Explanation of Assigned Task

- **Input**

  Firstly, we read through the Neuron Network Simulation Program. The network will definitely have more than 2 neurons. There is a chance that one neuron will not be connected to another neuron. Besides that, each neuron serves as a node in the network. There will be none or more connections with other neurons. However, two neurons can have more or only one connection. Finally, the Synapse or Connection, this part will help each synapse is similar to edges connecting two neurons. The connection has two properties, one being the distance of synapse, the other is time needed for a message to travel through it.

- **Unidirectional**

  The synapse are only allowed to pass message in one direction. As an example, if Neuron 1 has a path to Neuron 2 at distance 3 and time 4, this means messages can only move from neuron 1 to neuron 2. The message could not go from Neuron 2 to Neuron 1 with the same path. A path has to be given under Neuron 2 if the message wants to be sent from Neuron 2 to Neuron 1. Thus, Neuron 1 to Neuron 2 (Path 1 = distance 3 and time 4), while Neuron 2 to Neuron 1 (Path 2 = distance 5 and time 2). Hence, message sent from Neuron 1 to 2 uses only Path 1 and message sent from Neuron 2 to 1 uses only Path 2. This is achievable if assumption of having only one synapse between two neurons is removed.

- **Optimization in Bidirectional**

  The synapse are allowed to send messages in any direction, forward or backword. When message must to be sent by going through 1 or more neurons in between, it has to check which path is the shortest. Shortest total time is given priority as the chosen path, if total time is the same hence, shortest total distance is given second priority. If all total time and total distance are the same, any chosen time and distance is allowed.

- **Output**

  For output, it will first ask to input number of messages to pass through, n. The following lines requests n instances of neuron, each separated by a blank line (x y). x represents the

ID of starting neuron while y represents the ID of destination neuron for the message. Output would then be given depending on choice of direction with its distance and time to send the message.

The Requirement of the Task

- **Input**

  Neurons are the nodes in a network with a connection between them known as synapse. The synapse helps to connect the nodes with similar edges. They do have properties such as distance of the synapse and the time required to pass a message. They input also separates the path of the synapses by unidirectional or bidirectional.

- **Unidirectional**

  A distance matrix and time matrix is used to save the distance and time of a specific neuron. Example using Neuron 1 to Neuron 2 (Path 1 = distance 3 and time 4), while Neuron 2 to Neuron 1 (Path 2 = distance 5 and time 2),

distance	time
0 1 2	0 1 2
1 0 3	1 0 4
2 5 0	2 2 0

  In path class, it would take the distance and time for the path from a certain neuron to a certain neuron. Example if message sent from Neuron 1 to Neuron 2, distance 3 and time 4 would be given while Neuron 2 to Neuron 1 would be distance 5 and time 2.

- **Optimization in Bidirectional**

  A distance matrix and time matrix is used to save the distance and time of a specific neuron. Example using Neuron 1 to Neuron 2 (Path 1 = distance 3 and time 4), while Neuron 2 to Neuron 3 (Path 2 = distance 5 and time 2) and Neuron 1 to Neuron 3 (Path 3 = distance 6 time 8,

  Note: synapse can be used forward or backward.

distance	time
0 1 2 3	0 1 2 3
1 0 3 6	1 0 4 8
2 3 0 5	2 4 0 2
3 6 5 0	3 8 2 0

In path class, it would take the total distance and total time for the path from a certain neuron to a certain neuron. Example if message sent from Neuron 1 to Neuron 3, there are two available path:

From Neuron 1 to Neuron 3 through Neuron 2, Total 1 = distance 8 time 6

From Neuron 1 to Neuron 3, Total 2 = distance 6 time 8

Thus,

Total 2 has shorter distance than Total 1. However, Total 1 has shorter time than Total 2. Since shortest time is prioritized, Total 1 would be chosen as the path to send message from Neuron 1 to Neuron 3 (and Neuron 3 to Neuron 1 since path can be used forward and backward).

