United International **University** (**UIU**)

Dept. of Computer Science and Engineering (CSE)

Final Assessment Year: **2022** Semester: **Summer**

Course: **CSE 2213/CSI 219** Title: **Discrete Mathematics** Section: **(A-L)**

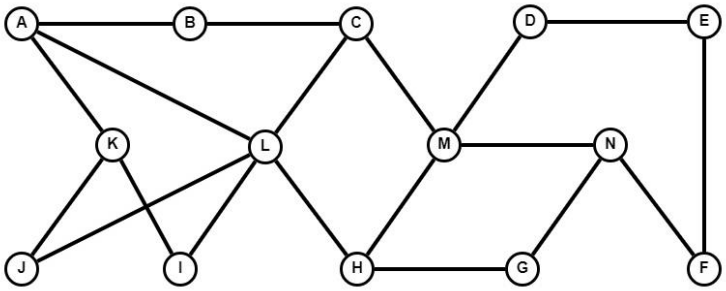
Marks: **40** Time: **2 Hours**

[Any examinee found adopting unfair means will be expelled from the trimester/program as per UIU disciplinary rules.]

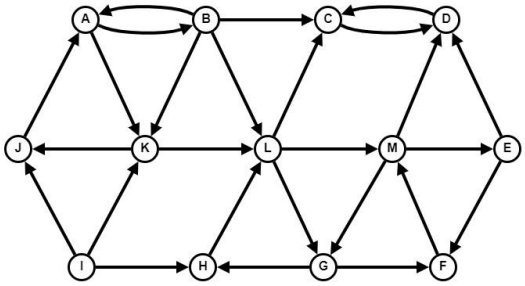
There are **5 (Five)** questions. Answer **all 5 (Five)** questions. All questions are of values indicated on the right-hand margin.

Q1. a. A complete graph K_n and a wheel graph $W_{(n-1)}$ has the same number of vertices n. What is the value of n? **[2]**

Q1. b. Using two-coloring algorithm, find out whether the following graph is bipartite or not. If bipartite, show the graph in bipartite form. **[4]**



Q1. c. Find out the strongly connected components of the following graph. **[3]**



Q2. a. How many strings (considering only lowercase alphabets) are there of length five or less that begin and end with the alphabet "a"? (Do not consider empty string). **[3]**

Q2. b. Suppose that a software company has 7 front-end developers and 9 back-end developers. A standard team is formed by having at least one front-end developer and at least one back-end developer. How many ways are there to form a standard team of seven members so that it must have more front-end developers than back-end developers? **[3]**

Q2. c. In a game of UNO, there are cards of 4 colors- red, green, blue and yellow. There are 25 cards for each color (there are some special cards, but we will not be considering them now). A player is dealt 7 cards in a round. Now using the pigeonhole or generic pigeonhole principle do the followings: **[1+2]**

i. Explain why there is no guarantee that a player will get at least 2 blue cards.

ii. Minimum how many cards should be picked to ensure that he gets at least 3 cards of the same color?

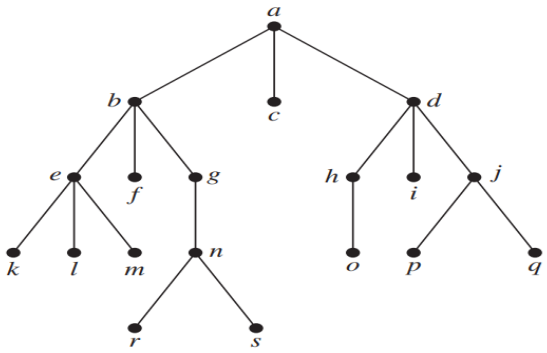
Q3. Use mathematical induction to prove the following summation formula for all positive integer values of n. **[5]**

$$\frac{1}{2\,X\,5}+\frac{1}{5\,X\,8}+\frac{1}{8\,X\,11}+\cdots\cdots+\frac{1}{(3n\,-1)\,(3n\,+\,2)}=\frac{n}{6n\,+\,4}$$

Q4. a. Form a binary search tree for the word's mathematics, physics, geography, radiology, technology, meteorology, geology, criminology, psychology, neurology, chemistry, and terminate (using alphabetical order). **[2]**

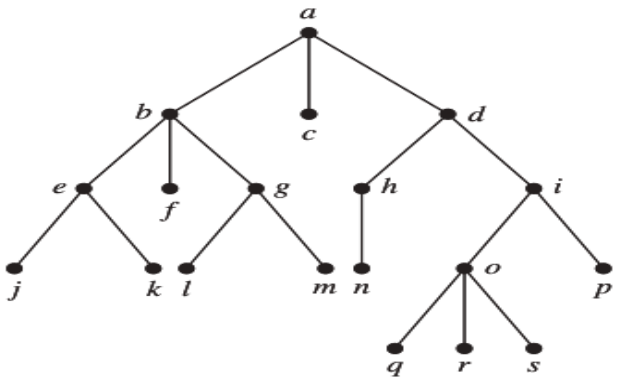
Q4. b. Is the tree you constructed in Q4. (a) balanced tree? Explain with proper justification. What is the maximum limit of the number of leaves in this tree? **[1+1]**

Q4. c. Traverse the following tree using post-order technique. You must show all the steps in the process. **[2.5]**



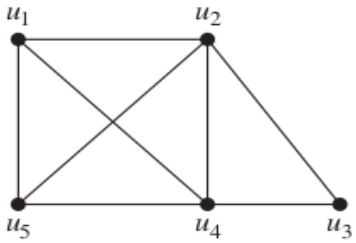
Q4. d. Represent the expression $x + ((x*y + x)/y)$ using binary tree. Write the expression in prefix notation. Evaluate the prefix expression that you created using values of $x = 4$, and $y = 3$. **[1+1 +0.5]**

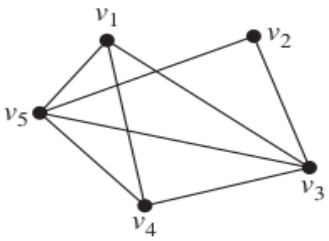
Q5. a. Is the rooted tree in the figure a full *m-ary* tree for some positive integer *m*? If yes, what is the possible value of *m*? If not, how can you make it a full *m-ary* tree? **[1+2]**



Q5. b. A full *m-ary* tree has 136 vertices. Among them, 109 are leaves. Calculate the values of *m*, and the number of edges in the tree. **[2]**

Q5. c. Find the degree sequences of both the graphs. Determine whether the given pair of graphs is isomorphic. **[3]**





Good Luck