COMP5048 - Main Exam 2022 Semester 1

EXAM WRITING TIME: 2 hours

INSTRUCTIONS TO STUDENTS:

There are 9 questions in total.

Questions 1-7: You are allowed to type words and/or upload images to answer the questions.
Questions 8-9: You are allowed to type words and/or formulas to answer the questions.

Note that for each question, there is a maximum cap of 200 words.
Submit the PDF file generated by exporting the word document for the exam.

Question 1 (5 marks)

1. Explain the hv-tree drawing method with $O(n)$ drawing area (n is the number of vertices in the tree) and constant aspect ratio.

2. Construct a drawing of the tree below using the method and analyse the width W and height H of the drawing. Show your working process and explain how you compute your answer.
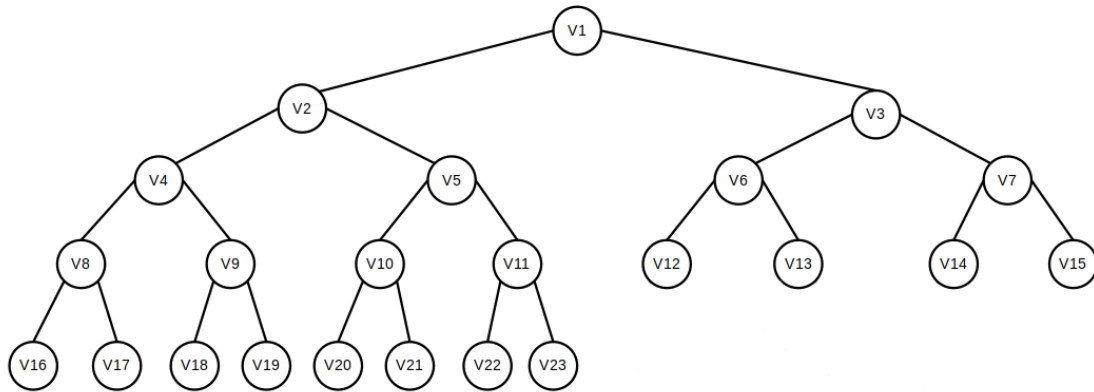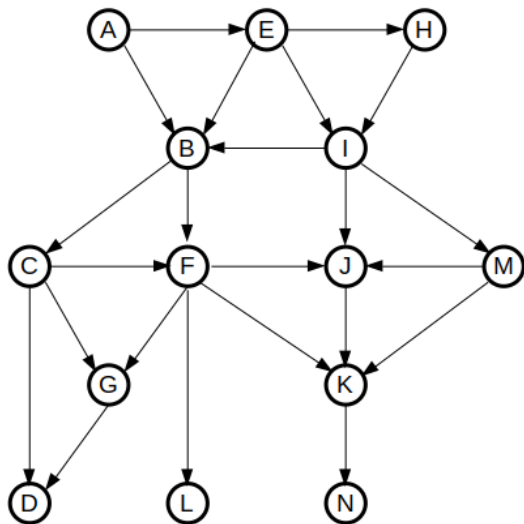

Question 2 (5 marks)

Given the coordinates of the vertices (V_1 to V_6), compute the (x,y)-coordinates of the vertices (V_7 to V_{10}) using Tutte's Barycenter algorithm.
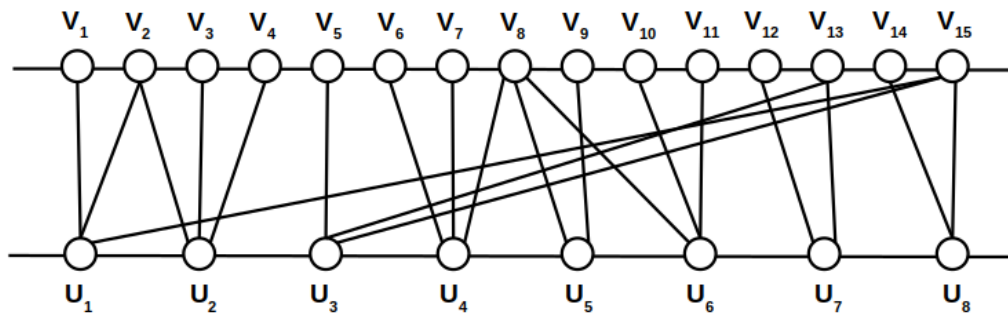Show your working process and explain how you compute your answer.

2
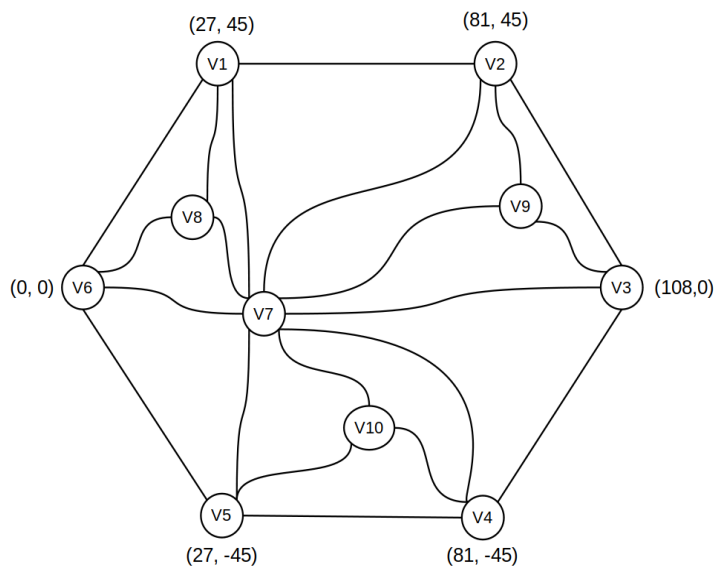
Question 3 (5 marks)

