QQI

MSc AI

SUMMER 2021 EXAMINATIONS

Module Code: **B9AI101_2021_TMD2**

Module Description: **Graph & AI**

Examiner: **Terri Hoare**

Internal Moderator: **Shahram Azizi Sazi**

Date: 4th May 2021
Time: 09:30-11:30

INSTRUCTIONS TO CANDIDATES

Time allowed is 2 hours
Answer ALL Questions

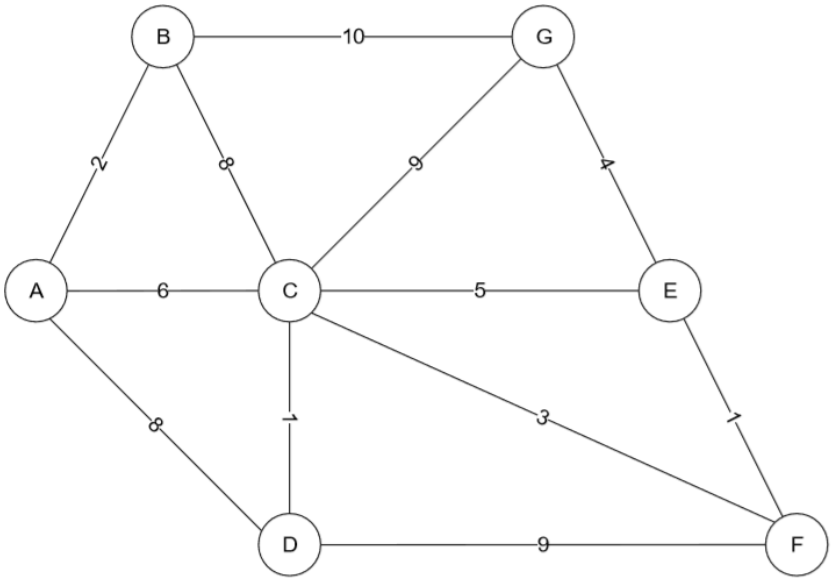
All answers should reference literature and case studies as appropriate. Use of scientific calculators is permitted.

Question 1 **(25 Marks)**

a) The question of whether a computer can think is no more interesting than the question of whether a submarine can swim. — Edsger W. Dijkstra.

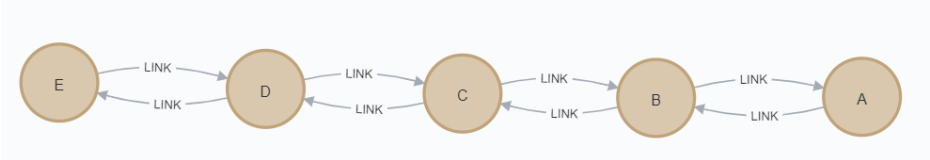
Specify and Use Dijkstra's Shortest Path algorithm to find the shortest path between the nodes A and F in the network below.

Show all working.



[15]

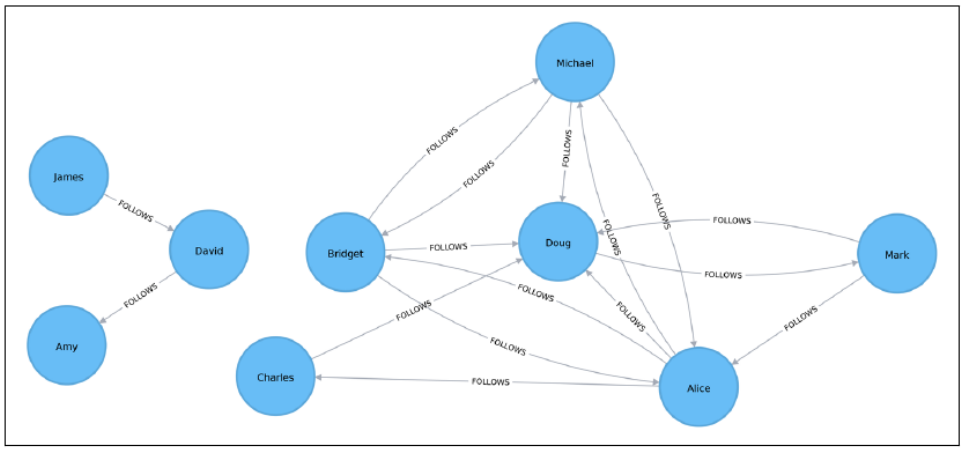
b) Calculate the closeness centrality measure for the five nodes in the graph below. Specify the formula you are using and show all working.

