Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015

COURSE NAME	:	LINEAR PROGRAMMING
COURSE CODE	:	BWA20403
PROGRAMME	:	2 BWA
EXAMINATION DATE	:	DECEMBER 2014 / JANUARY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS 2. ATTACH **GRAPH PAPER** WITH YOUR ANSWER BOOKLET

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 Given the primal LP model as follows:

Maximize $z = x_1 + 2x_2$
Subject to

$$\begin{aligned} x_1 + 3x_2 &\leq 4 \\ 4x_1 + x_2 &= 6 \\ x_1 \text{ unrestricted}, \quad x_2 &\geq 0. \end{aligned}$$

(a) Find the optimal solution for the primal problem by using big M-method.

(15 marks)

(b) Write the dual problem for this model.

(5 marks)

Q2 (a) Given the LP model as follows:

Maximize $z = x_1 + 4x_2$
Subject to

$$\begin{aligned} -x_1 + 2x_2 &\leq 6 \\ 5x_1 + 4x_2 &\leq 40 \\ x_1, x_2 &\geq 0. \end{aligned}$$

Find the optimal solution for the LP model by using isoprofit line method.

(4 marks)

(b) Given the LP model as follows:

Maximize $z = x_1 + 4x_2$
Subject to

$$\begin{aligned} -x_1 + x_2 &\leq 6 \\ 5x_1 + 4x_2 &\geq 40 \\ x_1, x_2 &\geq 0. \end{aligned}$$

By using two-phase method, find the solution for this new LP model. Is the solution optimal? Explain your answer by relate it with special cases.

(16 marks)

Q3 Given the primal LP model as follows:

Minimize $z = 6x_1 + 2x_2$

Subject to

$$\begin{aligned} 5x_1 + x_2 &\geq 6 \\ 4x_1 + 2x_2 &\geq 9 \\ x_1, x_2 &\geq 0. \end{aligned}$$

and its optimal simplex tableau is as follow:

Basis	x_1	x_2	s_1	s_2	R_1	R_2	Solution
z	0	0	-2/3	-2/3	2/3-M	2/3-M	10
x_1	1	0	-1/3	1/6	1/3	-1/6	1/2
x_2	0	1	2/3	-5/6	-2/3	5/6	7/2

(a) Change the primal model to dual model, hence find the dual optimal solution by using the simplex method.

(5 marks)

(b) By referring to the optimal simplex tableau, find the dual value for the primal model by two different ways. *Graphical solution is not allowed in this question.*
(Hint: Please don't repeat the calculation which you have done in (a).)

(4 marks)

(c) If new decision variable x_3, is added into the primal model as follows :

Min $z = 6x_1 + 2x_2 + \frac{1}{2}x_3$

Subject to

$$\begin{aligned} 5x_1 + x_2 + 2x_3 &\geq 6 \\ 4x_1 + 2x_2 - x_3 &\geq 9 \\ x_1, x_2, x_3 &\geq 0. \end{aligned}$$

By using the optimal simplex tableau for the original primal model, find the optimal solution for this new problem.

(11 marks)

Q4 *Graphical solution is not allowed in this question.*
Given the primal LP model as follows:

Maximize $z = 4x_1 + 6x_2$
Subject to

$$\begin{aligned} x_1 + x_2 &\leq \tfrac{5}{2} \\ x_1 + 5x_2 &\leq \tfrac{19}{2} \\ x_1, x_2 &\geq 0 \end{aligned}$$

and its optimal simplex tableau is as follows:

Basis	x_1	x_2	s_1	s_2	Solution
z	0	0	7/2	1/2	27/2
x_1	1	0	5/4	-1/4	3/4
x_2	0	1	-1/4	1/4	7/4

(a) By referring to the optimal simplex tableau, compute the range of optimality for the objective function coefficient of x_2.

(6 marks)

(b) By referring to the optimal simplex tableau, compute the range of feasibility of the right hand side value of constraint 1, RHS_1.

(5 marks)

(c) Find the new optimal solution if the RHS_1 changes from 5/2 to 5. Also, find the new optimal solution if the RHS_1 change to 12.

(9 marks)

Q5 (a) Given the primal LP model as follows:

Maximize $z = 7x_1 + 10x_2$

Subject to

$$\begin{aligned} 2x_1 + 5x_2 &\leq 13 \\ 5x_1 + 4x_2 &\leq 24 \\ x_1, x_2 &\geq 0 . \end{aligned}$$

Calculate the optimal simplex tableau. Hence write the optimal solution for this problem.

(6 marks)

(b) By using optimal simplex tableau obtained in (a),

(i) if the new constraint $3x_1 + x_2 \leq 15$ is added to LP problem in (a), find the optimal solution.

(ii) if the new constraint $5x_1 + 6x_2 \leq 15$ is added to LP problem in (a), find the optimal solution.

(14 marks)

- END OF QUESTION -