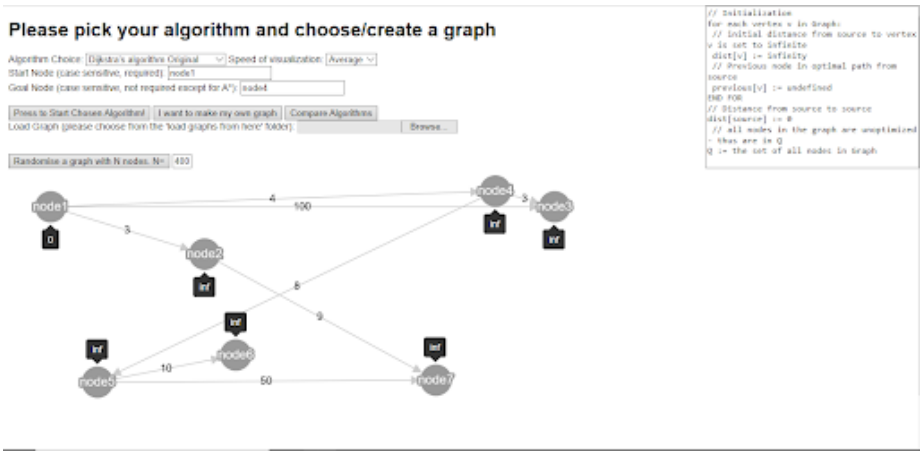
9 Instructions For Using the Software (User Guide)

9.1 Requirements:

- The code supplied (alternatively a copy is available at: https://github.kcl.ac.uk/k1631070/4thYearProj)
- No special or additional hardware or software is required for setting this up

9.2 How to Run:

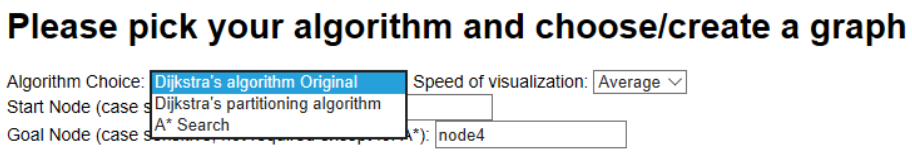
1. Find 'createGraph.html' in the source code folder
2. Open it in your favourite browser (this may be automatic via a double-click or you may need to right click and 'open with' the browser you desire)
3. Test it loaded correctly in the browser (e.g. Microsoft Edge and Firefox have been found to work well). It should look very similar to:



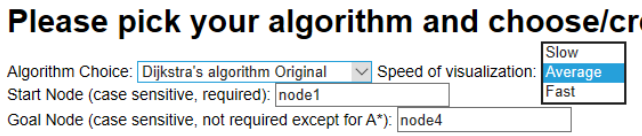
   If it does not, try a different browser.
4. Note that at any point you may zoom in or out on your screen using your chosen browser's zoom features. This may make graphs clearer to read or buttons easier to press for you if you find difficulties doing so normally due to sight or mouse issues. You may also drag nodes one at a time and the edges attached will follow if this is something you wish to do.

9.3 Running an algorithm:

1. Choose your algorithm (selecting from the drop down list):

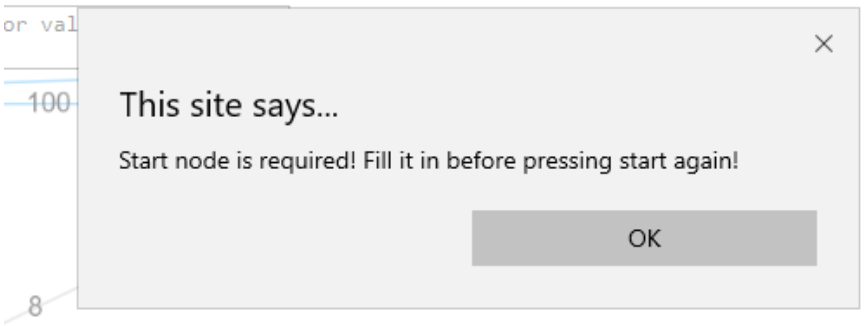


2. Choose the speed you desire from the drop down list (Slow means each highlight while the algorithm runs takes 1 second. Average means each highlight while the algorithm runs takes 500ms. Fast means each highlight while the algorithm runs takes 50ms.)

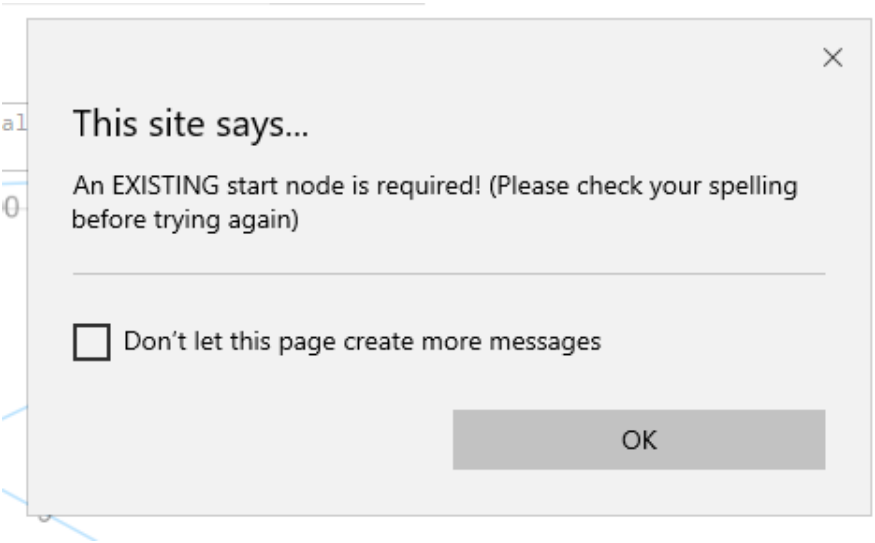


3. Input your chosen start node. An existing start node is required for all the algorithms. Warning and error messages may appear depending on what input you provide.

