Exercise #1

Question 2.1

I noticed that while changing GbarE from 0.3 to 0.4 the neural spiking increased. This did not seem to affect membrane potential as much as I thought it would as it seemed to stay below 0.5. As expected, when we lower GbarE from 0.3 to 0.2, there is much less neural spiking and the same stayed true for decreasing the value to 0.1 where there seemed to be little to no spiking.

Question 2.2

Yes there is a qualitative difference between the higher values and the lower values in GbarE. The lower the value was, the less spiking occurred. This means that the neuron has to sustain a certain amount of conductance in order to spike.

Question 2.3

I found that when I set GbarE to 0.12, the neuron did not spike and when I set it to 0.13, it did indeed spike.

Question 2.4

$$V_m = \frac{g_e G_e + g_l G_l + g_i G_i}{g_e + g_i + g_l}$$

$$0 = G_e(E_e - v_m) + G_l(E_l - v_m)$$

$$G_e = -((G_l(E_l - v_m))/(E_l - v_m))$$

$$= -(0.3(0.3 - 0.5)/(1 - 0.5))$$

$$= (-0.3)(-0.8)(0.5)$$

$$= 0.12$$

Question 2.5

I found the value to be 0.3. Using the tug of war model, this means that the leak is going to be relatively high which suggests that this is going to be the dominant force. This prevents the excitatory from reaching the threshold and prevents it from firing.

Question 2.8

Digits	Overlap
0	6
1	6
2	12
3	12
4	5
5	14
6	12
7	6
8	17
9	12

Question 2.10

With a lower GbarL value, it is going to be a lot easier for the excitatory to reach the threshold and begin to fire. This means that it will influence the membrane potential a lot easier and allows the neuron to respond better to signals which can possibly increase the ability in which it processes information.