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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015**

COURSE NAME	:	ADVANCED LINEAR PROGRAMMING
COURSE CODE	:	BWA 30903
PROGRAMME	:	3 BWA
EXAMINATION DATE	:	DECEMBER 2014/JANUARY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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- Q1** (a) Show that the following set is convex.

$$C = \{(x_1, x_2) \mid x_1 \leq 2, x_2 \leq 3, x_1, x_2 \geq 0\}$$

(6 marks)

- (b) Determine and classify all the basic solutions of the following system of equations as feasible or infeasible.

$$\begin{pmatrix} 1 & 3 & -1 \\ 2 & -2 & -2 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$$

(8 marks)

- (c) Consider the following system of equations:

$$\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} x_1 + \begin{pmatrix} 0 \\ 2 \\ 1 \end{pmatrix} x_2 + \begin{pmatrix} 1 \\ 4 \\ 2 \end{pmatrix} x_3 + \begin{pmatrix} 2 \\ 0 \\ 0 \end{pmatrix} x_4 = \begin{pmatrix} 3 \\ 4 \\ 2 \end{pmatrix}$$

Determine if any of the following combinations forms a basis (P_1, P_2, P_3) .

(6 marks)

- Q2** Solve the following Linear Programming Problem by using the revised simplex method.

subject to Maximize $Z = 2x_1 + x_2 + 2x_3$

$$4x_1 + 3x_2 + 8x_3 \leq 12$$

$$4x_1 + x_2 + 12x_3 \leq 8$$

$$4x_1 - x_2 + 3x_3 \leq 8$$

$$x_1, x_2, x_3 \geq 0$$

(20 marks)

Q3 Consider the following Linear Programming model:

$$\begin{aligned} & \text{Maximize } Z = 2x_1 + 4x_2 + 7x_3 + 5x_4 \\ & \text{subject to} \\ & 2x_1 + x_2 + 2x_3 + 4x_4 = 10 \\ & 3x_1 - x_2 - 2x_3 + 6x_4 = 5 \\ & x_1, x_2, x_3, x_4 \geq 0 \end{aligned}$$

- (a) Generate the simplex tableau associated with the basis $B = (P_1, P_2)$.
(10 marks)
- (b) Generate the simplex tableau associated with the basis $B = (P_3, P_4)$.
(10 marks)

Q4 (a) The optimal basis for the following Linear Programming is $B = (P_1, P_4)$. Write the dual and find its optimum solution using the optimal primal basis.

$$\begin{aligned} & \text{Maximize } Z = 3x_1 + 5x_2 \\ & \text{subject to} \\ & x_1 + x_2 + x_3 = 5 \\ & -x_1 + 3x_2 + x_4 = 2 \\ & x_1, x_2, x_3, x_4 \geq 0 \end{aligned}$$

(10 marks)

- (b) A Linear Programming model includes two variables x_1 and x_2 and three constraints of the type \leq . The associated slack variables are x_3, x_4 and x_5 . Suppose that the optimal basis is $B = (P_1, P_2, P_3)$ and its inverse is

$$B^{-1} = \begin{pmatrix} 0 & -1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & -1 \end{pmatrix}$$

The optimal primal and dual solutions are

$$\begin{aligned} X_B &= (x_1, x_2, x_3)^T = (2, 6, 2)^T \\ Y &= (y_1, y_2, y_3) = (0, 3, 2) \end{aligned}$$

Determine the optimal value of the objective function in two ways using the primal and dual problems.

(10 marks)

Q5 Solve the following problem using parametric changes in RHS value.

subject to

$$\begin{aligned} \text{Maximize } Z &= 3x_1 + 2x_2 + 5x_3 \\ x_1 + 2x_2 + x_3 &\leq 40 - t \\ 3x_1 + 2x_3 &\leq 60 + 2t \\ x_1 + 4x_2 &\leq 30 - 7t \\ x_1, x_2, x_3 &\geq 0 \end{aligned}$$

(20 marks)

- END OF QUESTION -