

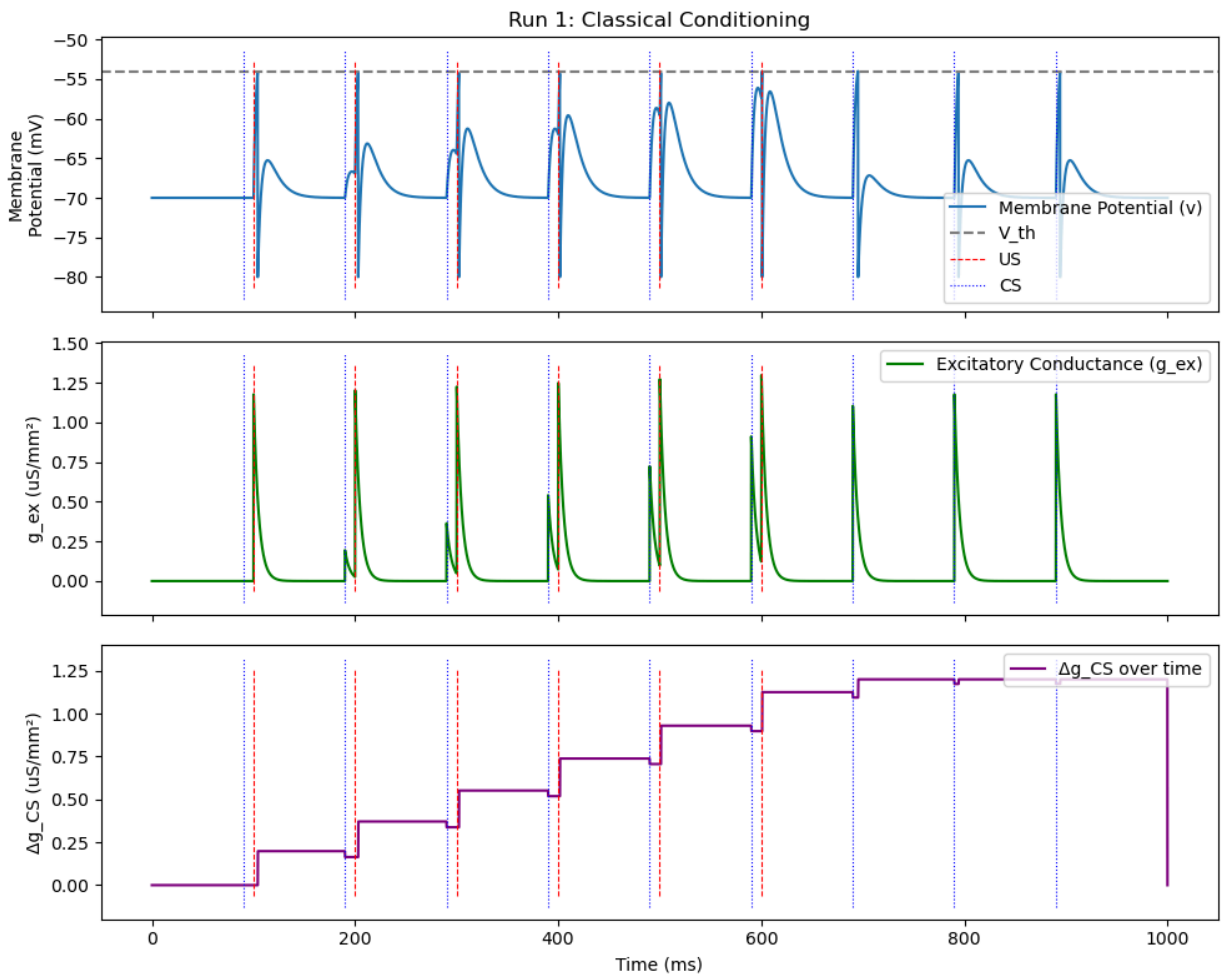
HOMEWORK - 03

Computational Neuroscience

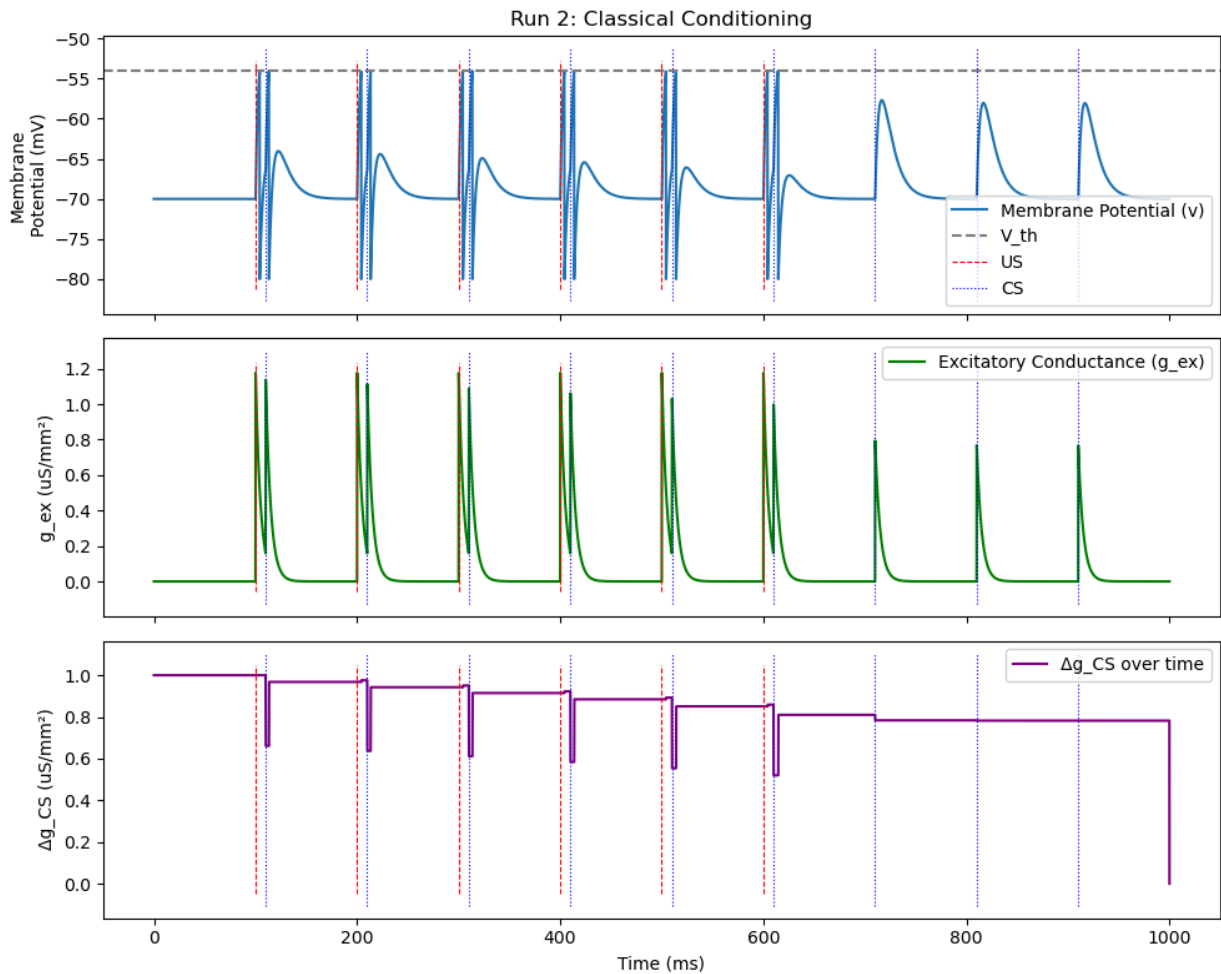
[Submitted by: Priyansha Verma]

Question : 1

- In the first case, when the conditioned stimulus is received before the unconditioned stimulus- initially the neuron only spikes when the unconditioned stimulus is presented. Eventually, this potentiation is sufficient to allow the CS alone to drive the membrane potential above threshold, causing the neuron to fire even in the absence of the US.

