = 2$, $v_3 = 5$, and $v_3 = 10$. Find the associated optimal cost. [4]

c) SunRay Transport Company ships truckloads of grain from three silos to four mills. The supply (in truckloads) and the demand (also in truckloads) together with the unit transportations costs per truckload on the different routes are summarized in the following table. The unit transportation costs c_{ij} are in hundreds of dollars. Find the Optimal minimum cost shipping schedule between the silos and the mills starting with the initial solution obtained by Vogel's method.

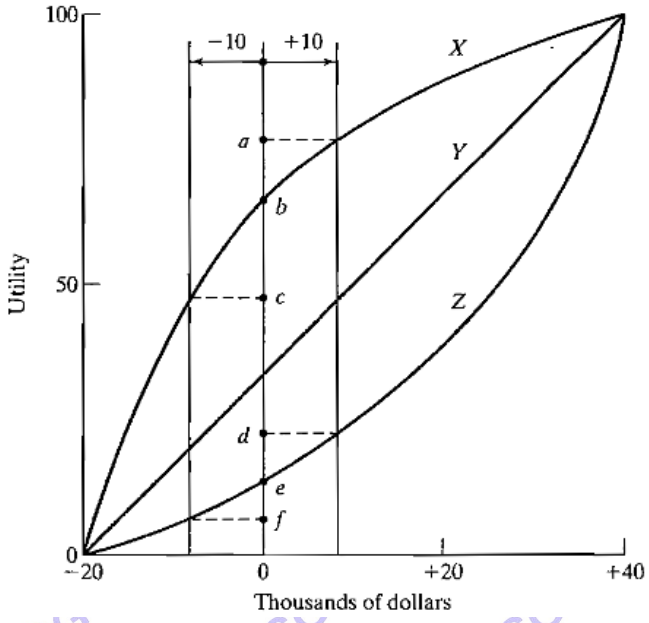
		Mill 1	2	3	4	
Silo	1	4	6	8	8	40
	2	6	8	6	7	60
	3	5	7	6	8	50
		20	30	50	50	

4. a) Joseph needs to assign three jobs to three workers. The cost of performing a job is a function of the skills of workers. The following table summarizes the cost of assignments.

	Job 1	Job2	Job3
Worker 1	$15	$10	$9
Worker 2	$9	$15	$10
Worker 3	$10	$12	$8

Find the optimal assignment and cost.

b) i) Suppose there is a 50-50 chance that a $20,000 investment will produce a profit of $40,000 or lost completely. The investors utility function from 0 to 100 is given as U(-$20,000)=0 and U($40,000)=100. The following graph illustrates the cases of three individuals X, Y and Z.



- From the above graph, what can you say about the investors X, Y and Z?
- Identify the behaviour of investors X and Z when there is loss or profit of $10,000. [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) You are the author of what promises to be a successful novel. You have the option either to publish yourself or through a publisher. The publisher is offering you $20,000 for signing the contract. If the novel is successful it will sell 2,00,000 copies. If it isn't it will sell only 10,000 copies. The publisher pays $1 royalty per copy. A market survey indicates 70% chance that the novel is successful. If you publish novel yourself you will incur an additional cost of $90,000 but for each copy sold you will get $2.

- Will you accept publisher's offer or publish yourself? Justify.
- Suppose a survey for novel's success is conducted. When novel is successful, the survey will predict for not successful as 20% and when the novel is not successful, the survey will predict for not successful as 85%. How this information affect the above decision?

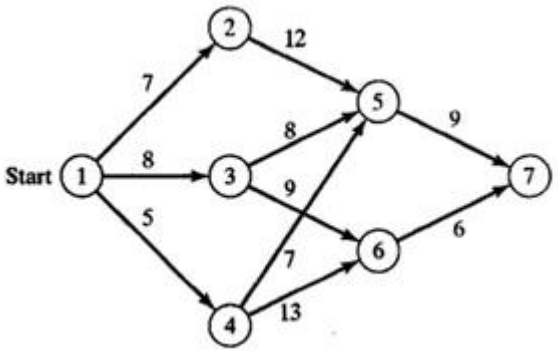
(OR)

(ii) XYZ airline operating 7 days a week has given the following timetable. Crews must have a minimum layover of 5 hours between flights. Obtain the pairing flights that minimizes layover time away from home. For any given pairing the crew will be based at the city that results in small layover.

Chennai-Mumbai			*Mumbai-Chennai*		
Flight Number	*Depart.*	*Arrive*	*Flight Number*	*Depart.*	*Arrive*
A1	*6 AM*	*8 AM*	*B1*	*8 AM*	*10 AM*
A2	*8 AM*	*10 AM*	*B2*	*9 AM*	*11 AM*
A3	*2 PM*	*4 PM*	*B3*	*2 PM*	*4 PM*
A4	*8 PM*	*10 PM*	*B4*	*7 PM*	*9 PM*

5. a) What is random walk method for solving unconstrained optimization technique? How does it differ from the random jump method?

b) (i) The following figure provides the possible routes between the starting city at node 1 and the destination city at node 7. The routes pass through the intermediate cities designated by nodes 2 to 6. Find the shortest route between city 1 and 7 using dynamic programming(backward recursion) computation. [3]



(ii) Outline the steps involved in estimating the area of circle defined as $(x-3)^2 + (y+2)^2 = 16$, using Monte-Carlo simulation technique. [4]

c) (i) Use Cauchy's steepest descent method to minimize the following function $f(X_1, X_2) = X_1 - X_2 + 2X_1^2 + 2X_1X_2 + X_2^2$ starting from the point (0,0). Perform 3 iterations only.

(OR)

(ii) 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

/END/

FD/RL