   If you do not enter a start node you will get an alert like this:



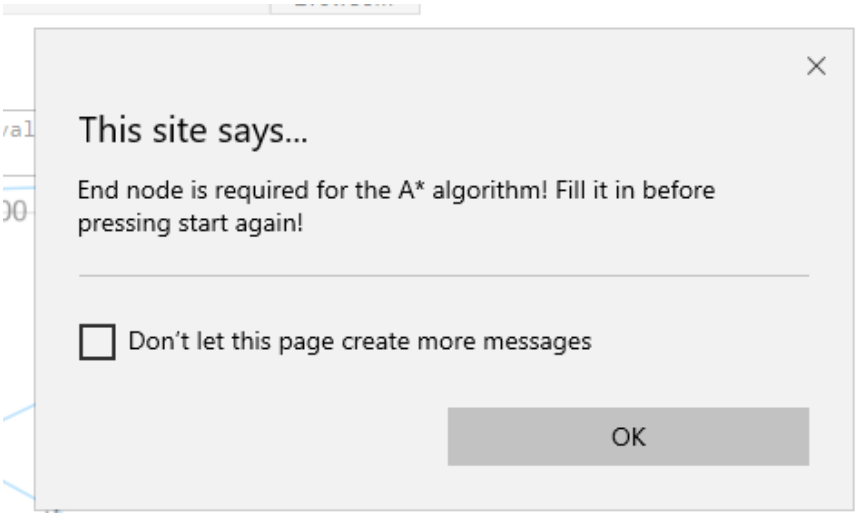
   If you enter a start node that is not part of the graph you will get an alert like this:



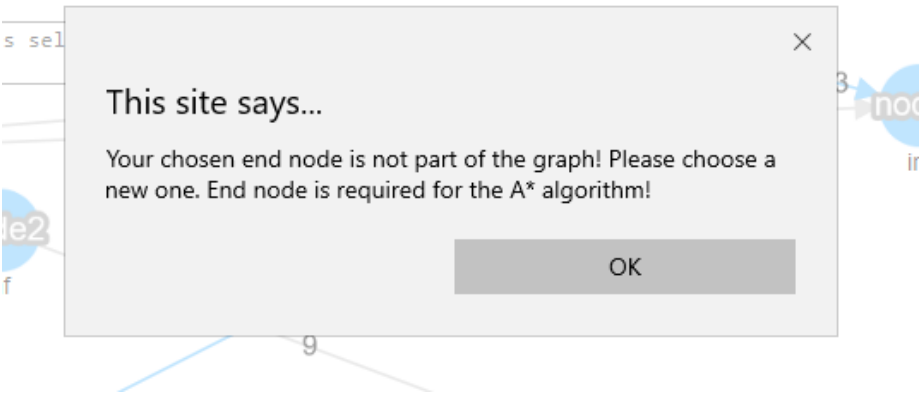
As no algorithm will run with missing or invalid start nodes, please ensure that if you get one of the above messages enter a valid node to start with before trying to start again.

4. Input your chosen end node if you desire one for the Dijkstra algorithms or if you select the A* algorithm. An existing end node is required for the A* algorithm but the other two do not require one. Warning and error messages may appear depending on what input you provide.

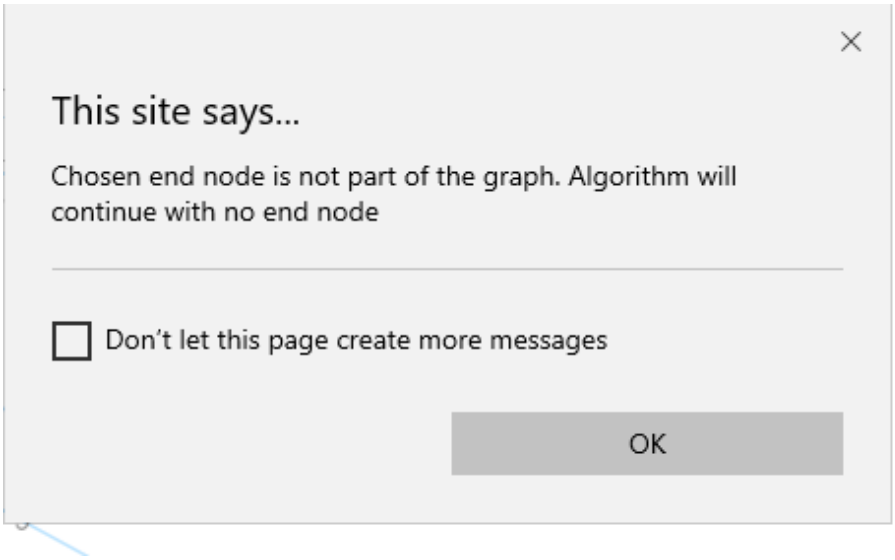
   If you fail to provide an end node despite choosing the A* algorithm you will get a message like this:



