Christopher Gsell HW7 3/8/18

Problem 1 a) $Ax = b$

$$\begin{bmatrix} 1 & t_1 & t_1^2/2 \\ 1 & t_2 & t_2^2/2 \\ 1 & t_3 & t_3^2/2 \end{bmatrix} \begin{bmatrix} X_0 \\ V_0 \\ a \end{bmatrix} = \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix}$$

The system is linear because we can write it as a matrix, and the t^2 values are known values.

c) $\Delta t = 5s$ suggests the best conditioning because R is at its maximum. This is what I expected because the more spread out the t's are, it usually means error will have less of an impact and thus conditioning will be better.

d) The value of t_2 that suggests best conditioning is 4.7s. at this point R is at its greatest (2.4). This is better than what I obtained in the evenly spaced interval because R is higher (2.38 vs 2.37).

e) The best fit parameters are the same

f)

error	Strategy 1	Strategy 2	error	
.003	.2515	.2555	.011	Upper V_0
	.2485	.2445		Lower V_0
$4 \cdot 10^{-4}$	.2298	.229	.002	Upper a
	.2302	.231		Lower a

Strategy 1 offers better accuracy. This is what I predicted because the conditioning at $t_2 = 5$ is better than that at $t_2 = 1$.

Problem 2

a) The elimination phase of Gauss elimination arranges the matrix such that all of the coefficients are represented in either the upper right triangle or lower left triangle. You can arrange these by taking linear combinations of the rows of A and b of a $Ax = b$ system. We like to triangularize it because then we can use forward or backward substitution to find the x elements.

c) When you input the matrices as written, there is a division by zero error. this occurs because the pivot element is 0. To get around this, you can simply swap the 1st & 2nd rows of A & b.

Problem 3.

b) There are no differences between the input A and the dot product of L and U. My friends, however, due have small differences in the A_2 matrix. This might be because they swapped the 3rd & 4th rows in their A_2 and b from the problem before (in addition to swapping rows 1 & 2). Or, it could be due to the limits of machine precision. Either way, the differences are so small, they can be rounded to 0.