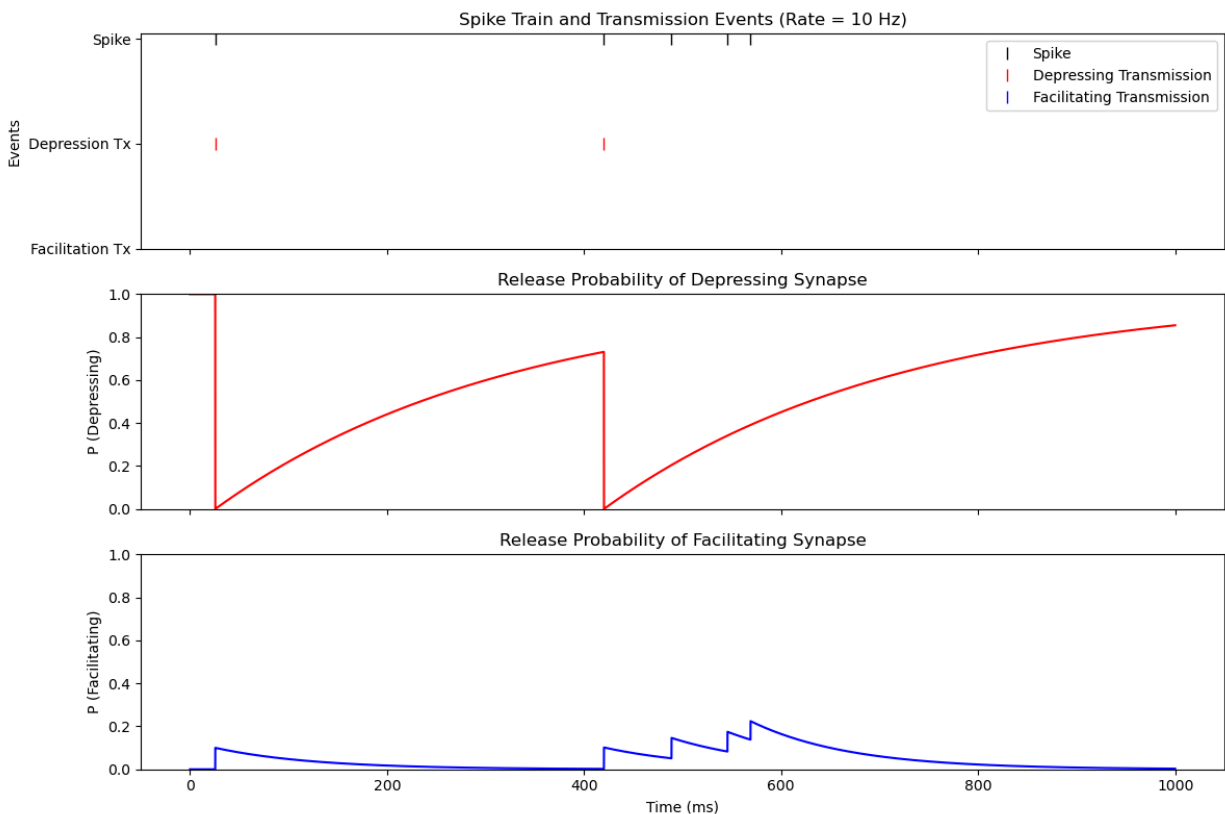


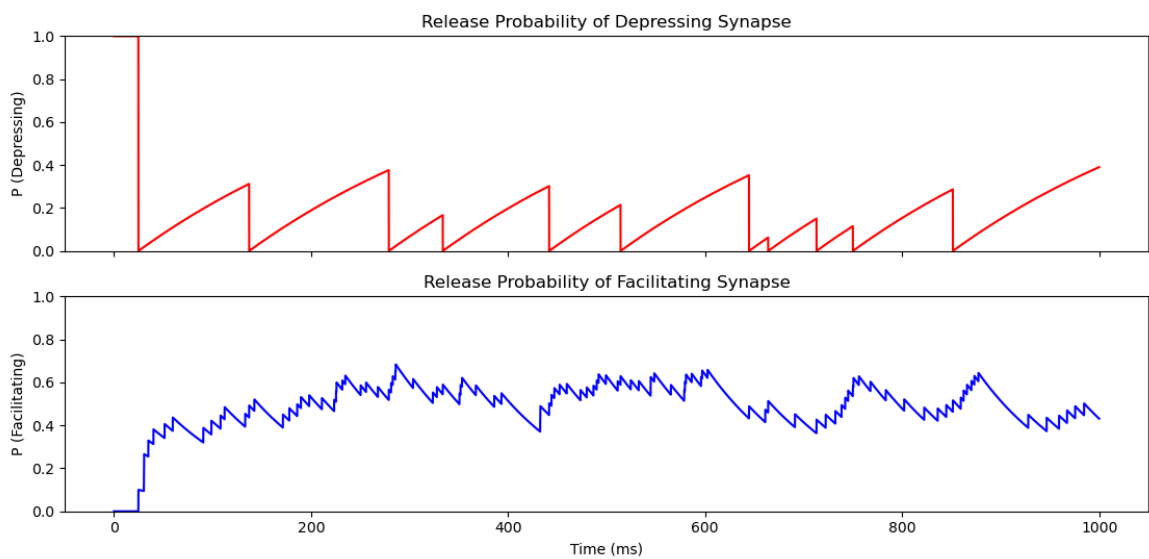
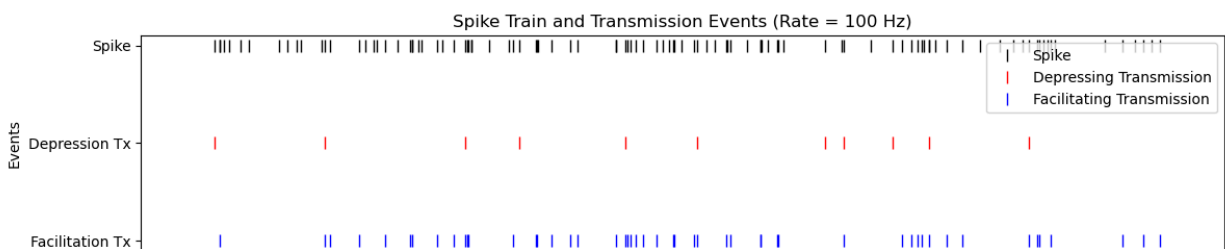
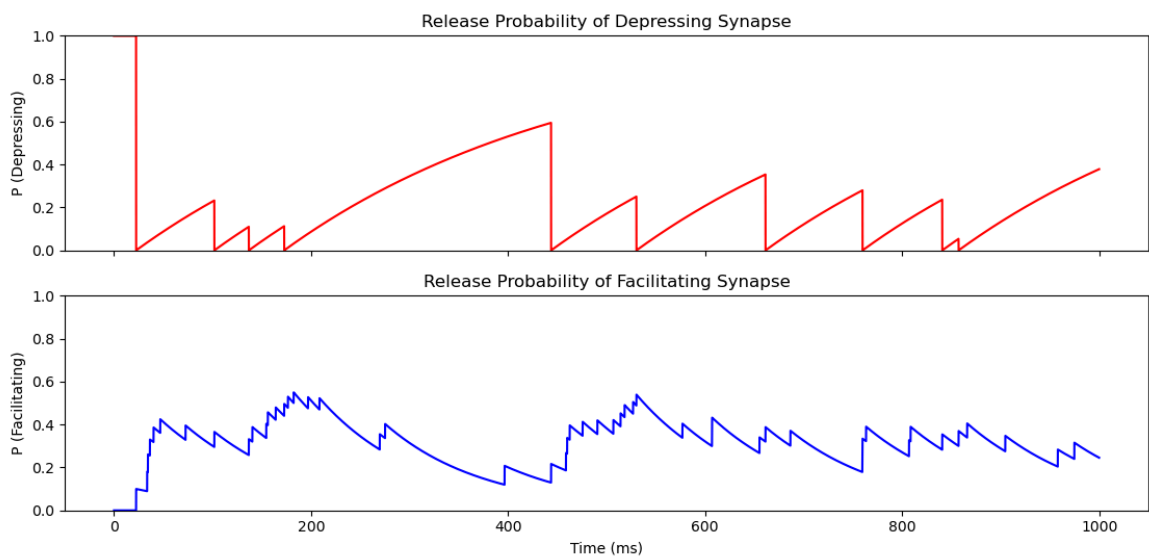
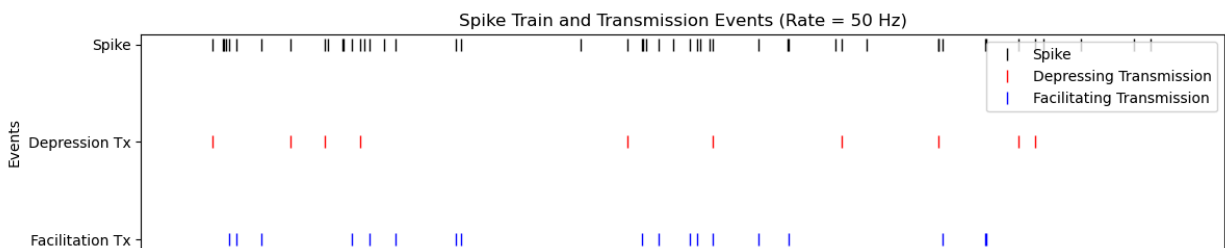
- In the second case, the postsynaptic neuron initially fires in response to both the conditioned stimulus (CS) and the unconditioned stimulus (US). However, because the CS consistently follows the US in time, the synapse undergoes depression with each iteration. As a result, synaptic strength gradually diminishes, and eventually, the CS alone is no longer sufficient to trigger a postsynaptic spike.