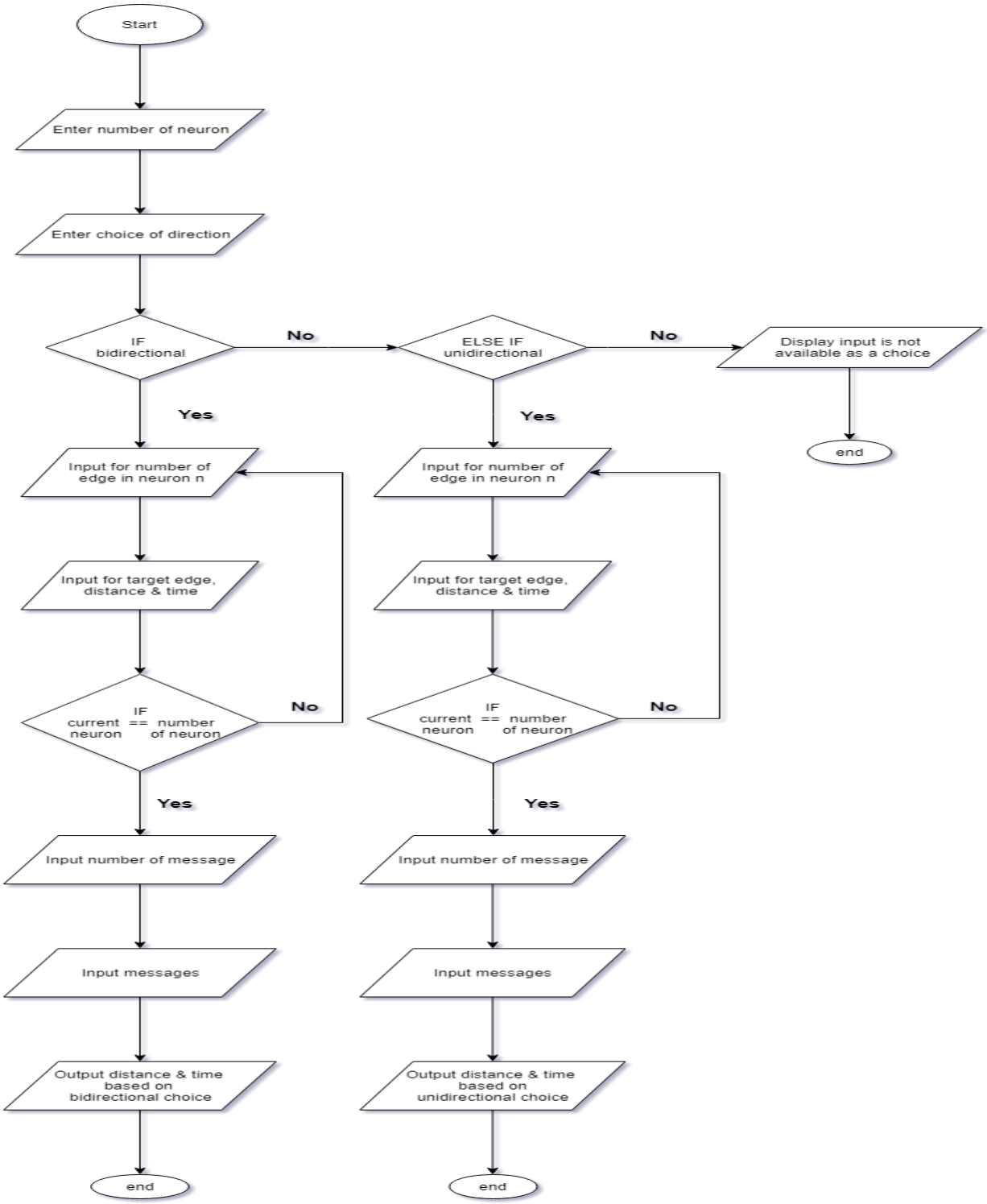
- **Output**

  The two inputs are entered in integer value, then it has the requirements of unidirectional or bidirectional. If unidirectional it shows the distance and time of the synapse. While if bidirectional, it undergoes optimization that shows the shortest distance of synapse.

