DEPARTMENT OF MATHEMATICS

Ma 162 Second Exam October 17, 2011

Instructions: No cell phones or network-capable devices are allowed during the exam. You may use calculators, but you must show your work to receive credit. 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 Score**	**Actual Score**
1	10	
2	10	
3	10	
4	15	
5	10	
6	10	
7	15	
8	10	
9	10	
Total	100	

NAME: _____ **Section:** _____

Last four digits of Student ID: _____

(Practice version)

1. Paul E. Titian is running for SG based on a platform of bribery and libations. To gain popular support, Paul is putting together two gift bags most simply described as the Cheap and the Tasty. The Cheap includes 2 packets of diet tea mix, 1 energy drink, 1 fun size candy bar, and 10 mints. The Tasty contains 2 packets of diet tea mix, 1 energy drink, 5 fun size candy bars, and 2 mints. Paul's generous patrons have donated 200 packets of diet tea mix, 96 cans of energy drink, 200 fun size candy bars, and 800 mints, but he cannot include anything extra or he'll have gone over budget and be disqualified. Paul expects votes from about 10% of the people he gives the Cheap, and from about 40% of the people he gives the Tasty. How many bags of each type should Paul give away in order to maximize his support?

	Tea	Energy	Candy	Mint	Voters
Cheap	2	1	1	10	10%
Tasty	2	1	5	2	40%
Total	200	96	200	800	

Paul's long time advisor Gesse McGee suggests that Paul produce 76 Cheap bags, and 20 Tasty bags. What would be the result of Gesse's advice?

Expected number of supporters: _____

Leftover tea mixes: _____

Leftover energy drinks: _____

Leftover candy bars: _____

Leftover mints: _____

Can you do better?

Number of cheap: _____

Number of tasty: _____

Expected number of supporters: _____

2. 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?

	P	O	B	Demand	Profit
PO	8	8	0	1500	$1.00
OB	0	12	4	500	$0.80
POB	4	8	4	1500	$0.90
Total	16000	24000	5000		

Variables:

Constraints:

Objective:

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

Maximize $P = x + 2y + 3z$
subject to:

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

4. Apply one full 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 for #2 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?

5. Read the answer from the following finished tableau (based on #2). Give the location of the maximum, the maximum itself, and the resulting surpluses.

Use the word problem in #2 to give a plain English version of the answer for the Jumble Juice supplier and your supervisor. Be sure to include the recommended decision, its important effect (the "bottom line"), and any information on surplusses.

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 = _____

Plain English recommendation:

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?