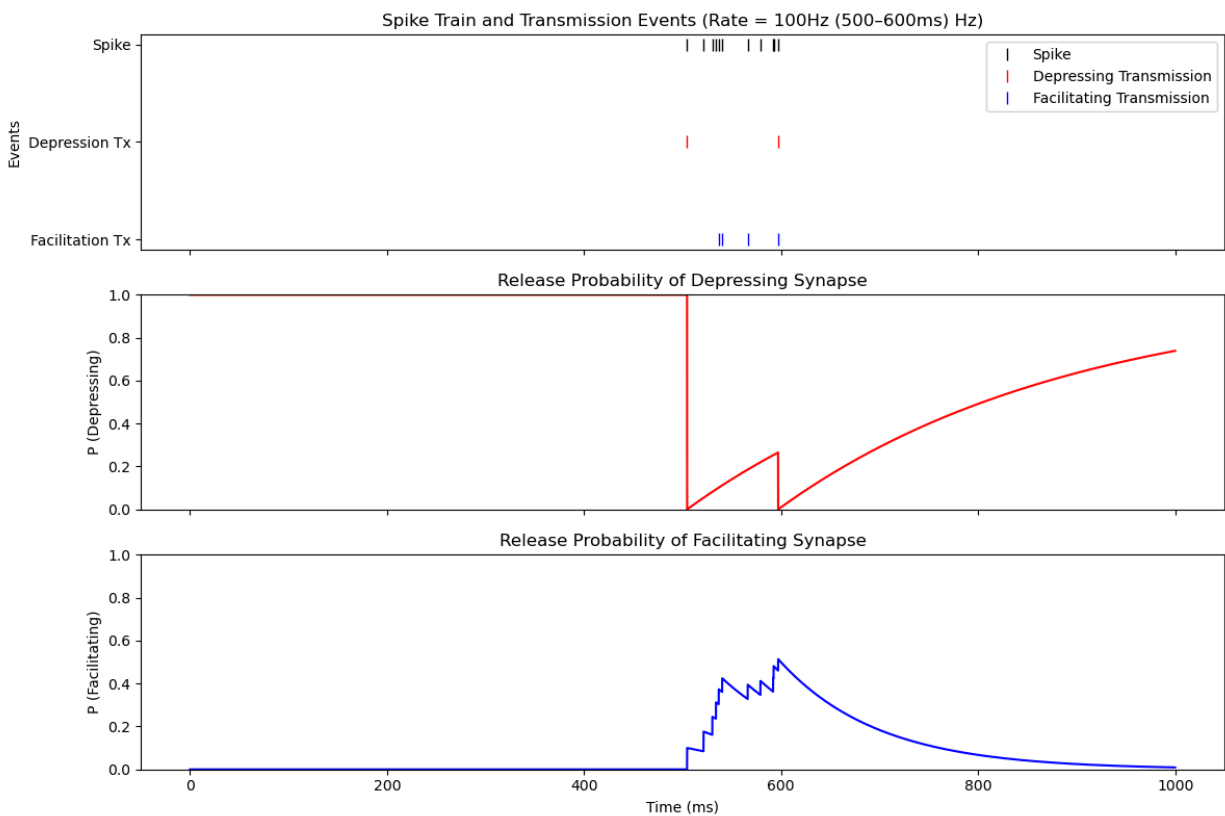


Question : 2

- The firing probability increases linearly with increase in firing rate (10 Hz to 100 Hz). Since the facilitation happens after each spike, the probability of transmission for facilitating synapse increases much more rapidly as compared to the depressing synapse- For smaller firing rates, the depression is minimal and infrequent as the transmission only happens sparsely, and it is more pronounced as the firing rate increases. We observe similar cases for facilitation. Hence, high firing may cause transmission might be suppressed (depression) or enhanced (facilitation).







•