If you choose the A* search algorithm and an end node but the end node is invalid (does not exist in the graph) then you will get a message like this:



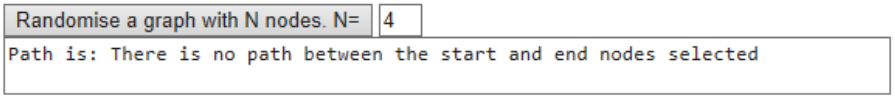
If you choose an algorithm that does not require an end node and do not supply one then the algorithm runs without a message. However, if you choose an algorithm that does not require an end node and do supply one but it is not valid then it will run after you get a message like this:



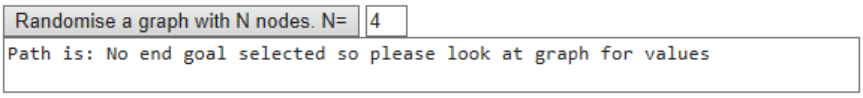
5. Press the start button to start the algorithm. Nodes and edges will glow blue as they are looked at. Edges will become unhighlighted once they no longer correspond to shortest paths to the node from the source. They will glow red if they are part of the final path. Final paths will also appear

written in a text box for maximum clarity. Edges will be grey and dashed for the modified Dijkstra's algorithm when the edge could have been a possibility but is ignored instead of being looked at because it does not have the corresponding edge flag.

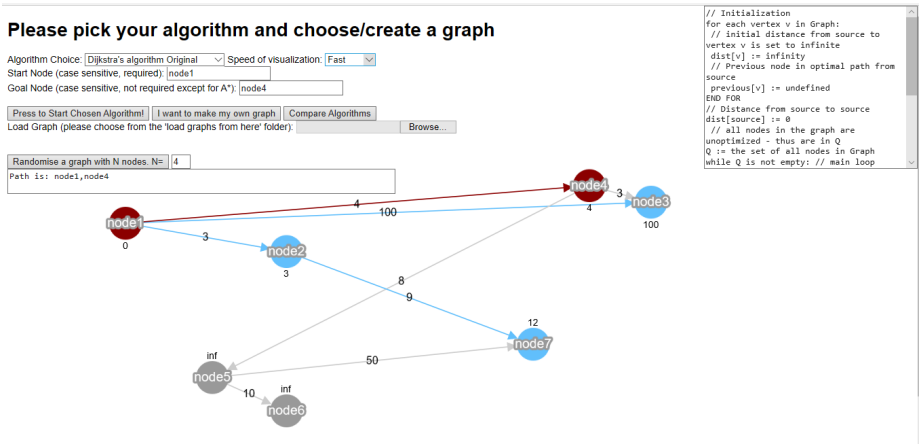
Where there is no path the text path will look like this:



If no end node was selected the text path will look like this:



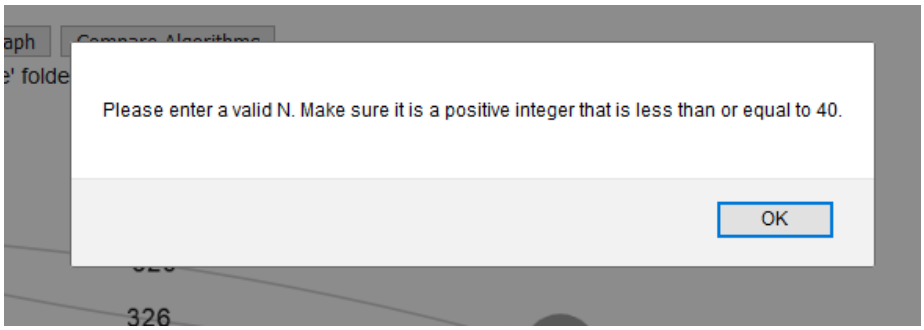
If a path existed the written path and graph will look like this:



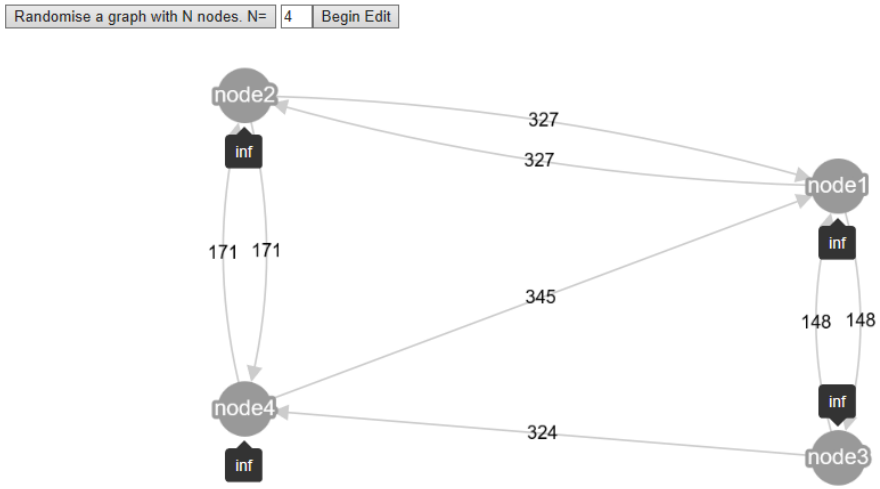
9.4 Creating, Editing, and Saving a Random Graph:

