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)

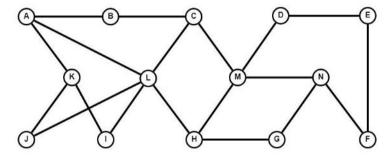
Marks: 40 Time: 2 Hours

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

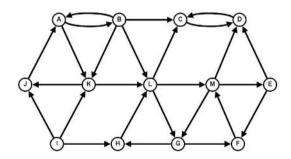
There are **5 (Five)** questions. Answer <u>all **5 (Five)**</u> questions. All questions are of values indicated on the right-hand margin.

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?

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



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).

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?

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:

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?

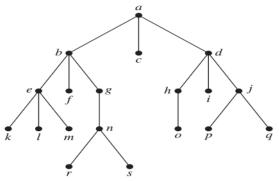
Q3. Use mathematical induction to prove the following summation formula for all positive integer values of n. [5]

$$\frac{1}{2 \times 5} + \frac{1}{5 \times 8} + \frac{1}{8 \times 11} + \dots + \frac{1}{(3n-1)(3n+2)} = \frac{n}{6n+4}$$

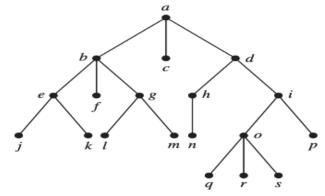
Q4. a. Form a binary search tree for the word's mathematics, physics, geography, radiology, technology, meteorology, geology, criminology, psychology, neurology, chemistry, and terminate (using alphabetical order). [2]



- **Q4. b.** Is the tree you constructed in Q4. (a) balanced tree? Explain with proper justification. What is the [1+1] maximum limit of the number of leaves in this tree?
- 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. [1+1 Evaluate the prefix expression that you created using values of x = 4, and y = 3. +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 [1+2] value of m? If not, how can you make it a full m-ary tree?



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

