The Open University of Sri Lanka
B.Sc/B.Ed. Degree Programme
Final Examination - 2011/2012
Applied Mathematics-Level 05
APU3141 – Linear Programming

Duration:- Two hours.

Date:-06.01.2012 **Time: - 9.30a.m.-11.30a.m.**

Answer **Four** Questions only.

1. The manager of an oil refinery has to decide upon the optimal mix of two possible blending processes, of which the inputs and outputs per production run are as follows:

	Input		Output	
Process	**Crude A**	**Crude B**	**Gasoline X**	**Gasoline Y**
1	5	2	5	8
2	5	5	4	4

The maximum amount available of crude A and crude B are 240 units and 150 units respectively. Market requirements show that at least 100 units of gasoline X and 80 units of gasoline Y must be produced. The profits per production run from Process 1 and Process 2 are Rs.3 and Rs.4 respectively. Formulate the problem as a linear programming problem and solve it using the graphical method.

2. Use **Big- M** method to solve the following linear programming problem:

$$\begin{aligned} &\textit{Maximize } z = 3x_1 + 4x_2, \\ &\textit{subject to } 2x_1 + 3x_2 \le 600, \\ &\qquad x_1 + x_2 \le 225, \\ &\qquad 5x_1 + 4x_2 \le 1000, \\ &\qquad x_1 + 2x_2 \ge 150 \\ &\qquad x_1 \ge 0,\ x_2 \ge 0. \end{aligned}$$

3. Use the **revised simplex** method to solve the following linear programming problem:

$$\begin{aligned} &\textit{Maximize } z = 3x_1 + 5x_2, \\ &\textit{subject to } 3x_1 + 2x_2 \le 18, \\ &\qquad x_1 \le 4, \\ &\qquad x_2 \le 6, \\ &\qquad x_1 \ge 0,\ x_2 \ge 0. \end{aligned}$$

Verify the solution graphically.

4. Consider the following linear programming problem:

$$\begin{aligned} &\textit{Maximize } z = 15y_1 + 20y_2 - 2.5y_3, \\ &\textit{subject to } 4y_1 + 8y_2 - y_3 \le 5, \\ &\qquad 12y_1 + 8y_2 - y_3 \le 8, \\ &\qquad 8y_1 + 4y_2 - y_3 \le 6, \\ &\qquad y_1 \ge 0,\ y_2 \ge 0,\ y_3 \ge 0. \end{aligned}$$

(a) Give the dual linear program for the above problem.

(b) Solve the dual linear program given in (a) by using the dual simplex method. Hence, write the solution of the primal problem.

5. A company has factories at *A*, *B*, *C* which supply warehouses at *D*, *E*, *F* and *G*. Monthly factory capacities are 50, 50 and 100 units respectively. Monthly warehouse requirements are 30, 40, 60 and 70 units respectively. Unit shipping cost (in rupees) is as follows:

Warehouse / **Factory**	***D***	***E***	***F***	***G***
A	15	0	20	10
B	12	8	11	20
C	0	16	14	18

(a) Formulate a linear programming model for the given transportation problem.

(b) Find an initial basic feasible solution to this problem by Northwest corner rule.

(c) Find an optimal solution.

(d) Suppose now that the requirement of warehouse *F* is increased to 100. Explain how the resulting unbalanced problem may be modelled as a balanced Transportation problem. [**Do not need to solve the problem**]

6. (a) Briefly explain the Assignment Problem in linear programming.

(b) The accounting firm of *A* has just hired six new junior accountants who are to be placed into six specialty areas within the firm. Each applicant has been given an overall skills test in the specialty areas. The results are presented in the table below:

Areas / Applicants	Auditing	Corporate Tax	Personal Tax	Financial Analysis	Information Systems	General Accounting
I	62	75	80	93	95	97
II	75	80	82	85	71	97
III	80	75	81	98	90	97
IV	78	82	84	80	50	98
V	90	85	85	80	85	99
VI	65	75	80	75	68	96

If test scores are judged to be a measure of potential success, which applicant should assigned to which specialty area to obtain maximum potential?