Assignment 1

Please make sure that you always use notations consistent with lecture notes. Different notations will not be accepted.

The deadline for assignment 2 is: Fri 24, June 5:00 pm (Sydney Time)

Question 1 (12 marks)

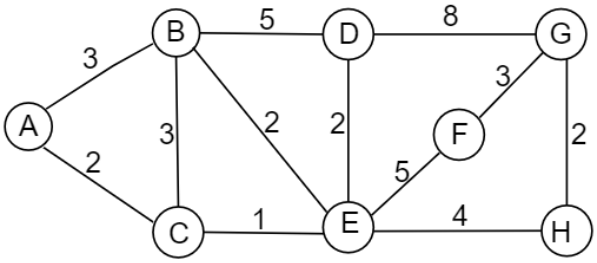

Figure 1

1) Please determine whether the following statements for Figure 1 are TRUE or FALSE (4 marks)

   a) A-B-C-D-E-F-G-H is a BFS traversal

   b) B-A-C-E-D-G-H-F is a BFS traversal

   c) B-A-C-E-D-G-H-F is a DFS traversal

   d) E-C-B-D-F-H-A-G is a DFS traversal

2) Please use Prim's algorithm or Kruskal's algorithm to generate the minimum spanning tree and sequentially show each intermediate tree with each new added vertex. (4 marks)

3) Please use Dijkstra's algorithm to find the shortest distance from D in Figure 1 to every other vertex and sequentially show each step of the distance table as following. For details of the table format, please refer to the lecture note. (4 marks)

Vertex	Visited	Distance	Previous
A	F	∞	Ø
B	F	∞	Ø
C	F	∞	Ø
...	...	...	...

Question 2 (18 marks)

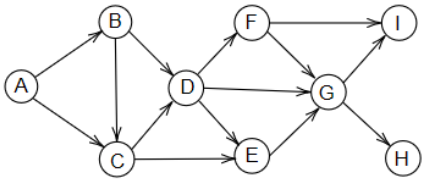

Figure 2: Example graph

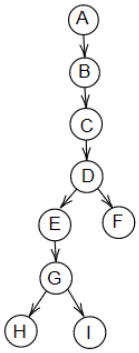

Figure 3: An optimal tree cover

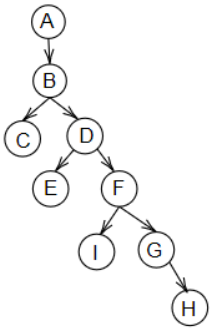

Figure 4: A random spanning tree

Given reachability queries: (A, F), (C, G), (E, F):
For each question, please show intermediate steps and justify your answer.
Assumption: For two intervals $[i_1, j_1]$ and $[i_2, j_2]$, only when $i_1 < i_2$ and $j_1 > j_2$, these two intervals are combined into one interval $[i_1, j_1]$.

1) Construct the **transitive closure** of this graph and use it to answer the above reachability queries. (4 marks)

2) The **optimal tree cover** is shown above. Based on the post-order traversal numbers of each node, add the necessary intervals if needed. Report the number of intervals in the resulting compression scheme. Use the tree cover to answer the above reachability queries. (5 marks)

3) A **random spanning tree** is shown above. Based on the post-order traversal numbers of each node, add the necessary intervals if needed. Report the number of intervals in the resulting compression scheme. Use the tree cover to answer the above reachability queries. (4 marks)

4) Based on the above questions, explain the difference between the above two tree covers. (1 marks)

5) Compute the **2-hop cover** of figure 2. And based on the computed 2-hop cover, answer the above reachability queries. (4 marks)

Assignment Submission

- Students must submit an electronic copy of their answers to the above questions to the course website in Moodle.
- Only **.doc** or **.pdf** file is accepted. The file name should be ass1_**studentID**.doc or ass1_**studentID**.pdf (e.g., **ass1_z5100000.doc** or **ass1_z5100000.pdf**).

Note:

1. For any problems in submissions, please email to comp9312unsw@gmail.com
2. All submissions will be checked for plagiarism.
3. We do not accept e-mail submissions.

Warning: Before submission, please keep a copy in your university account or other reliable cloud servers (such as dropbox or google drive). If you are not sure how, please have a look at taggi. Usually, the submission should be successful. In case it fails, we do **not** accept backups from your own computers as the modification time can be edited.

The university regards plagiarism as a form of academic misconduct and has very strict rules regarding plagiarism. For UNSW policies, penalties, and information to help avoid plagiarism, please see: https://student.unsw.edu.au/plagiarism as well as the guidelines in the online ELISE tutorials for all new UNSW students: https://subjectguides.library.unsw.edu.au/elise

Late Submission Penalty

- 5% of your final mark will be deducted for each additional day (24hr) after the specified submission time and date.
- Submissions that are more than five days late will not be marked.