1. Choose how many nodes you want for your graph and input this as N. Then press the button to randomise. Here is an example for how to input for a graph with 4 nodes (the grey box is the button):

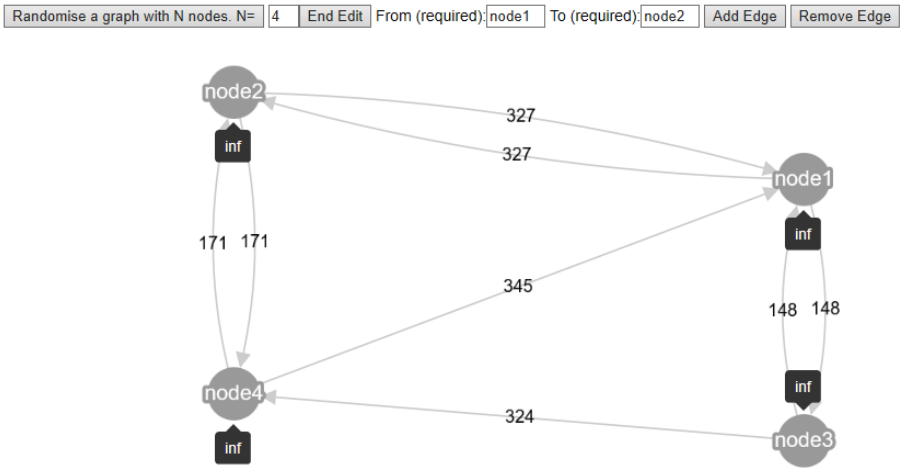
If you choose an invalid number, you will get a message like this:



2. After the button press a new graph should replace your old graph. Each node will have random edges coming from them (two edges from each node, as long as N was 3 or more). Weights are calculated and assigned by the software to ensure they don't break the heuristics for A* Search. A 'Begin Edit' button will appear. Press this to begin editing.

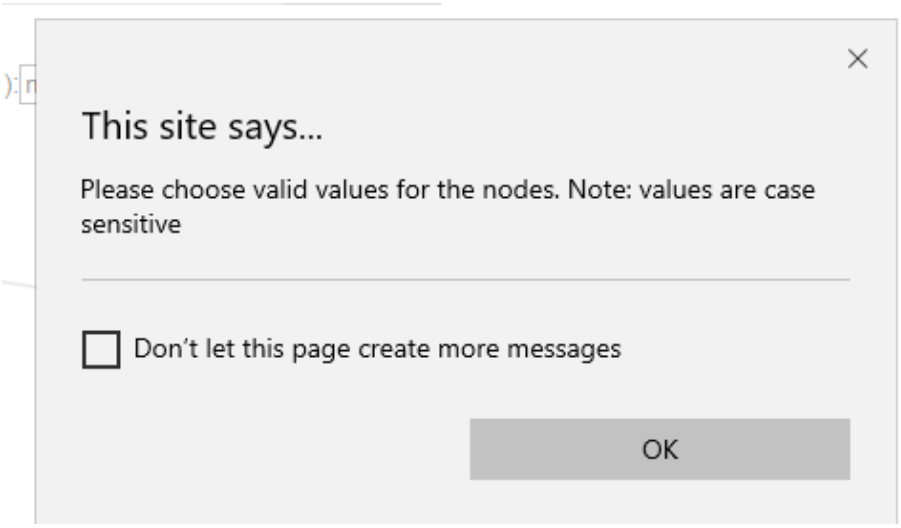


3. After you press begin edit you should these new buttons above your generated graph:

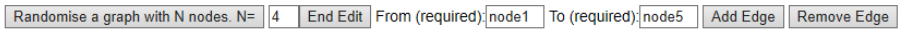


If you wish to add or remove an edge input the start and end nodes for the edge and press the corresponding button to the action you wish to take, 'Add Edge' to add an edge between those two nodes, or 'Remove Edge' if you wish to remove it.

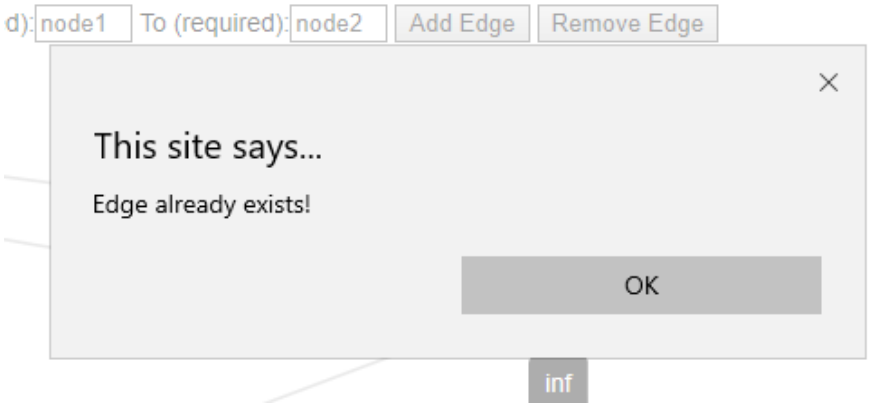
Invalid nodes will give a message like this:



