



RAJARATA UNIVERSITY OF SRI LANKA

FACULTY OF APPLIED SCIENCES, MIHINTALE

B.Sc. (General) Degree in Information and Communication Technology
Third Year – Semester II Examination – October/November 2017

ICT 3202 OPERATIONAL RESEARCH

Answer **ALL** Questions.

Time : **Two (02)** hours.

01. (a) State the steps of the **graphical method** in solving a linear programming problem. [10 Marks]
- (b) A factory makes two types of beds, type A and type B. Each month, x number of beds of **type A** and y number of beds of **type B** are produced. The following constraints control the monthly production:
- Not more than 50 beds of type A and 40 beds of type B can be made.
 - At least 60 beds in all must be made.
 - Maximum number of beds that can be produced is 80.
- (i) Express the above constraints in inequality form in terms of x and y . [15 Marks]
- (ii) Represent the feasible region graphically. [20 Marks]
- (iii) If the objective function is given by the equation $y = -2x + \frac{P}{150}$, where P is the monthly profit in rupees, what is the profit per bed of each type of bed? [10 Marks]
- (iv) How many of each type of bed must be produced per month to maximize the monthly profit? [35 Marks]
- (v) What is the maximum monthly profit? [10 Marks]

02. Consider the following linear programming problem:

$$\text{Minimize } Z = -3x + 9y$$

subject to

$$x + 4y \leq 8$$

$$x + 2y \leq 4$$

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

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Using slack or surplus variables, convert the given problem into standard form and hence find the optimal solution using the simplex method. [100 Marks]

Turn over

03. Nevil makes luxury cars and jeeps for high-income men and women. It wishes to advertise with 1 minute spots in comedy shows and football games. Each comedy spot costs Rs. 30 and is seen by 12 high-income women and 4 high-income men. Each football spot costs Rs. 70 and is seen by 3 high-income women and 9 high-income men.

(i) Formulate the linear programming model so that Nevil can reach 32 high-income women and 16 high-income men at the least cost? [40 Marks]

(ii) Find the least cost for the given LP problem using the *Big-M-Method*. [60 Marks]

04. Consider the following table which describes a balanced transportation problem consists of four plants and four destinations. Table exhibits the unit shipping cost from each plant to each destination. Let x_{ij} be the number of units shipped from i^{th} plant to j^{th} destination:

Destination

Plant		1	2	3	4	Supply
	1	9	7	12	8	18
	2	15	12	12	15	4
	3	8	9	6	12	6
	4	14	12	11	12	12
	Demand	6	14	15	5	

(a) Formulate the problem as a transportation model so as to minimize the total shipping cost. [20 Marks]

(b) Solve the model formulated in part (a) and write the optimal solution to each x_{ij} . [60 Marks]

(c) Suppose that the unit shipping cost from 4th plant to 3rd destination is increased from 11 to 13. Is the solution still optimal? If not, find the new optimal solution. [20 Marks]

05. A university Department Head has five instructors to be assigned to four different courses. All of the instructors have taught the courses in the past and have been evaluated by the students. The rating for each instructor for each course is given in the following table (a perfect score is 100). The Department Head wants to know the optimal assignment of instructors to courses that will maximize the overall average evaluation. The instructor who is not assigned to teach a course will be assigned to grade exams. Solve this problem using *Hungarian method* :

Instructor	Course				
		<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
	1	80	75	90	85
	2	95	90	90	97
	3	85	95	88	91
	4	93	91	80	84
	5	91	92	93	88

[100 Marks]

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