Simplex Method

After setting it up

Standard Max and Standard Min

You can only use a tableau if the problem is in standard max or standard min form. Otherwise your only option is graphing and using the corner point method. For both standard max and min, all your variables (x1, x2, y1, y2, etc.) must be greater than or equal to 0.

For standard max, ALL constraints must have variables <u>less than</u> or equal to a number. For min, ALL constraints must have variables <u>greater than</u> or equal to a number. For example if your constraints are in the form $2x_1 + 3x_2 \leq 5$, it's standard max. If they are in the form $2y_1 + 3y_2 \geq 5$, it's standard min.

Maximizing

Pivoting

Pivoting means that you find your pivot position, and get everything in its <u>column</u> except for itself to be 0.

To determine pivot position:

- Look at the column that has the most negative indicator (the indicator row is the very bottom).
- Only look at rows with positive numbers in that column (if it's negative or 0, ignore it).
- For each of these rows, divide the number in the solutions column by the number in the column with the most negative indicator. Whichever row contains the smallest ratio (solutions column over neg. indicator column) is the pivot row.

Other tips while row reducing:

- Avoid fractions. For example, use 2R1 + 3R2 instead of (2/3)R1 + R2.
- Only use the pivot row to get zeros in all other rows. For example, if you have 3 rows and your pivot position is in row 2, that row shouldn't change at all. You use row 2 to get your 0 in row 1 and use row 2 to get your 0 in row 3.
- When you're done getting a 0, make sure nothing in the solutions column is negative. If it is, times that whole row by -1 to make it positive.
- If you still have a negative indicator after pivoting once, repeat the process until all indicators are positive.

Reading

Once all indicators are positive, look at your desired column (depending on if you want to read x1, x2, s1, etc.). If this column has <u>more than one</u> non-zero number, the variable associated with this column equals 0. If it has <u>only one</u> non-zero number, it equals the corresponding solutions column number divided by the non-zero number.

Your maximum value is the number in the bottom right (indicators row, solutions column) provided that the z-column indicator is 1. If it's not 1, you'll have to divide the entire indicators row by that number to get a 1 there. Then you can read your maximum.

Minimizing

Transpose
Before you even think about setting up a tableau for a minimization problem, put your constraints and objective function into a regular matrix with the objective on the bottom. Transpose it. This means taking the first row of your current matrix and making it the first column of your new matrix, etc. Now you have new constraints and a new objective (objective will be the one on bottom).

For example, if you started off with 2 constraints with variable y1, y2, y3, you should now have 3 constraints with variable x1, x2.

Now set up a tableau as if it were a maximization problem. In the example above, you will have 3 slacks to go along with your 3 new constraints. This is important because these slack variables correspond to your original y1, y2, y3 variables.

Pivoting
This will be the exact same process as with a maximization problem.

Reading
This is different from a maximization problem. <u>You look only at the numbers in the indicators row.</u>
First look at your z-column. If it is not 1, divide the whole row by that number to get 1 in that place.
Now look at your slack variable columns. S1 = y1, s2 = y2, etc. Your minimum value will be the number in the solutions column.