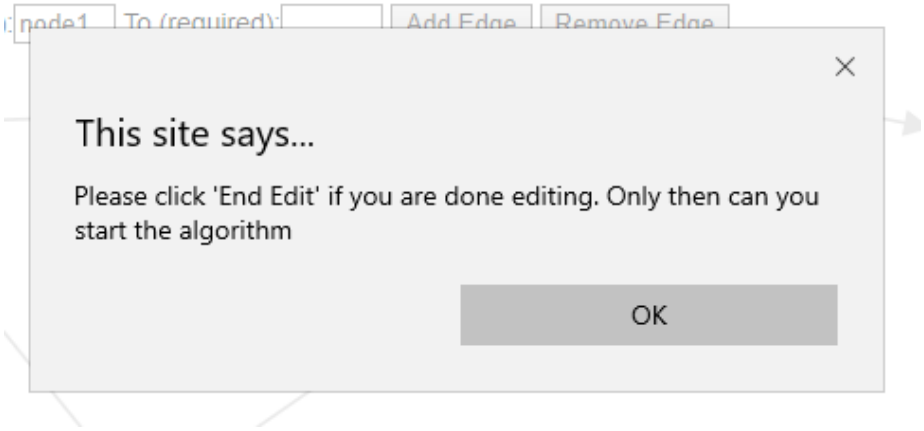
From inputs such as this:



If you try to add an already existing edge you will simply get a message like this:



4. Press 'End Edit' at any time to end the edit (no addition or removal of edges is necessary for the cases where you press 'Begin Edit' accidentally or change your mind). You cannot try to run the algorithm whilst editing so ensure to press 'End Edit' before running. If you forget to do so a message like this will appear:



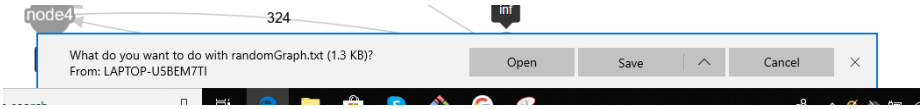
5. Once you have ended the editing you should be able to see:

If you still wish to add or remove more edges then you can press 'Begin Edit' again and follow steps 3 and 4 again. You may do this as many times as you wish but it is recommended to edit it all in as few times as possible to minimise the time it will take you and the software to create the graph.

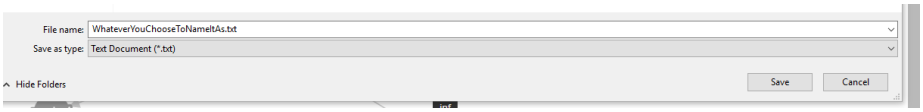
To save the graph after editing press the ‘Save Graph To File’ button.

You will get a message letting you know if the saving is happening.

The default name for this file will be ‘randomGraph.txt’ but you may choose to save as a different name when the saving options appear (will differ based on browser but will look similar to):

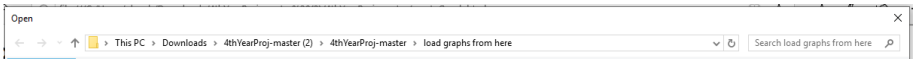


Here is an example of saving as a named graph:



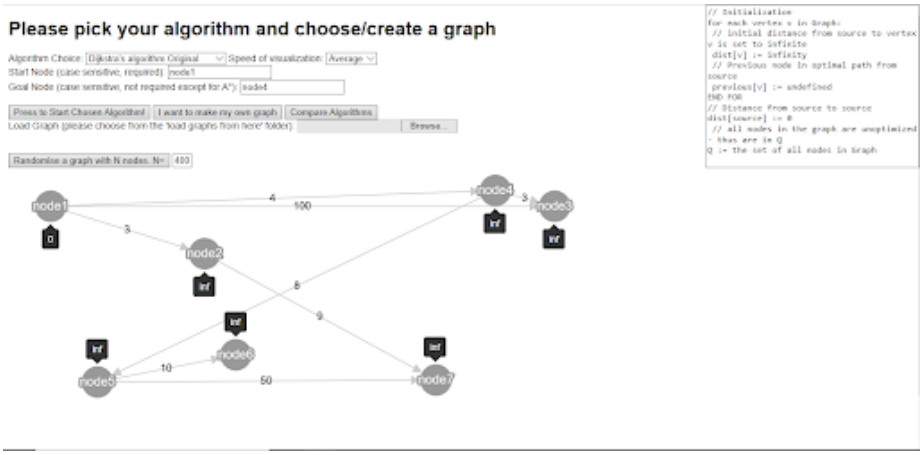
It is recommended that the folder saved in is the ‘load graphs from here’ folder supplied with the code for an easier time finding it to load at a later date but it is up to you where you save it.

