The main program to be run is main.m. It begins by declaring many global variables that will mainly be used to store data throughout the entire simulation. Main\_iniitialization.m executes various files that initialize all the parameters for every electric vehicle (EV) in the simulation, e.g., initialize\_travel\_load.m for destination house load and distance initialization, max\_battery\_calc.m and min\_retain\_calc.m for EV battery upper and lower limits, etc. Along with the EV parameters, main\_initialization.m also initializes the time-based variables for every EV, e.g., EV.x(t) = 0 and EV.y(t) = 0 is the state of charging and state of discharging initialization for an EV, EV.soc(t) = EV.isoc is the state of charge initialization for an EV, etc.

The simulation consists of three different scenarios described in the research paper – first\_scenario.m, where the overall cost for each EV owner is based only on the amount of charging and discharging done throughout the simulation, second\_scenario.m, where the overall cost is also based on the number of unfulfilled EV battery charges as determined by the desired final battery value and the actual final battery value at the end of the simulation, and third\_scenario.m, where the overall cost is determined by the amounts of charging and discharging, the number of unfulfilled charges, and the cost of total number of switches (i.e., EV going from a state of charging to discharging, charging to idle, etc.).

In all three scenarios, the EVs are programmed to start with a full battery charge and leave the charging station to their designated households to discharge at the house loads. After they finish discharging to the full load limit of their respective households, the EVs return to the charging station to recharge as much as possible till the end of the 24 hour simulation, which in the code is described as 48 half-hour periods (i.e, time, t = 1:48).

Throughout each scenario, the variable time-based values are stored, and afterwards, three files – first\_scenario\_plot\_parameters.m, second\_scenario\_plot\_parameters.m and third\_scenario\_plot\_parameters.m – are used to generate vectors for plots that are described in the Results section of the research paper, but are not used for the second part of the project, only the first part of the project. Also, at the end of each scenario, main.m prints the state of charge for each EV at the following points in the simulation – when the EV arrives at the household, when it finishes discharging at the house load and leaves to head back to the charging station, when it arrives at the station and, finally, at the end of the simulation.

Finally, main.m generates the following plots – SOC vs. distance for an arbitrarily chosen vehicle when travelling to the household, SOC vs. distance for the EV when travelling back to the station, and SOC vs time for the entire simulation.