UNIVERSITY OF MORATUWA

Faculty of Engineering

Department of Computer Science

B.Sc. Engineering

Semester 3 (18 Batch) Final Assessment

CS 2150 Graph Theory for Computings

Time allowed: 1 hour 15th August, 2021

INSTRUCTIONS

- This is an online assessment.
- This assessment contains 2 questions on 3 pages.
- Answer **ALL** questions and show all your work.
- This assessment accounts for 35% of the module assessment.
- You must show the work to get the full marks. Else, only 25% of the allocated marks will be given.
- Please write down your answers in the papers, take clear images and upload them in the Moodle orderly only in jpg, png or pdf format
- Start a new problem in a new page and number the pages.
- The total maximum mark attainable is 50. The marks assigned for each question are indicated in square brackets.
- Assume reasonable values for any data not given in or with the assessment. Clearly state such assumptions made on the script.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.
- An hour is assigned to answer the questions and an additional 15 min is given to upload the answer script in the Moodle

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QUESTION 01

(a) A graph G has following adjacency matrix where the first entry of the first row is 0 and last 4 entries are the last 4 digits of your index number.

$$A = \begin{pmatrix} 0 & & & & \\ 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 & 1 \\ 2 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 \end{pmatrix}$$

i. Is G a simple graph. Give reasons. **[3 marks]**

ii. What is the degree sequence of G. **[3 marks]**

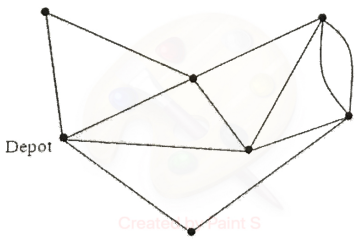
iii. How many edges does G have? **[3 marks]**

iv. How many edges does G have? **[3 marks]**

v. With suitable choice of labelling, write down the incidence matrix of the graph G. **[3 marks]**

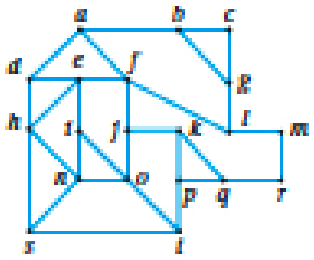
(b) The graph in figure 1 represent roads linking village in a country area. These roads are to be kept free from ice during winter. Is it possible for a truck spreading salt to travel along each road exactly once staring and finishing the depot? If so determine a suitable route.[Use suitable choice of labelling.] **[5 marks]**

Figure 1



(c) Determine whether or not the following graph contains Hamiltonian cycle. If there is a Hamiltonian cycle, exhibit it; otherwise, give an argument that shows there is no Hamiltonian cycle. **[5 marks]**

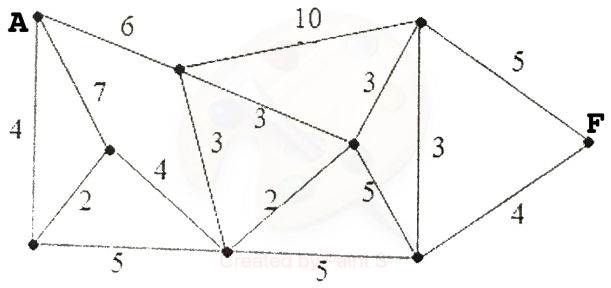
Figure 2



QUESTION 02

(a) Using Prim's or Kruskal's algorithm find a minimum spanning tree for the network given below. **[8 marks]**

Figure 3



(b) i. Apply Dijkstra's algorithm and calculate the shortest path from A to F in the graph in Figure 3. **[5 marks]**

ii. Obtain the shortest paths from A to all the other vertices. [Use suitable choice of labelling.] **[7 marks]**

(c) Show that the property "Has an edge (v, w), where $\delta(v) = i$ and $\delta(w) = j$ is an invariant. **[5 marks]**

– End of the Assessment –