

**Assignment 1:** Due Monday 9th August at 5pm

Late assignments will not be accepted except by prior arrangement (for a good reason)

**Please include your student number in your handed up work, as Canvas doesn't give this to me automatically.**

1. Write code to read in a *directed* graph specified as an edge list in TGF (Trivial Graph Format) and output its adjacency matrix.
  - (a) Your code should read a file in TGF, *i.e.*, a list of edges (in our cases in CSV form).
  - (b) To test your code, I have created a set of graph files in the form of `a1010101_graph_A1.tgf`, which you can find at [https://roughan.info/notes/Network\\_Modelling/10data.html](https://roughan.info/notes/Network_Modelling/10data.html)  
You should find the data set corresponding to *your* student number, and compute the adjacency matrix for this data set.
  - (c) Note that there are 6 nodes in the network, labelled 1-6. The file will omit a node if there are no edges to that node, but your code must understand the implicit node.
  - (d) The main thing I will mark will be the resulting adjacency matrix, but please include your code in the material you hand in.

[3 marks]

2. For a clique (a fully-connected) undirected network with  $|N|$  nodes the number of links is  $|N|(|N| - 1)/2$ . Determine the number of loop-free (acyclic) paths  $|P|$  and calculate an asymptotic expression for this for large networks.

Hint: note that *paths are directed*, even if the underlying network is undirected.

[4 marks]

3. Explain why the computational cost for removing an edge from a directed graph representation is:
  - $O(|E|)$  for an edge list
  - $O(1)$  for an adjacency matrix
  - $O(|N|)$  for a neighbourhood list

Make sure to account for the cost of accessing memory, presuming the most direct data structure is used for each (e.g., a list is stored as a list).

[3 marks]