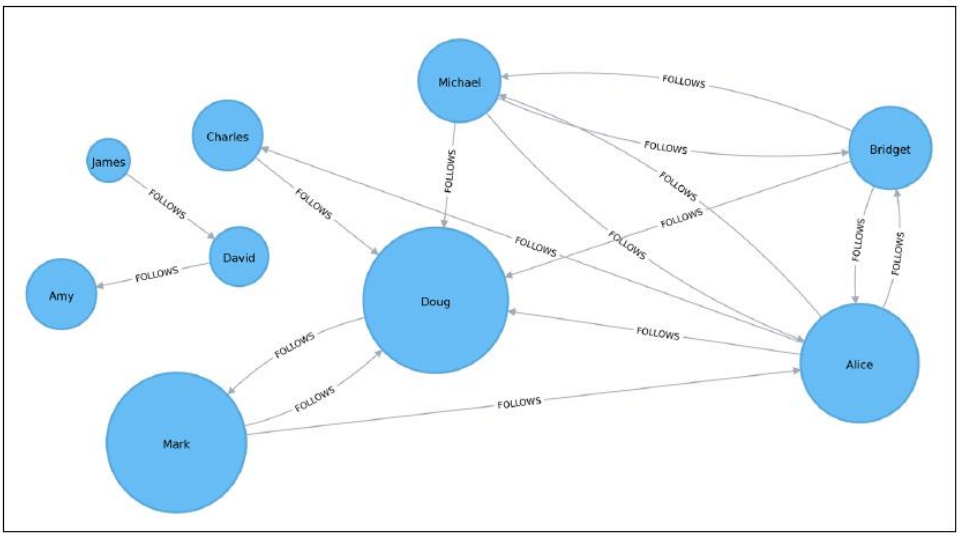


[10]

Question 2 **(25 Marks)**

a) A sample Twitter Social Graph is shown in the first figure below. Identify the graph algorithm applied to the Graph listing the evidence supporting your conclusion.





[4]

b) Identify three other use cases for the algorithm.

[6]

c) Degree centrality can be used to categorise network types. Identify the three network types below giving the reasons for your categorisation and the properties of the network.

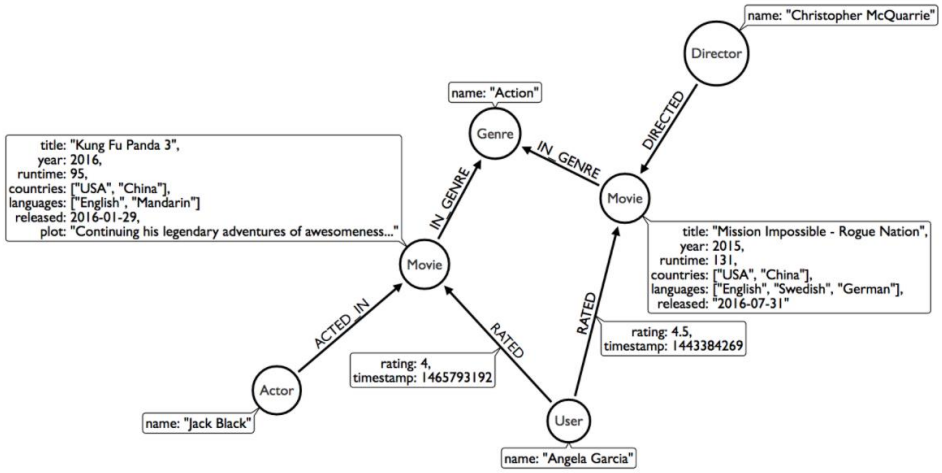
[15]