If you downloaded the code from github the path may look like this:

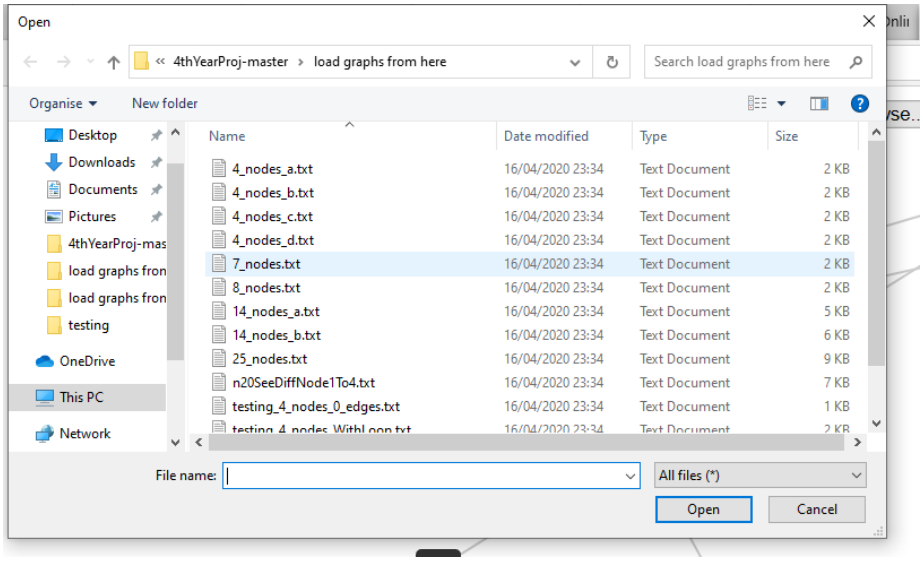


9.5 Loading a Graph from a File:

1. Find the Load Graph section on the page and press the browse button. This button may look a little different based on your browser but should remain in the same place on the page as shown here:



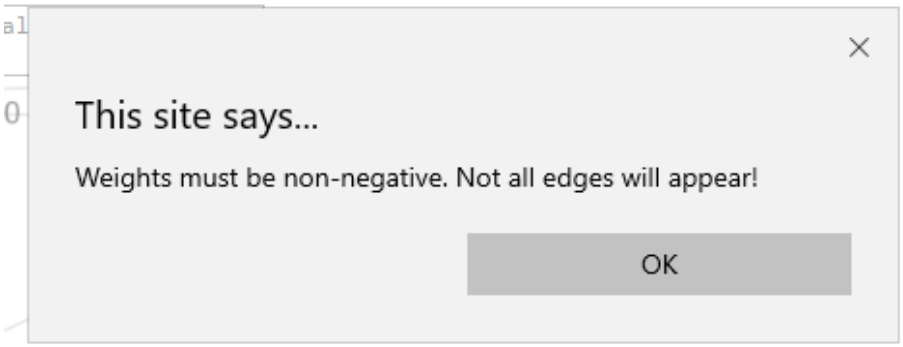
2. You should have a screen like this appear in front of the graph:



   Select the file with a graph you wish to load (you may need to find the folder it is saved in if that is not the folder that opens up) and press open.

3. Your desired graph should have loaded. Note: you should not have a negative weight for any edge. The algorithms do not work as expected with

negative edges and so require non-negative weights for all edges. If your chosen file had negative weights for any of the edges then they will not be counted or shown as part of the graph and you will get a message like this:



9.6 Creating a Graph in a text File:

1. Open a new file in your favourite text editor that allows files to have a '.txt' extension. Notepad works well for this.

2. Save this file in the folder of your choice ('load graphs from here' is recommended) with whatever name you desire and with the '.txt' extension

3. To create the graph the file should be similar to:

   "group": "nodes", "data": "id": "A", "name": "A" , "position": "x": 123.125, "y": 125 #

   "group": "nodes", "data": "id": "B", "name": "B" , "position": "x": 249.375, "y": 170 #

   More generally:

   "group": "nodes", "data": "id": "nodeIDHere", "name": "nodeNameHere" , "position": "x": x-position, "y": y-position #

   For the nodes. The ID should not contain the character '-' and numeric values for the ID without letters are not recommended. The x and y positions are used for the A* algorithm calculations as well as general visualisation for all the algorithms. If you are unsure what x and y values are appropriate for your computer screen, try generating a random graph, saving it, and seeing which x and y values are used there in the file you saved.

   And similar to:

"group": "edges", "data": "id": "AB", "name": "E1", "source": "A", "target": "B", "weight": 3 #

More generally:

"group": "edges", "data": "id": "sourceIDtargetID", "name": "edgeNameHere", "source": "sourceNodeIDGoesHere", "target": "endNodeIDGoesHere", "weight": weight-value #

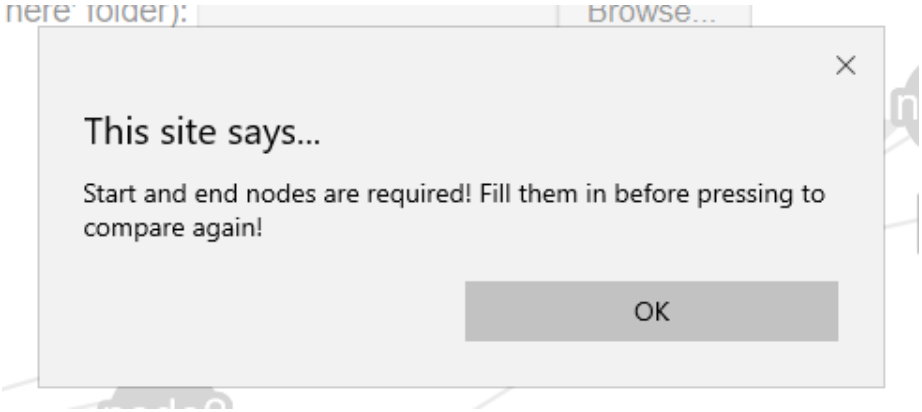
For the edges. The ID must be the source node ID followed by the target node ID. Ensure weight value is not in quotes and non-negative. Source and target values should be existing node IDs that you have previously written in the file.

