



RAJARATA UNIVERSITY OF SRI LANKA

FACULTY OF APPLIED SCIENCES, MIHINTALE

B.Sc. (General) Degree in Information and Communication Technology
Second Year – Semester II Examination – April / May 2015

ICT 2208 Operational Research

Answer ALL Questions.

Time: Two (02) hours.

1. (a) "Linear programming has no real life applications." Do you agree with this statement?
Discuss with some examples. **[10Marks]**

- (b) What is an infeasible solution in a linear programming problem? How does it occur?
How is the condition for an infeasible solution recognized in the graphical method?
[15 Marks]

- (c) A company manufactures two types of products A and B. Product A yields a contribution of Rs.30 per unit and product B yields Rs. 40 per unit. It is estimated that sales of product A for the coming month will not exceed 20 units. Sales of product B have not been estimated but the company does have a contract to supply at least 10 units to a regular customer.

The number of machine hours available for the coming month is 100, and products A and B take 4 machine hours each, to produce. The number of labour hours available for the month is 180, and products A and B take 4 hours and 6 hours of labour, respectively. Materials available are restricted to 40 units for the two products; each unit of A or B uses one unit of material. The company wishes to maximize the yield.

- (i) Formulate this problem as a linear programming problem. **[25 Marks]**

- (ii) Using the graphical method, find the optimum product mix. **[50 Marks]**

Turn Over

2. (a) Define the following terms:

(i) Initial Basic Feasible Solution

[05 Marks]

(ii) Slack variable and surplus variable

[05 Marks]

(b) while finding the solution by simplex method, when does the problem have multiple solutions and infeasible solution?

[10 Marks]

(c) A manufacturer produces two different models: X and Y , of the same product. Model X makes a contribution of Rs.50 per unit and model Y , Rs.30 per unit towards total profit. Raw materials R_1 and R_2 are required for production. At least 18 Kg of R_1 and 12 Kg of R_2 must be used daily. Also at most 34 hours of labour are to be utilized. A quantity of 2Kg of R_1 is needed for model X and 1 Kg of R_1 for model Y . For each of X and Y , 1 Kg of R_2 is required. It takes 3 hours to manufacture model X and 2 hours to manufacture model Y .

(i) Define the variables so as to maximize the total profit.

[10 Marks]

(ii) Obtain the objective function using the variables defined in part (i).

[10 Marks]

(iii) Formulate a linear programming model to find the number of units of each model to maximize the total profit.

[15 Marks]

(iv) Solve the linear programming model obtained in part (iii), using an appropriate method.

[30 Marks]

(v) Compare your solution with the graphical method.

[15 Marks]

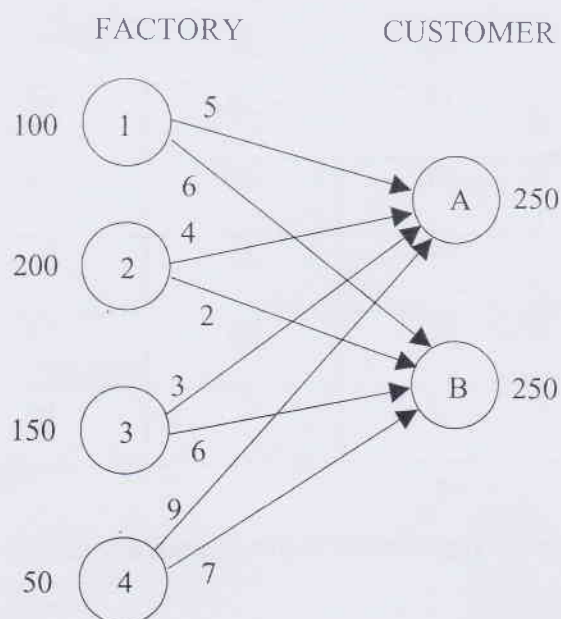
3. (a) What is meant by unbalanced transportation problem? Explain the method for solving such a problem.

[20 Marks]

(b) Why does Vogel's approximation method [VAM] provide a good initial basic feasible solution [IBFS]?

[10 Marks]

- (c) Write the linear programming problem for the following network representing a transportation problem: [20 Marks]



- (i) Find an Initial Basic Feasible Solution using Vogel's approximation method. [20 Marks]
- (ii) Is it optimal? If not, find the optimal solution using an appropriate method. [30 Marks]
4. (a) Give an algorithm to solve an assignment problem. [25 Marks]
- (b) How do you deal with the assignment problems, where
- (a). the objective function is to be maximized? [05 Marks]
 - (b). some assignments are prohibited? [05 Marks]

- (c) A city cooperation has decided to carry out road repairs on four main roads of the city. The government has agreed to make a special grant of Rs.5,000,000 towards the cost with a condition that the repairs be done at the lowest cost and quickest time. If the conditions warrant, a supplementary token grant will also be considered favourably. The cooperation has floated tenders and five contractors have sent their bids. In order to expedite work, one road will be awarded to only one contractor.

Cost of Repairs (Rupees in lakh)

	R_1	R_2	R_3	R_4
C_1	9	14	19	15
C_2	7	17	20	19
C_3	9	18	21	18
C_4	10	12	18	19
C_5	10	15	21	16

(i). Find the best way of assigning the repair work to the contractors and the costs.

[45 Marks]

(ii). If it is necessary to seek supplementary grants, what should be the amount sought?

[10 Marks]

(iii). Which of the five contractors will be unsuccessful in his bid?

[10 Marks]