6. (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

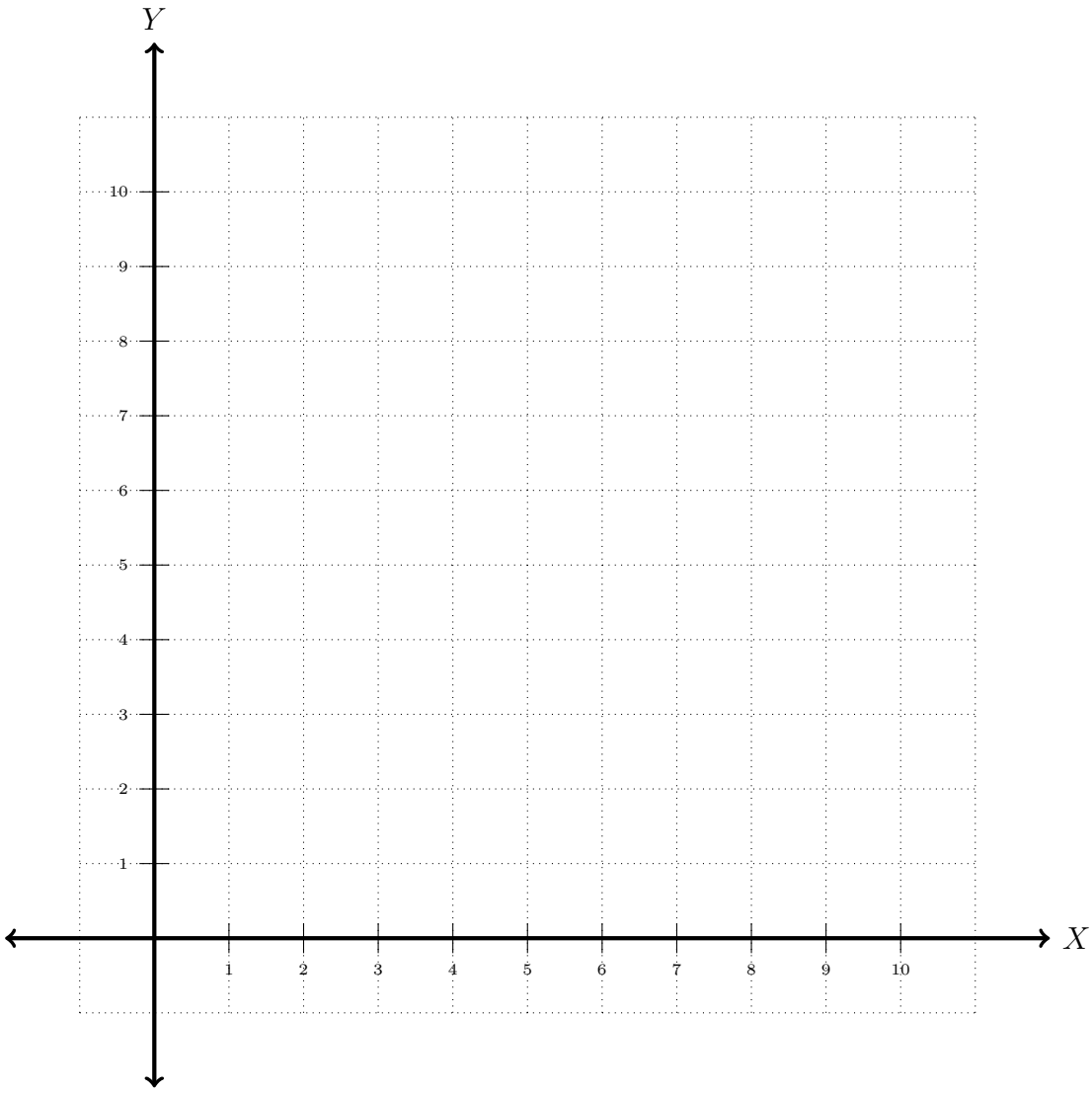
A = _____ S = _____

B = _____ L = _____

C = _____ Z = _____

7. Graph the feasible region for the following LPP. You will be graded on three aspects: correctly drawn edges, correctly shaded region, and correctly labelled corners.

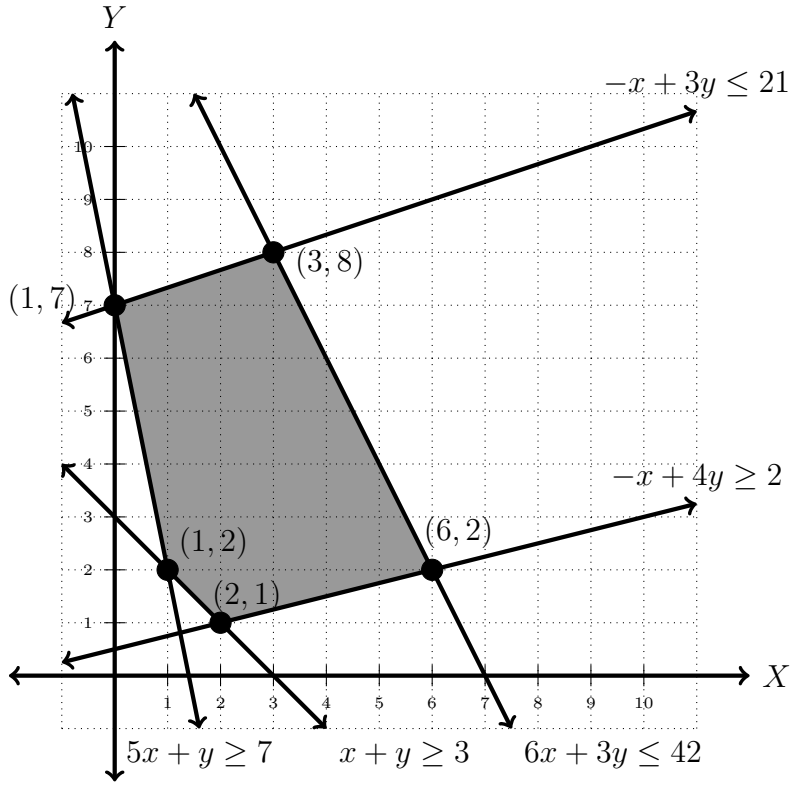
Maximize $P = 8x + 2y$ subject to $\begin{cases} 2x + y \geq 3 \\ 4x - 4y \leq 0 \\ 5x + 5y \leq 50 \\ -11x + 10y \leq 30 \end{cases}$ and $x \geq 0$, $y \geq 0$.



Is this region bounded or unbounded?

8. List the corners, determine if the region is bounded or unbounded, and find the maximum value of P.

Maximize $P = 8x + 2y$ subject to $\begin{cases} 5x + y \geq 7 \\ x + y \geq 3 \\ -x + 4y \geq 2 \\ 6x + 3y \leq 42 \\ -x + 3y \leq 21 \end{cases}$ and $x \geq 0$, $y \geq 0$.

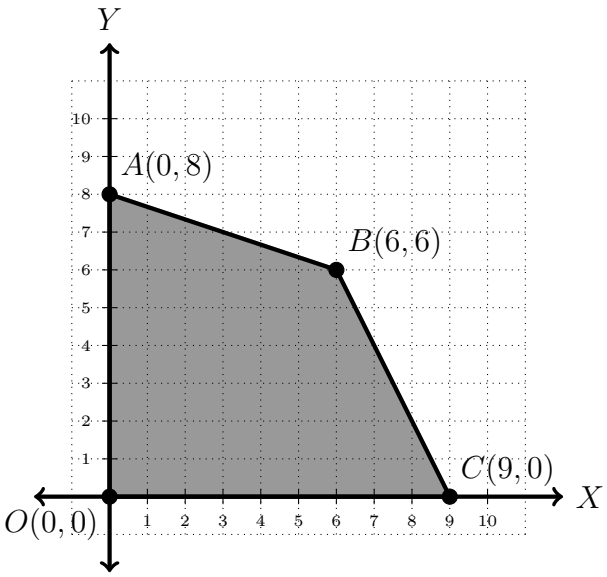


X	Y	P

Is this region bounded or unbounded?

The maximum value of P is _____ and it occurs at ($x =$ _____, $y =$ _____).

9. Determine a system of inequalities that defines the feasible region graphed below:



Maximize $P = x + y$ subject to

$$\begin{cases} OA: \_\_\_\_\_ \\ AB: \_\_\_\_\_ \\ BC: \_\_\_\_\_ \\ CO: \_\_\_\_\_ \end{cases}$$