For the file: all lines other than the last one should end with '#'.

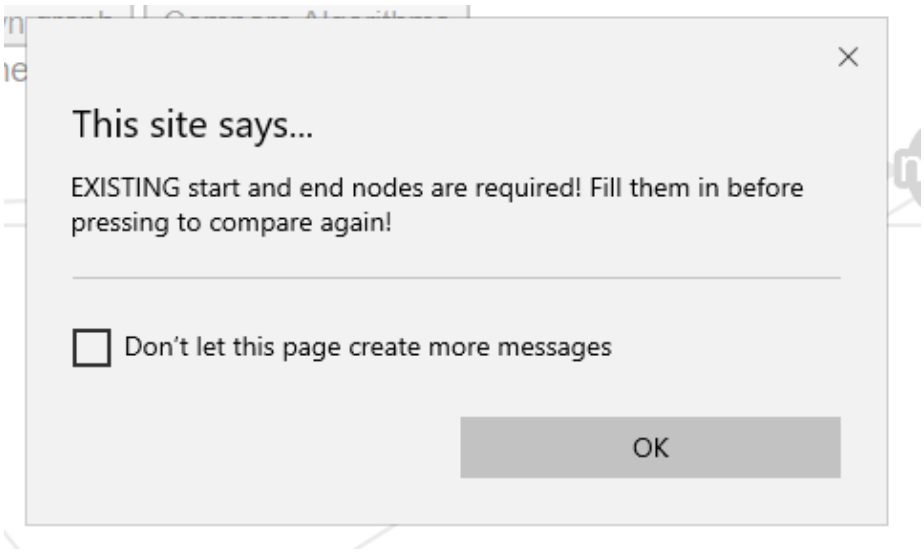
4. Save the completed file
5. Follow instructions from the loading section to see your created graph

9.7 Comparing Algorithms:

1. Input start and end nodes. If either node is empty an error message like the following will appear:



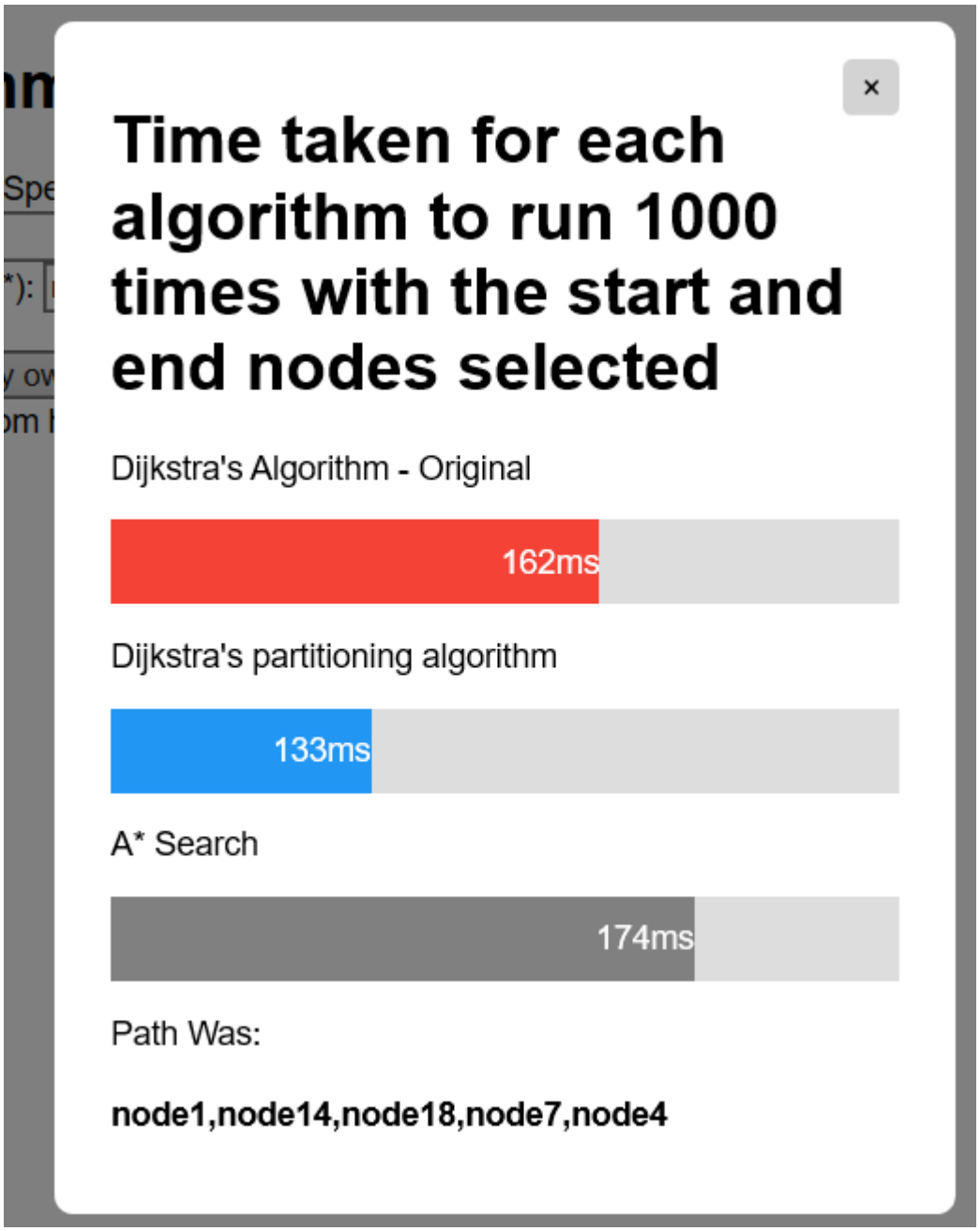
If neither node is empty but one or both are invalid then an error message like the following will appear:



