

a) row reduce this system by hand to find the exact solution

Discussion 1: A^{-1} converted to fractions to save space

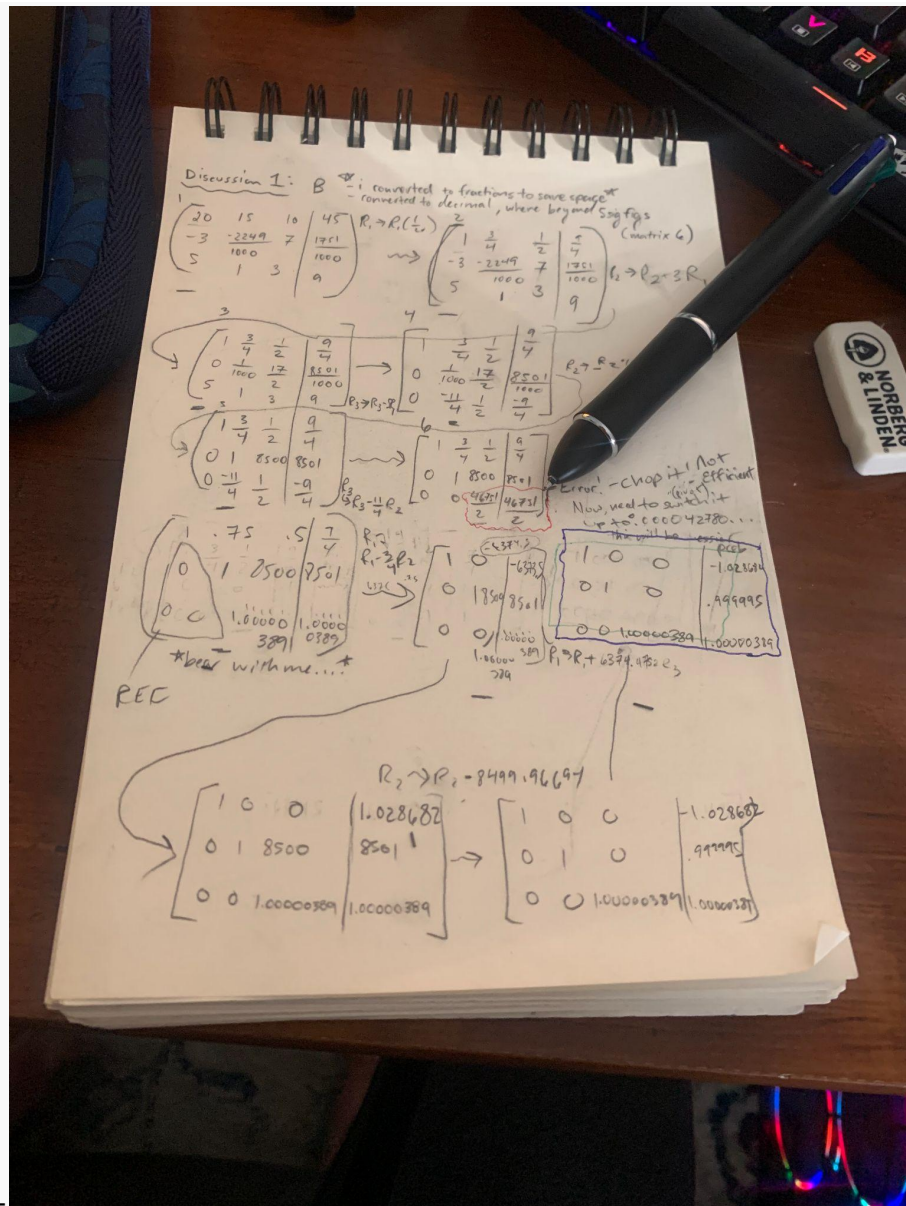
$$\begin{pmatrix} 20 & 15 & 10 & 45 \\ -3 & -2249 & 7 & 1981 \\ 5 & 1 & 3 & 9 \end{pmatrix} \xrightarrow{R_1 \rightarrow R_1/L_1} \begin{pmatrix} 1 & \frac{3}{4} & \frac{1}{2} & \frac{9}{4} \\ -3 & -2249 & 7 & 1981 \\ 5 & 1 & 3 & 9 \end{pmatrix} \xrightarrow{L_2 \rightarrow L_2 - 3R_1, L_3 \rightarrow L_3 - 5R_1}$$

$$\begin{pmatrix} 1 & \frac{3}{4} & \frac{1}{2} & \frac{9}{4} \\ 0 & \frac{1}{1000} & \frac{17}{2} & \frac{8501}{1000} \\ 0 & -\frac{11}{4} & \frac{1}{2} & -\frac{9}{4} \end{pmatrix} \xrightarrow{R_2 \rightarrow R_2 \cdot 1000, R_3 \rightarrow R_3 \cdot 4} \begin{pmatrix} 1 & \frac{3}{4} & \frac{1}{2} & \frac{9}{4} \\ 0 & 1 & 8500 & 8501 \\ 0 & -11 & 2 & -9 \end{pmatrix} \xrightarrow{R_3 \rightarrow R_3 + 11R_2}$$

$$\begin{pmatrix} 1 & \frac{3}{4} & \frac{1}{2} & \frac{9}{4} \\ 0 & 1 & 8500 & 8501 \\ 0 & 0 & 922 & 9221 \end{pmatrix} \xrightarrow{R_3 \rightarrow R_3/922} \begin{pmatrix} 1 & \frac{3}{4} & \frac{1}{2} & \frac{9}{4} \\ 0 & 1 & 8500 & 8501 \\ 0 & 0 & 1 & 10 \end{pmatrix} \xrightarrow{R_2 \rightarrow R_2 - 8500R_3, R_1 \rightarrow R_1 - \frac{3}{4}R_2 + \frac{1}{2}R_3}$$

$$\begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \end{pmatrix}$$

b) row reduce this matrix using only 5 significant digits, where the 6th significant digit and beyond is "chopped" (that is, truncate after 5 sig digs -- do not round.)



c) compare your two solutions.

-a) This is ideal and yields an optimal solution, with nice clean 1s and 0s in a matrix. Very precise.

-b) Perhaps you may not always have the time to evaluate all the decimals of a matrix, and speed is your priority. this is what has to happen in example b, where the extra digits were *chopped*! Equating this to real life, this is what happens: glance quickly over things without evaluating in depth & miss the digits.

precision vs speed

d) what are other challenges of representing matrices in a computer?

-limitations to data points. There may be scenarios where the computer does not evaluate the full big picture, and “truncates” part of the matrix, or data.

-This can be misinformative, and have serious repercussions, as shown in the example above. Such a minor recalculation sets off the rest of the matrix, and I imagine there will be variation in our b answers. It is harder to predict data at the individual level: Black swan?