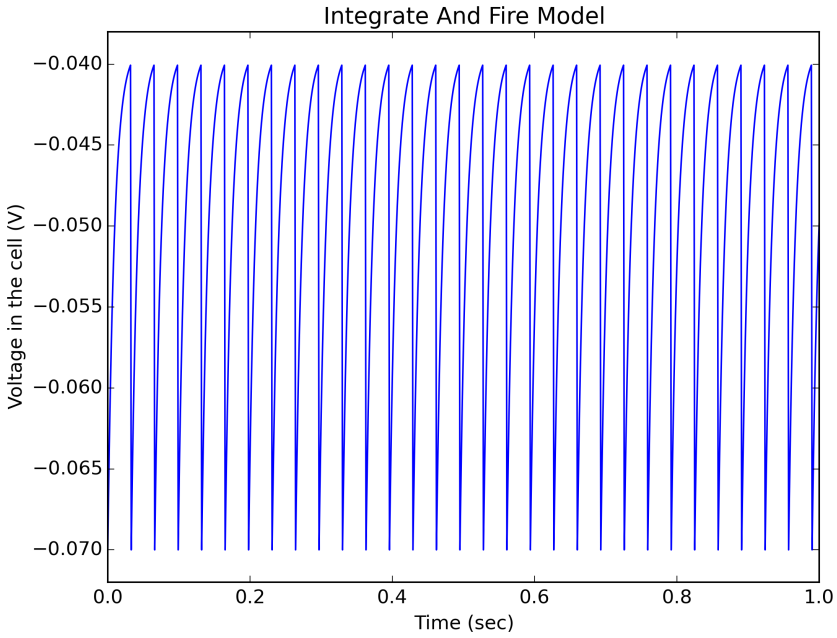
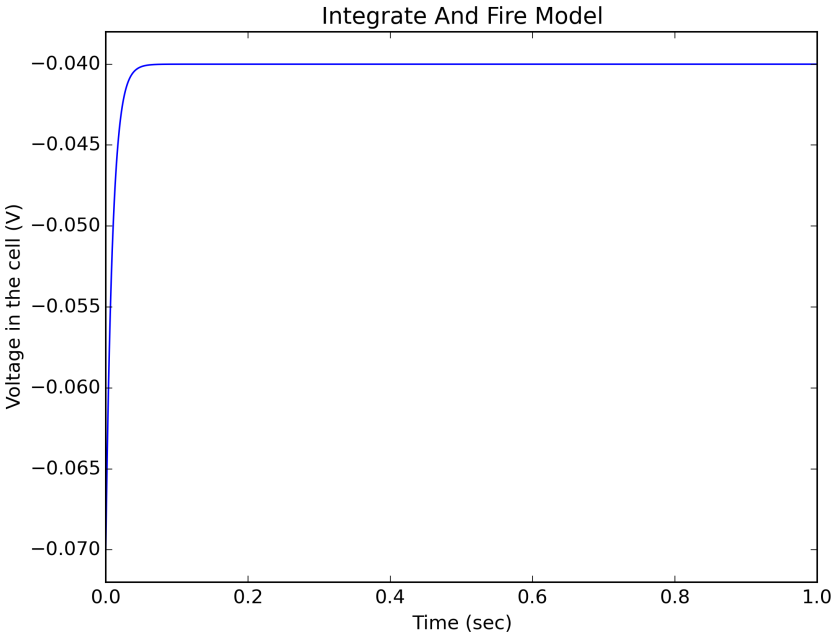
Part 1



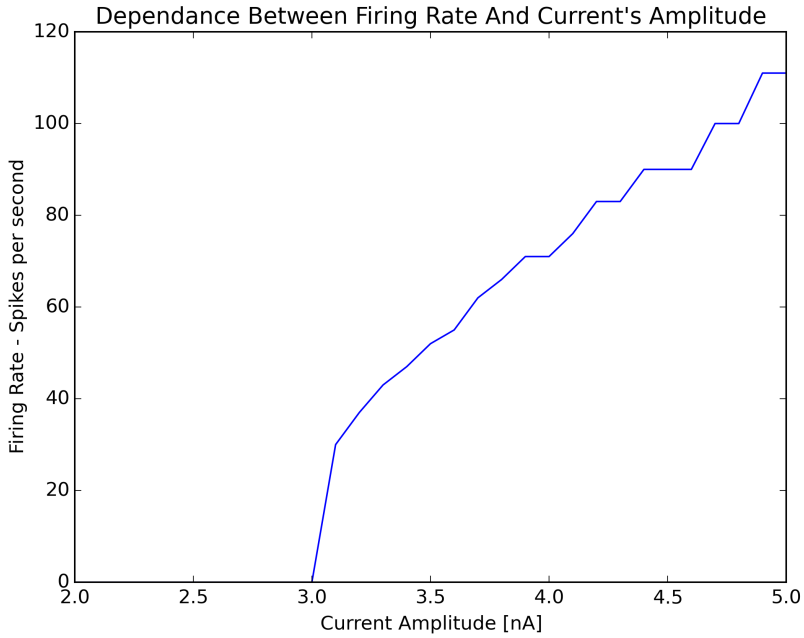
Part 2 a)