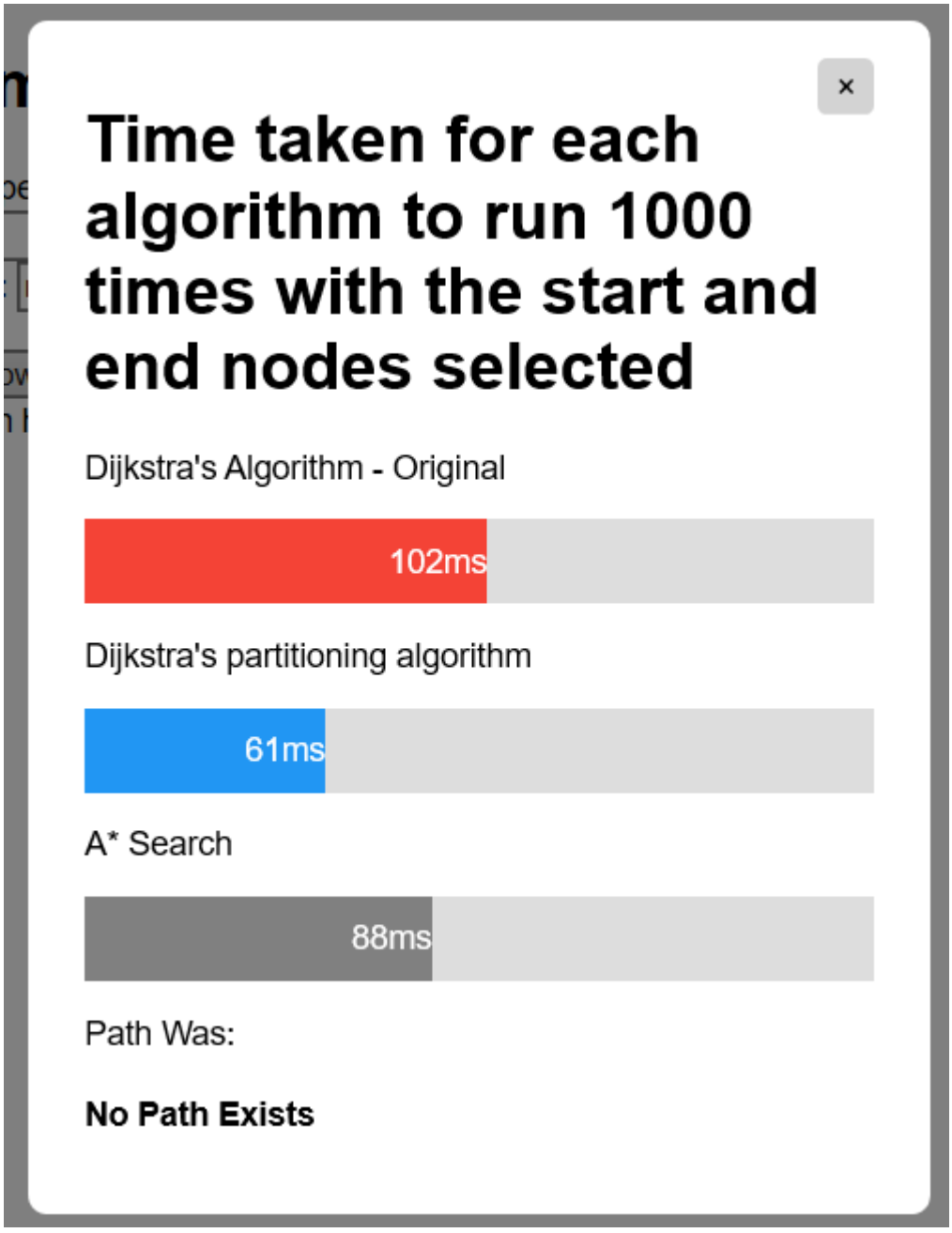
The start and end nodes must exist and be valid before you can continue.

2. Click 'Compare Algorithms'

   You should see something similar to:



Time values will differ based on the graph. Different algorithms will do better based on the graph and the nodes chosen. Not all nodes will have paths between them in which case it will look like this:


Time taken for each algorithm to run 1000 times with the start and end nodes selected
Dijkstra's Algorithm - Original
102ms
Dijkstra's partitioning algorithm
61ms
A* Search
88ms
Path Was:
No Path Exists