EASTERN UNIVERSITY, SRI LANKA

DEPARTMENT OF MATHEMATICS

THIRD EXAMINATION IN SCIENCE - 2008 / 2009

FIRST SEMESTER (Feb., 2010)

MT 305 - OPERATIONAL RESEARCH

(Proper & Repeat)

Answer all questions **Time: Three hours**

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1. (a) Define the "feasible region for a linear programming problem".

   (b) Explain how do you find the optimal solution in the graphical method.

   (c) A firm assembles and sells two different types of outboard motors, A and B, using four resources. The production process can be described as follows:

Resources	Capacity per month
Motor unit shop resource	400 Type A units or 250 type B units or any linear combination of both
Type A gear and drive shop resource	175 Type A units
Type B gear and drive shop resource	225 Type B units
Final assembly resource	200 Type A units or 350 Type B units or any linear combination of both

Type A units bring in a profit of Rs.90 each and Type B units, Rs.60 each. What should be the optimum product mix?

2. Use simplex method to solve the following Linear Programming Problem:

Maximize $Z = 30x_1 + 20x_2$, subject to the constraints:

$$\begin{aligned} -x_1 - x_2 &\geqslant -8, \\ -6x_1 - 4x_2 &\leqslant -12, \\ 5x_1 + 8x_2 &= 20, \quad x_1, x_2 \geqslant 0. \end{aligned}$$

3. Use Revised Simplex Method to solve the following Linear Programming Problem:

Minimize $Z = -4x_1 + x_2 + 2x_3$, subject to the constraints:

$$\begin{aligned} 2x_1 - 3x_2 + 2x_3 &\leqslant 12, \\ -5x_1 + 2x_2 + 3x_3 &\geqslant 4, \\ -3x_1 + 2x_3 &= -1, \quad x_1, x_2, x_3 \geqslant 0. \end{aligned}$$

4. Briefly explain the Vogel's approximation method.

A company has four factories F_1, F_2, F_3 and F_4 manufacturing the same product. Production and raw material cost differ from factory to factory, and are given in the following table in the first two rows. The transportation costs from the factories to sales depots S_1, S_2, S_3 are also given.

The last two columns in the table give the sale price and the total requirement at each depot. The production capacity of each factory is given in the last row.

		F_1	F_2	F_3	F_4	Sales Price per units	Requirement in units
Production cost/unit		15	18	14	13		
Raw material cost/unit		10	9	12	9		
	S_1	3	9	5	4	34	80
Transportation cost/unit	S_2	1	7	4	5	32	120
	S_3	5	8	3	6	31	150
		10	150	50	100		

Determine the most profitable production and distribution schedule and the corresponding profit.

. Enumerate the steps involved in solving minimization assignment problems.

An air -line that operates 7 days a week has the time table shown below. Crews must have a minimum layover 5 hours between flights. Obtain the pairing of the flights that minimizes layover time away from home assuming that crews flying from Delhi to Jaipur can be based either at Delhi or Jaipur for any given pairing, the crew will be based at the city that results in smaller layover.

Flight No.	Delhi Depart	Jaipur Arrival	Flight No.	Jaipur Depart	Delhi Arrival
101	7.00	8.00	201	8.00	9.15
102	8.00	9.00	202	8.30	9.45
103	13.30	14.30	203	12.00	13.15
104	18.30	19.30	204	17.30	18.45

6. The following information are given regarding a project:

Activity	Required Preceding Activity	Duration (Days)
A	None	2
B	None	7
C	None	1
D	A	6
E	B	5
F	B	8
G	C	3
H	D	1
I	E	4
J	G, F	5
K	H, I	3

(a) Draw the network for the above project.

(b) Find the maximum flow for the following network using

i. Intuitive technique,

ii. Labeling technique.