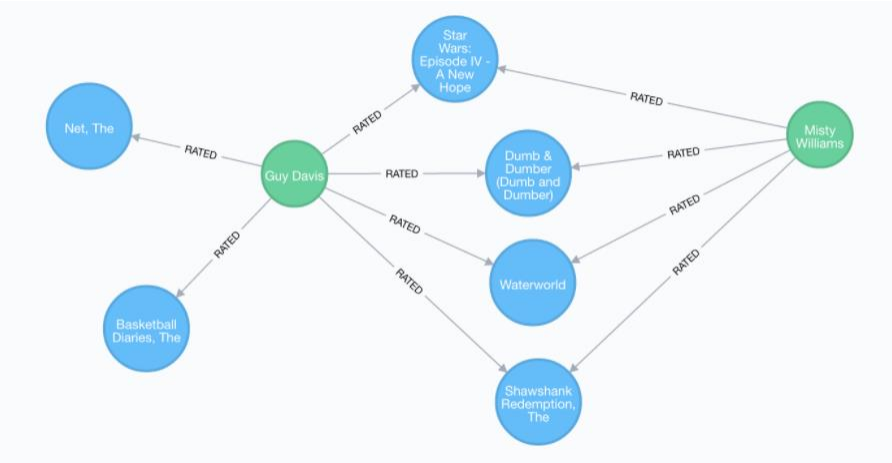
Question 3 **(25 Marks)**

a) The Movielens dataset of movies and ratings has been loaded into the property graph database Neo4j. The data model and a sample of data are shown below.

Use the preferences, ratings and actions of other users in the network to find items to recommend. Specify the **Cypher** pattern matching instructions to make recommendations.

"Users who bought this thing, also bought that other thing."





[10]

b) Compare and contrast the **Label Propagation** and **Louvain** graph algorithms used for **Community** detection.

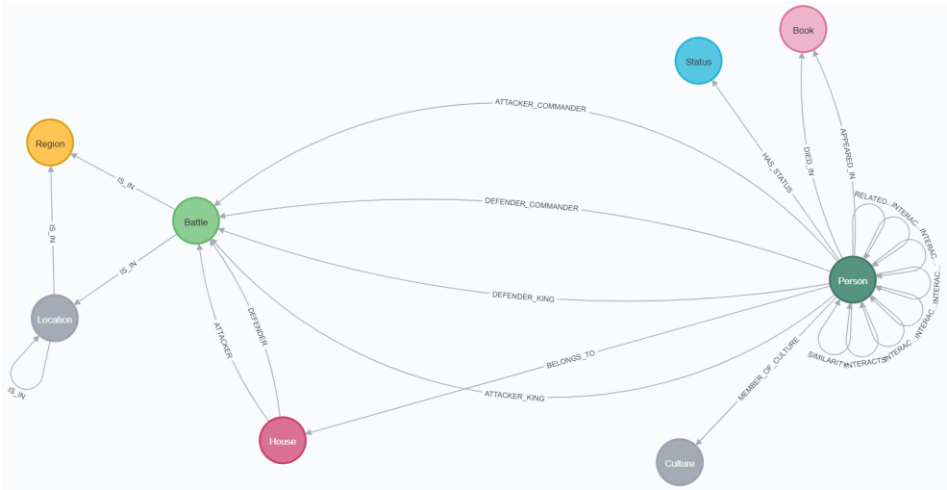
[15]

Question 4 **(25 Marks)**

a) The data model below is based on the research of Dr Andrew Beveridge as applied to the Game of Thrones series. The Person nodes represent characters in the books and the INTERACTS relationships represent characters' interactions. An interaction occurs each time two characters' names (or nicknames) **appear within 15 words of one another** in the book text.

The (:Person)-[:INTERACTS]→(:Person) graph is enriched with data on houses, battles, commanders, kings, knights, regions, locations, and deaths.

Recommend how graph algorithms can be applied to gain insight into interactions, themes, and importance of characters in the books.



END OF EXAMINATION