Department of Mathematics

MA162 Chapter 4 Exam

July 12, 2010

DO NOT TURN THIS PAGE UNTIL INSTRUCTED TO DO SO.

Instructions: Be sure that your name, section number, and student ID are filled in below. Cell phones must be OFF and put away before you open this exam. You may use calculators (including graphing calculators, but no laptops or cellphone calculators) for checking numerical calculations, but you must show your work to receive credit. Put your answers in the answer boxes provided, and show your work. If your answer is not in the box or if you have no work to support your answer, you will receive no credit. The test has been carefully checked and its notation is consistent with the homework problems. No additional details will be provided during the exam.

Problem	**Maximum**	**Actual**
1	20	
2	20	
3	20	
4	20	
5	20	
Total	100	

Name: _____
Section: 020
Last four digits of Student ID: _____

1. Setup the problem but do not solve.

You've been hired to get the Jumble Juice through some hard times. They are not interested in your big ideas about new product lines and extreme franchise make-overs; they just want you to set the production goals for their local supplier of juice mixes. The supplier is currently having trouble getting enough fresh juice, and only has 16,000 oz. of pineapple concentrate, 24,000 oz. of orange juice concentrate, and 5,000 oz. of banana pulp. Despite their fancy brand names, the Jumble Juice line depends on three pre-mixed juice blends: Pineapple-Orange (PO), Orange-Banana (OB), and Pineapple-Orange-Banana (POB). Each is measured in 16 oz. units (called "pints"). PO is blended from 8 oz. each of pineapple and orange juice concentrate. OB is blended from 12 oz. of orange juice concentrate and 4 oz. of banana pulp. POB is blended from 4 oz. of pineapple concentrate, 8 oz. of orange juice concentrate, and 4 oz. of banana pulp. Jumble Juice expects to make a profit of \$1.00 per pint of PO, \$0.80 per pint of OB, and \$0.90 per pint of POB. The local store-fronts can sell up to 1500 pints of PO, 500 pints of OB, and 1500 pints of POB. How much of each blend should be shipped in order to maximize profit under the current inventory constraints and without exceeding the current demand?

Variables:

Constraints:

Objective:

2. Write down the (standard, primal) tableau corresponding to the problem:

Maximize $P = x + y + z$
subject to:

$$\begin{aligned}
4x + 5y + 3z &\leq 1001,\\
6x + 7y + 8z &\leq 1002,\\
11x + 10y + 9z &\leq 1003,\\
13x + 14y + 12z &\leq 1004,\\
15x + 17y + 16z &\leq 1005,\\
x, y, z &\geq 0
\end{aligned}$$

3. Apply 1 step of the simplex algorithm. Circle your pivot, write out your row operations, and write down the next tableau. Explain why that next tableau is or is not final. (This is the table resulting from the initial decision to make as much POB blend as possible, a decision primarily limited by the supply of banana pulp).

PO	OB	POB	PC	OJC	BP	POD	OBD	$POBD$	P	RHS
8	-4	0	1	0	-1	0	0	0	0	11000
8	4	0	0	1	-2	0	0	0	0	14000
0	1	1	0	0	$1/4$	0	0	0	0	1250
1	0	0	0	0	0	1	0	0	0	1500
0	1	0	0	0	0	0	1	0	0	500
0	-1	0	0	0	$-1/4$	0	0	1	0	250
-1	$1/10$	0	0	0	$9/40$	0	0	0	1	1125

Is this a final tableau? Why or why not?

4. Read the answer from the following finished tableau (based on #1). Give the location of the maximum, the maximum itself, and the resulting surpluses. Use the word problem in #1 to give a plain English version of the answer for the Jumble Juice supplier and your supervisor.

PO	OB	POB	PC	OJC	BP	POD	OBD	$POBD$	P	RHS
1	0	0	0	0	0	1	0	0	0	1500
0	0	0	1	1	−3	−16	0	0	0	1000
0	0	1	1/4	0	0	−2	0	0	0	1000
0	1	0	−1/4	0	1/4	2	0	0	0	250
0	0	0	1/4	0	−1/4	−2	1	0	0	250
0	0	0	−1/4	0	0	2	0	1	0	500
0	0	0	1/40	0	1/5	4/5	0	0	1	2600

PO = _____ PC = _____ POD = _____

OB = _____ OJC = _____ OBD = _____

POB = _____ BP = _____ POBD = _____

P = _____

Bonus: (2pts) Which would be more profitable right now: an extra 40 oz. of pineapple concentrate, an extra 40 oz. of orange juice, or an extra 40 oz. of banana pulp?

5. (a) Write down the dual tableau of the problem:

Minimize $C = 15A + 18B$
subject to:

$$\begin{aligned} 3A + 1.8B &\geq 60 \\ 25A + 30B &\geq 650 \\ 30A + 27B &\geq 650 \\ A, B &\geq 0 \end{aligned}$$

(b) After pivoting for a few minutes, you get the final dual tableau. Write down the solution to the original (primal) minimization problem, including the location of the minimum, the minimum itself, and the surpluses.

S	L	Z	A	B	C	RHS
0	1	3/5	−1/25	1/15	0	3/5
1	0	5	2/3	−5/9	0	0
0	0	40	14	10	1	390

A = _____ S = _____

B = _____ L = _____

C = _____ Z = _____