Pivoting By Hand

1. Set up augmented matrix with slack variables.

Minimizing

$$Z = 4x + 5y$$

Must set Objective Function = 0 inorder to put into augmented matrix

$$Z = 4x + 5y$$

 $-4x - 5y - 4x - 5y$
 $4x - 5y + 7 = 0$

Positive

Constraints

$x + 2y \ge 80$

 $3x + y \ge 75$

Constraints must be ≥ inorder to put into augmented matrix

EX.

$$\frac{10x}{-1} \cdot \frac{5y}{-1} \le \frac{3}{-1}$$
 (Divide everything by -1 to flip sign)
 $\frac{1}{-1} \cdot \frac{3}{-1} \cdot \frac{3}{-1}$

Maximizing

$$Z = 10x + 8y$$

Must set Objective Function = 0 inorder to put into augmented matrix

$$\frac{Z}{Z} = 10x + 8y$$

 $\frac{-Z}{0} = 10x + 8y - Z$

Z must be Negative

Constraints

$$4x + 2y \le 80$$
$$x + 2y \le 50$$

Constraints must be ≤ inorder to put into augmented matrix

EX.

$$\underline{10x} - \underline{5y} \ge \underline{3}$$
 (Divide everything by -1 to flip sign)
 -1 -1 -1 -1 -1

Χ	У	S_1	S_2	Z	#
4	2	1	0	0	80
1	2	0	1	2 0 0	50
10	8	0	0	-1	0

2. Find the Pivot Column.

Minimizing The largest negative number in

the bottom row tells your pivot column.

Χ	У	S ₁	S 2	Z	#
1	2	1	0	0	80
3	1	0	1	0	75
4	-5	0	0	1	0

<u>Maximizing</u>

The largest positive number in the bottom row tells your pivot column.

Х	У	S_1	S_2	Z	#
4	2	1	0	0	80
1	2	0	1	0	# 80 50
10		0			

3. Find the Pivot Row.

The <u>smallest positive ratio</u> of solution # to the number in the pivot column.

Χ	У	S ₁	S 2	Z	#	
1	2	1	0	0	80/2 = 40	כ
3	1	0	1	0	75 75/1 = 75	5
4	-5	0	0	1	0	

Maximizing

Х	У	S ₁	S 2	Z	#	
4	2	1	0	0	80	80/4 = 20
1	2	0	1	0	50	50/1 = 50
10	8	0	0	-1	0	

4. Get pivot # to be 1 by dividing the pivot # by itself along with every number in the pivot row. Bring down the rest of the numbers.

 x
 y
 s1
 s2
 z
 #

 1
 2
 1
 0
 0
 80

 3
 1
 0
 1
 0
 75

 -4
 -5
 0
 0
 1
 0

<u>Minimizing</u>

 X
 y
 s₁
 s₂
 z
 #

 4
 2
 1
 0
 0
 80

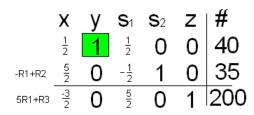
 1
 2
 0
 1
 0
 50

 10
 8
 0
 0
 -1
 0

Maximizing

5. Using the pivot # get the other number in the pivot column to be 0.

Maximizing



6. Am I done?

Minimizing

If there are still <u>negative</u> numbers in the bottom row repeat steps 2 - 5 until all numbers are <u>positive</u>.

<u>Maximizing</u>

If there are still <u>positive</u> numbers in the bottom row repeat steps 2 - 5 until all numbers are <u>negative</u>.

7. Solutions are in the Matrix.

Maximizing

Basic Variable: The variable that is in the column with a 1 and the rest of the numbers are 0. In both of these solutions the x and y variables are considered basic.

x = 14 y = 33 $s_1 = 0$

 S_1 and S_2 are = 0 because there is more than 1 number in that column.

x = 10 y = 20 $s_1 = 0$ $s_2 = 0$ Nonbasic Variable: The variable that is in the column with more than one number other than 0. In this case S1 and S2 are nonbasic.

 $s_2 = 0$ Minimum Value = 221

Maximum Value = 260