The Approach Taken to Solve the Task

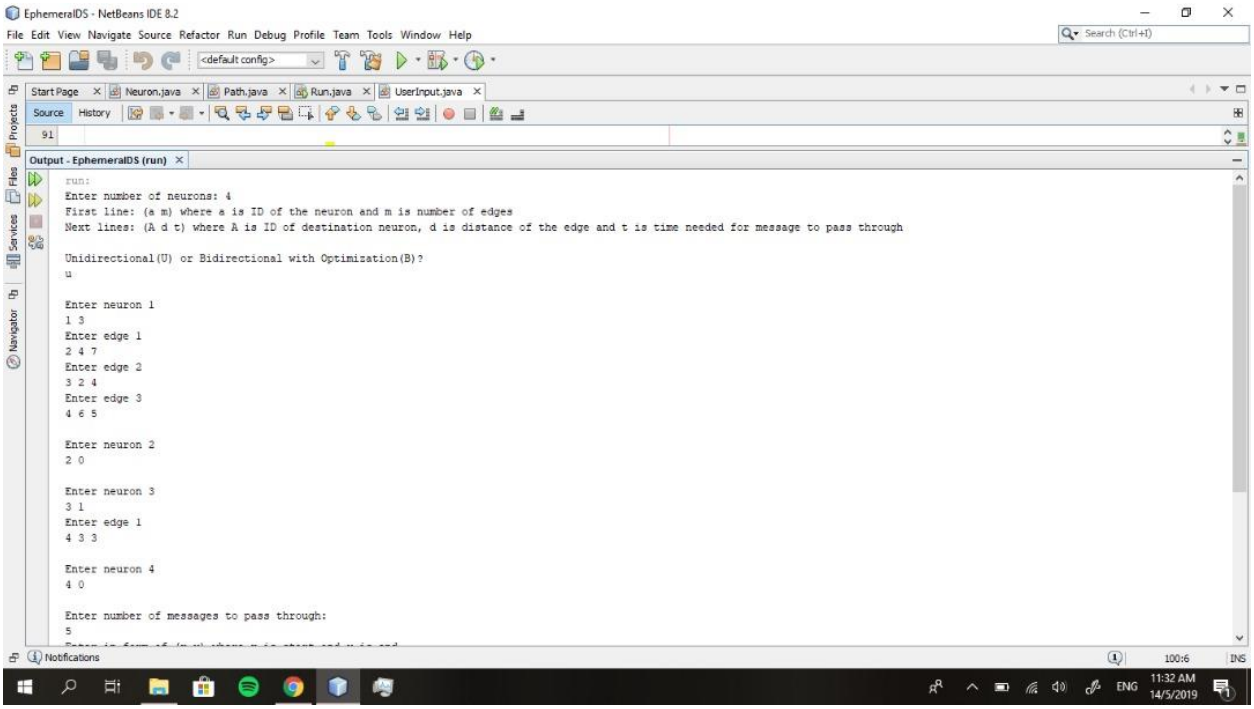
- Refer to website as example for better understanding on how unidirectional works as well as optimization.
- Referring to artificial intelligence chapter related to neural network.
- Obtain guidance from senior when error occurs.

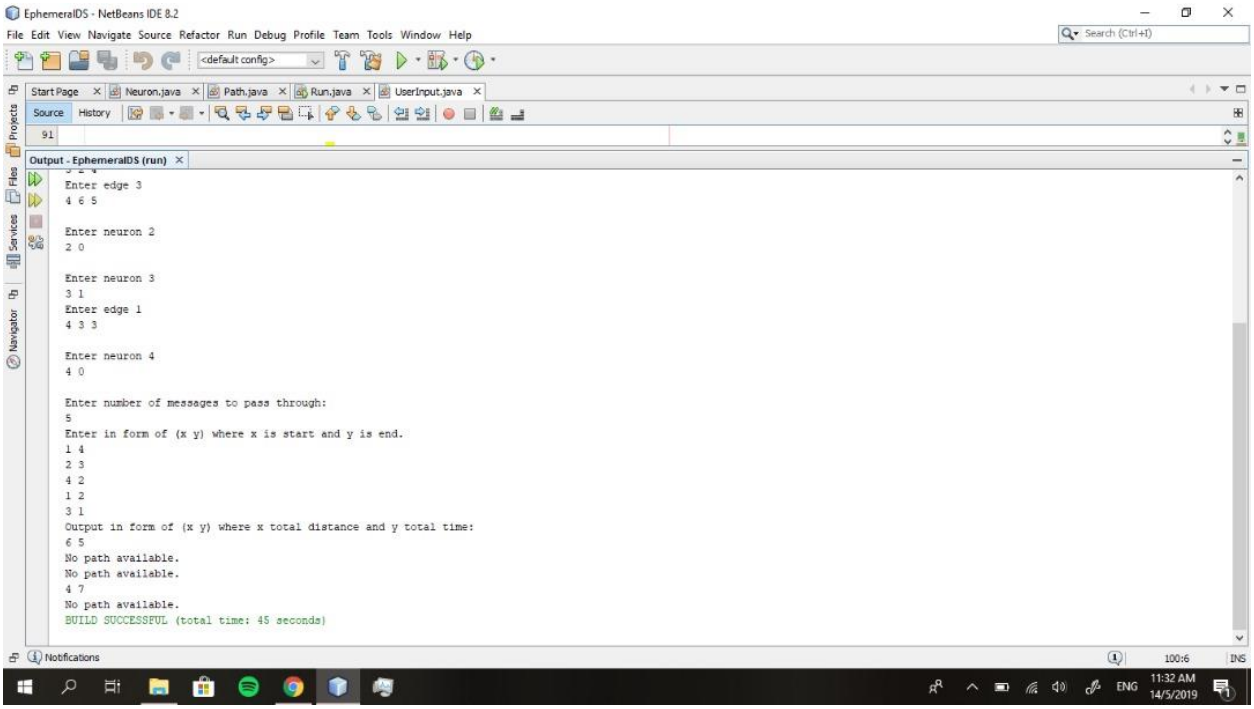
Detailed Description of Solution



Sample Snapshot

Unidirectional





Bidirectional with Optimization