Practice Exercises for MATH 460 Test #2

1. Given the following simplex tableau

Basis	c_B	x_1	x_2	x_3	s_1	s_2	
		3	4	5	0	0	
		1/2	1	0	1/2	-1/2	6
		0	0	1	-1/4	1	3
	c_j						
	$c_j - z_j$						

a. What variables form the basis?
b. What are the current values of the decision variables?
c. What is the current value of the objective function?
d. Which variable will be made positive next, and what will its value be?
e. Which variable that is currently positive will become 0?
f. What value will the objective function have next?

2. A simplex table is shown below.

Basis	c_B	x_1	x_2	x_3	s_1	s_2	s_3	
		5	4	8	0	0	0	
s_1	0	2/5	-3/5	0	1	-2/5	0	4
x_3	8	4/5	4/5	1	0	1/5	0	8
s_3	0	4/5	9/5	0	0	1/5	1	10
	z_j	32/5	32/5	8	0	8/5	0	64
	$c_j - z_j$	-7/5	-12/5	0	0	-8/5	0	

a. What is the current complete solution?
b. The 32/5 for z_1 is composed of $0 + 8(4/5) + 0$. Explain the meaning of this number.
c. Explain the meaning of the -12/5 value for $c_2 - z_2$.

3. Determine from a review of the following tableau whether the linear programming problem has multiple optimal solutions.

Basis	c_B	x_1	x_2	s_1	s_2	s_3	
s_3	0	0	0	1	-1/5	8/6	6
x_2	2	0	1	0	1/5	-3/5	1
x_1	3	1	0	0	1/5	2/5	4
	z_j	3	2	0	0	0	14
	$c_j - z_j$	0	0	0	-1	0	

4. Write the following problem in tableau form. Which variables would be in the initial basis? (Use the "big M" approach with artificial variables.)

Max $x_1 + 2x_2$
s.t. $3x_1 + 4x_2 \le 100$
$2x_1 + 3.5x_2 \ge 60$
$2x_1 - 1x_2 = 4$
$x_1, x_2 \ge 0$

5. Comment on the solution shown in this simplex tableau.

Basis	c_B	x_1	x_2	x_3	s_1	s_2	a_1	
		1	2	5	0	0	-M	
a_1	-M	-3	-1	0	-1	-2	1	4
x_3	5	1	1/2	1	0	1/2	0	4
	z_j	5+3M	2.5+M	5	M	2.5+2M	-M	-4M+20
	$c_j - z_j$	-4-3M	-.5-M	0	-M	-2.5-2M	0	

6. Solve the following problem by the simplex method.

Max $100x_1 + 120x_2 + 85x_3$

s.t. $3x_1 + 1x_2 + 6x_3 \leq 120$
$5x_1 + 8x_2 + 2x_3 \leq 160$
$x_1 , x_2 , x_3 \geq 0$

8. Draw the network for this LP problem.

Min $2X_{AX} + 3X_{AY} + 5X_{AZ} + 9X_{BX} + 12X_{BY} + 10X_{BZ}$

s.t. $X_{AX} + X_{AY} + X_{AZ} \leq 500$
$X_{BX} + X_{BY} + X_{BZ} \leq 400$
$X_{AX} + X_{BX} = 300$
$X_{AY} + X_{BY} = 300$
$X_{AZ} + X_{BZ} = 300$
$X_{ij} \geq 0$

9. Canning Transport is to move goods from three factories to three distribution centers. Information about the move is given below. Give the network model and the linear programming model for this problem.

Source	*Supply*	*Destination*	*Demand*
A	200	X	50
B	100	Y	125
C	150	Z	125

Shipping costs are:

	Destination		
Source	X	Y	Z
A	3	2	5
B	9	10	--
C	5	6	4

(Source B cannot ship to destination Z)

10. The following table shows the unit shipping cost between cities, the supply at each source city, and the demand at each destination city. The Management Scientist solution is shown. Report the optimal solution.

	Destination				
Source	Terre Haute	Indianapolis	Ft. Wayne	South Bend	***Supply***
St. Louis	8	6	12	9	100
Evansville	5	5	10	8	100
Bloomington	3	2	9	10	100
Demand	150	60	45	45	

TRANSPORTATION PROBLEM
****
OBJECTIVE: MINIMIZATION

SUMMARY OF ORIGIN SUPPLIES
****
ORIGIN	SUPPLY
1	100
2	100
3	100

SUMMARY OF DESTINATION DEMANDS
****
DESTINATION	DEMAND
1	150
2	60
3	45
4	45

SUMMARY OF UNIT COST OR REVENUE DATA
****
FROM ORIGIN	TO DESTINATION 1	2	3	4
1	8	6	12	9
2	5	5	10	8
3	3	2	9	10

OPTIMAL TRANSPORTATION SCHEDULE
****
SHIP
FROM ORIGIN	TO DESTINATION 1	2	3	4
1	0	10	45	45
2	100	0	0	0
3	50	50	0	0

11. Write the linear program for this transshipment problem.