Compute a layering of the following graph using the Coffman-Graham algorithm. Show your working process and explain how you compute your answer:

1. Compute a labelling for each vertex.
2. Compute a layering with width 3 and draw the resulting layering.

Question 4 (5 marks)

For the graph below with a fixed top layer (vertices V_1 to V_{15}) and a free bottom layer (vertices U_1 to U_8):

1. Compute the vertex ordering of the free layer using the Barycenter algorithm. Show your working process and explain how you compute your answer.

2. Compute the vertex ordering of the free layer using the Median algorithm. Show your working process and explain how you compute your answer.

3. Compare the quality and runtime of the two methods.

3

Question 5 (3 marks)
Select good visualisation methods for the following data and explain the methods.

List of scores of students at a school:
Frank: {Math: 80, English: 80, Chemistry: 85, Physics: 85, Economics: 80}
Greg: {Math: 50, English: 55, Chemistry: 60, Physics: 60, Economics: 60}
Hannah: {Math: 75, English: 80, Chemistry: 80, Physics: 80, Economics: 75}
Ian: {Math: 55, English: 50, Chemistry: 55, Physics: 55, Economics: 60}
Julie: {Math: 50, English: 55, Chemistry: 55, Physics: 50, Economics: 60}
Kenneth: {Math: 70, English: 75, Chemistry: 80, Physics: 70, Economics: 80}

Question 6 (4 marks)
1. Select two different methods to visualise the following data and explain the methods, including the pros and cons.

   V: entities and E: relationships
   January: V1 = {A, B, C, D}, E1 = {(A,B), (A,C), (A,D)}
   February: V2 = {A, B, C, D, E, F}, E2 = {(A,B), (A,C), (A,D),(B,C),(C,E),(C,F)}
   March: V3 = {A, B, C, D, F}, E3 = {(A,B), (A,C),(B,C),(B,D),(C,D),(C,F)}
   April: V4 = {A, B, C, D, F, G}, E3 = {(A,B), (A,C),(B,C),(B,D),(B,G),(C,D),(C,F),(F,G)}
   May: V4 = {A, B, C, D, G}, E3 = {(A,B), (A,C),(A,G),(B,C),(B,D),(B,G),(C,D)}

2. Write down the criteria for evaluating those methods.

Question 7 (6 marks)

1. Select a method to visualise the following data and describe the method:

    Oscar, Penny, Quinn, and Robert are friends.
    Penny, Steve, Tina, and Uma are friends.
    Tina, Vince and Wanda are friends.
    Nancy, Maria, Lucy, and Oscar are friends.
    Nancy is also friends with Wanda.

2. Analyse the pros and cons of the method, including the running time.

3. Describe how to modify the method to show the groups/clusters as well:

    Class A: Oscar, Quinn, and Robert
    Class B: Penny, Steve, and Uma
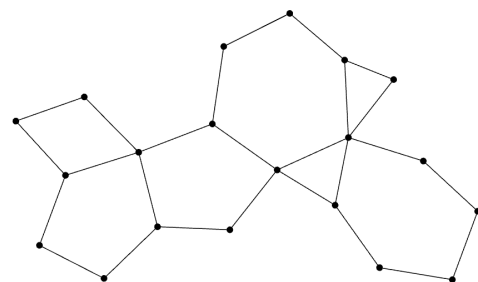   Class C: Tina, Vince, and Wanda
    Class D: Nancy, Maria, Lucy

4. Discuss a method to improve the running time, i.e., faster method.

Question 8 (3 marks)

Evaluate and compare the following two different drawings of the same graph.
Which drawing is better? Justify your answer.
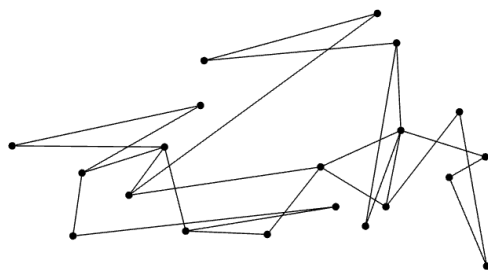
(a)   (b)

Question 9 (4 marks)

DBLP computer science bibliography (https://dblp.org/) provides information on major computer science journals and proceedings. For example, it contains data entries with multiple attributes: Paper Title, Authors, Journal/Conference/Book, Publisher, Year as follows:

Paper Title	Authors	Journal/Conference/Book	Publisher	Year
Interactive Dimensionality Reduction for Comparative Analysis	Takanori Fujiwara, Xinhai Wei, Jian Zhao, Kwan-Liu Ma	IEEE Transactions on Visualization and Computer Graphics	IEEE	2022

Design a Visual Analytic approach for the DBLP data, namely:
1. Define tasks that you want to support.
2. Design analysis methods.
3. Design visualisation methods.
4. Evaluate your approach including the Pros and Cons.