RAJARATA UNIVERSITY OF SRI LANKA

FACULTY OF APPLIED SCIENCES

B.SC (General) Degree

Third year – Semester II Examination – April / May 2016

ICT 3202 Operational Research

Time allowed: **Two hours.**   **Answer ALL**   Questions.

01. Explain the graphical method of solving a Linear Programming Problem.

A cold drink company has two bottling plants, located at two different places. Each plant produces three different drinks A, B , and C. The capacities of two plants, in number of bottles per day are as follows:

	Product A	Product B	Product C
Plant I	3000	1000	2000
Plant II	1000	1000	6000

A market survey indicates that during any particular month there will be a demand of 24000 bottles of A; 16000 bottles of B; and 48000 bottles of C. The operating costs, per day, of running plants I and II are respectively Rs. 600 units and Rs. 400 units.

(i) Define the decision variables so that the production cost is minimized while still meting the market demand.

(ii) Formulate an LPP model to solve the above problem.

(iii) Using the graphical method, find how many days should the company runs each plant during the month so that the production cost is minimized.

02. Given below are the objective function, the constraints and the final simplex table for a Linear programming product mix problem:

$Maximize \ z = 2x_1 + 5x_2 + 8x_3 + 0s_1 + 0s_2 + 0s_3$

Subject to the constraints

$6x_1 + 8x_2 + 4x_3 \leq 96$ (Department I)

$2x_1 + x_2 + 2x_3 \leq 40$ (Department II)

$5x_1 + 3x_2 + 2x_3 \leq 60$ (Department III)

$x_1, \ x_2, \ x_3 \geq 0$

Optimal Solution table

Variable	x_1	x_2	x_3	s_1	s_2	s_3	constant
x_2	1/3	1	0	1/6	-1/3	0	8/3
x_3	5/6	0	1	-1/12	2/3	0	56/3
s_3	7/3	0	0	-1/3	-1/3	1	44/3
-z	-19/3	0	0	-1/6	-11/3	0	-488/3

(i) Write the optimal product-mix and the profit contribution shown by the above solution.

(ii) Is this feasible? Why? Give brief reason(s).

(iii) If the company wishes to expand the production capacity, which of the three departments should be given priority?

(iv) If s_1 isslack variable in department I, s_2 is slack variable in department II and s_3 is slack variable in department III, which of the departments is being used to the full capacity when producing according to this solution.

03. Indicate how you will test for optimality of Initial Feasible Solution of a transportation problem.
A company has received a contract to supply gravel for three new construction projects locate in towns A, B and C. Construction engineer have estimated the required amounts of gravel which will be needed at these construction projects:

Project location   weekly requirement (truck loads)

A	72
B	102
C	41

The company has three gravel pits locate in towns X, Y and Z. The gravel required by the construction projects can be supplied by three pits. The amount of gravel which can be supplied by each pit as follows:

Plant	X	Y	Z
Amount available (truck loads)	76	82	77

The company has computed the delivery cost from each pit to each project site. These costs (in dollars) are shown in the following table:

Project location

pit		A	B	C
	X	4	8	8
	Y	16	24	16
	Z	8	16	24

Schedule the shipment from each pit to each project in such a manner so as to minimize the total transportation cost within the constraints imposed by pit capacities and project requirements. Also find the minimum cost.

04. Can there be multiple optimal solutions to an assignment problem? How would you identify the existence of multiple solutions, if any?

The personnel manager of a company decides to recruit two employees D and E in a particular section of the organization. The section has five defined tasks 1,2,3,4 and 5; and three employees A , B and C are already employed in the section. Considering the nature of task 3 and the special qualifications of the recruit employee D for task 3, the manager decides to assign task 3 to employee D and then assign the remaining tasks to remaining employees so as to maximize the total effectiveness.

The index of the effectiveness of each employee of different tasks is as follows:

Tasks

	1	2	3	4	5
A	25	55	60	45	30
B	45	65	55	35	40
C	10	35	45	55	65
D	40	30	70	40	60
E	55	45	40	55	10

Employee

(a) Assign the tasks for maximizing total effectiveness.

(b) Critically examine whether the decision of the manager to assign task 3 to employee D was correct.