$\tau_m \frac{dV}{dt} = E_L - V + R_m I$
$\frac{dV}{dt} = \frac{E_L - V + R_m I}{\tau_m}$
The minimum value of I that produces an action potential is the value I has when V has reached the threshold value and the function is constant. A function is constant when its derivative is equal to zero.
$\frac{dV}{dt} = \frac{E_L - V + R_m I}{\tau_m} = 0$
$E_L - V + R_m I = 0$
$I_{min} = \frac{E_L - V}{R_m}$
$I_{min} = \frac{-70mV + 40mV}{10M\Omega}$
$I_{min} = 3nA$

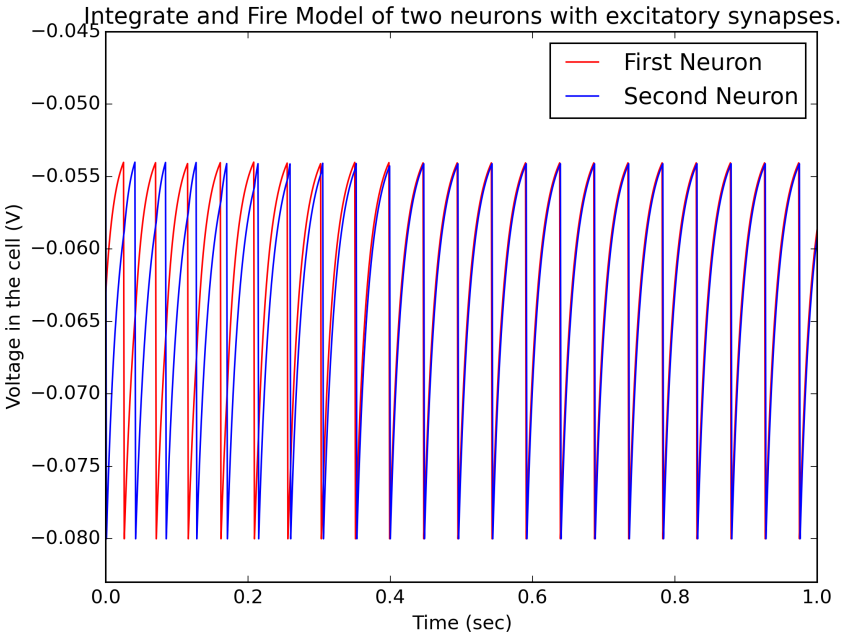
Part 2 b)


Integrate And Fire Model
−0.040
−0.045
−0.050
−0.055
−0.060
−0.065
−0.070
Voltage in the cell (V)
0.0
0.2
0.4
0.6
0.8
1.0
Time (sec)

Part 3

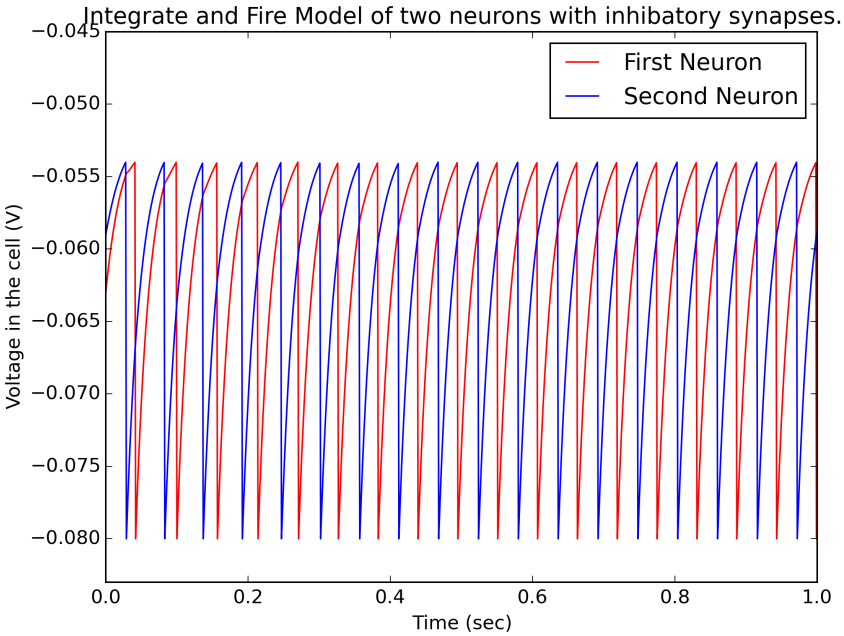

Dependance Between Firing Rate And Current's Amplitude
Firing Rate - Spikes per second
Current Amplitude [nA]
0
20
40
60
80
100
120
2.0
2.5
3.0
3.5
4.0
4.5
5.0

Part 4 a)



When the synapses are excitatory, the spikes of the two neurons synchronize after a few synapses.

Part 4 b)



When the synapses are inhibitory, the spikes of the two neurons diverge.