Problem Set 2 Writeup

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1 Exercise on elimination with matrices

Problem 2.1: In the two-by-two system of linear equations below, what multiple of the rst equation should be subtracted from the second equation when using the method of elimination? Convert this system of equations to matrix form, apply elimination (what are the pivots?), and use back substitution to nd a solution. Try to check your work before looking up the answer.

$$2x + 3y = 5$$

$$6x + 15y = 12$$

Three times the first equation needs to be subtracted from the second equation when using elimination in order to reach the upper-traingular form needed for back substitution. The pivots after converting to matrix form will be in the first row first column and in the second row second column. The converted matrix can be seen below.

$$\begin{bmatrix} 2 & 3 \\ 6 & 15 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5 \\ 12 \end{bmatrix}$$

Below is the augmented matrix converted to upper-triangular form and ready for back substiution.

$$\begin{bmatrix} 2 & 3 & 5 \\ 0 & 6 & -3 \end{bmatrix}$$

After back substiution we find that $x = 13/4$ and $y = -1/2$.

Problem 2.2: Find the triangular matrix E that reduces "Pascal's matrix" into a smaller Pascal.

$$E \begin{bmatrix} 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 1 & 2 & 1 & 0 \\ 1 & 3 & 3 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 1 & 2 & 1 \end{bmatrix}$$

$$E = \begin{bmatrix} 1 & 0 & 0 & 0 \\ -1 & 1 & 0 & 0 \\ 0 & -1 & 1 & 0 \\ 0 & 0 & -1 & 1 \end{bmatrix}$$