RAJARATA UNIVERSITY OF SRI LANKA

FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Applied Sciences
Third Year – Semester I Examination – November / December 2016

MAT 3301 ADVANCED LINEAR PROGRAMMING

Time: Three (03) Hours.

Answer ALL Questions.

01. (a) Describe the transportation problem with its general mathematical formulation. (20 marks)

(b) Briefly explain three methods of finding initial basic feasible solution for the transportation problem. (15 marks)

(c) A company has four factories F_1 , F_2 , F_3 and F_4 manufacturing the same product. Production and raw material costs differ from factory to factory and are given in the first two rows of the following table. The transportation costs from the factories to the sales depots S_1 , S_2 and S_3 are also given. The last two columns in the table give sales price per unit and the total demand at each depot. The production capacity of each factory is given in the last row of the table.

	F_1	F_2	F_3	F_4	Sales price /unit	Demand
Production cost/ unit	15	18	14	11		
Raw material cost/ unit	10	9	12	9		
Transportation cost/unit						
S_1	3	9	5	4	34	80
S_2	1	7	4	5	32	120
S_3	5	8	3	6	31	150
Supply	50	150	50	100		

Determine the most profitable production and distribution schedule and the corresponding profit. (65 marks)

02. (a) Briefly explain how you would deal with the assignment problems, when

(i) the objective function is to be minimized; (10 marks)

(ii) some assignments are prohibited. (10 marks)

(b) Five swimmers are eligible to compete in a relay team which is to consist of four different swimming styles; back stroke, breast stoke, free style and butterfly stroke. The time taken by the five swimmers , Chandu , Sanaketh, Vishwa , Rakesh and Manu to cover a distance of 100 meters in various swimming styles is given below in minutes and seconds.

Chandu swims the back stroke in 1:09 , the breast stroke in 1:15 and has never competed in the free style or butterfly.

Sanketh is a free style specialist averaging 1:01 for the 100 meters but can also swim the breast stroke in 1:16 and butterfly in 1:20.

Vishwa swims all styles: back 1:10, butterfly 1:12, free style 1:05 and breast stroke 1:20.

Rakesh swims only the butterfly stroke 1:11.

Manu swims the back stroke 1:20 , breast stroke 1:16, free style 1:06 and the butterfly 1:10.

(i) Which swimmer should be assigned to which swimming style? (70 marks)

(ii)Who will not be in the relay team? (10 marks)

03. Why are all goal programming problems minimization problems? (10 marks)

A hospital administration is reviewing departmental requests prior to the design of a new emergency room. At issue is the number of beds for each of the four departments A, B, C and D. The current plans call for a 15,000 square feet facility. The hospital board has established the following goals in order of importance:

Department	No. of beds required	Cost per bed (Rs.)	Area per bed (square feet)	Peak requirement (Max. no. of patients at one time)
A	5	12,600	474	3
B	20	5,400	542	18
C	20	8,600	438	15

Goal 01: avoid over spending of the budget Rs. 300,000.

Goal 02: avoid plan requiring more than 15,000 square feet.

Goal 03: meet the peak requirement.

Goal 04: meet the departmental requirements.

Formulate the given problem as a goal programming problem. ***(Do not solve it)*** . (90 marks)

04. Can there be multiple optimal solutions to an assignment problem? How would you identify the existence of multiple solutions, if any? (15 marks)

A salesmen hiring a Van has to visit five cities A, B ,C , D and E . The distance (in hundred kilometers) between the five cities are as follows:

To city

From city	A	B	C	D	E
A	-	1	6	8	4
B	7	-	8	5	6
C	6	8	-	9	7
D	8	5	9	-	8
E	4	6	7	8	-

If the salesman starts from city A and has to come back to city A , which route should he select so that the total distance travelled is minimum? (85 marks)

05. A furniture company produces three products; desks tables and chairs. The furniture is produced in the central plant. The production of a desk requires 3 hours in the plant, a table requires 2 hours and a chair only 1 hour. The regular plant capacity is 40 hours a week. According to the marketing department, the maximum number of desks, tables and chairs that can be sold weekly are 10 , 10 and 12 respectively. The chairperson of the company has set the following goals in order of preference:

Goal 01: avoid any underutilization of production capacity.

Goal 02: meet the order of certain store for seven desks and five chairs.

Goal 03: avoid overtime operation of the plant beyond 10 hours.

Goal 04: achieve sale goals of 10 desks , 10 tables and 12 chairs per week.

Goal 05: minimize overtime operation as much as possible.

Formulate and solve this problem as a goal programming model through two iterations (three tables) by the goal programming simplex method. (100 marks)

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