United International University (UIU)

Dept. of Computer Science and Engineering (CSE)

Final Exam Year: 2023 Trimester: Summer

Course: CSE 2213 Discrete Mathematics

Total 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 FOUR questions. Answer all of them. Figures in the right-hand margin indicate full marks.

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1 a. It has been a long day of classes at UIU. You just finished your DM theory class and brainstorming about counting problems made you really hungry! So, you decided to grab a quick lunch from the cafeteria. 2

However, on your way, you want to go for a quick counselling to your course teacher's room at the 6th floor before going to the café. So, your path is: Classroom -> 6th floor -> Café.

Suddenly, you were curious to know how many ways you can make this journey. For each part of your journey (i.e., Classroom to 6th Floor, and then 6th Floor to Café), you have two options: taking one of the 7 available lifts or choosing one of the 3 staircases.

Calculate the numbers of ways you can complete this "Classroom -> 6th floor -> Café" journey with the necessary steps.

b. Suppose that, BRTC is introducing a new type of numberplates for electric cars in Bangladesh that is in the format W-XXXX-NNNN, where X is **any** English letter (case sensitive) and N is a digit. W is a special character that can be either 'F' or 'B'. Now, calculate how many different license plates are available if: 3

i. Letters (X) and Numbers (N) cannot be repeated.

ii. Letters (X) can be repeated, but numbers (N) cannot be repeated.

c. You are arranging a party where you have kept three boxes of chocolates containing KitKat, Dairy Milk and Snickers. You will let your friends take only one chocolate. What is the minimum number of friends you have to invite to ensure that 10 of them end up with the same type of chocolate? 2

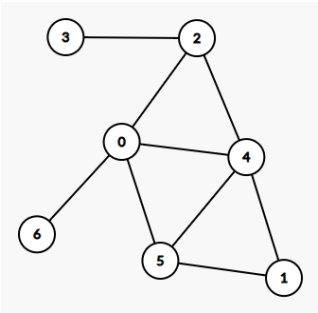
d. 15 students from CSE and 12 students from BBA are appearing in term final exams in the same room. Some answers for the CSE question can easily be copied. However, BBA students cannot copy since all questions are descriptive. 3

Can you calculate how many ways may we seat all students so that no two students from CSE seat next to each other? For simplicity, consider that the all students are seated in a single continuous line.

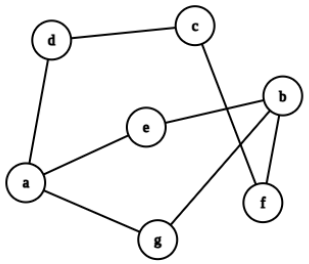
2 a. There is a graph with 13 vertices. Among them 4 vertices each of degree 5 and 9 vertices each of degree 2. How many edges are there in a graph? 3

b. What is total number of edges in the graph W_{110} ? 2

c. Does the following graph follow the Handshaking Theorem? Give argument in favor of your answer. 2



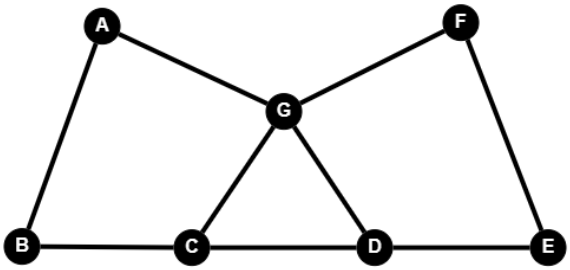
d. Determine whether the following graph is bipartite or not, using the two-coloring algorithm. If the graph is bipartite, redraw the graph in bipartite form. 3

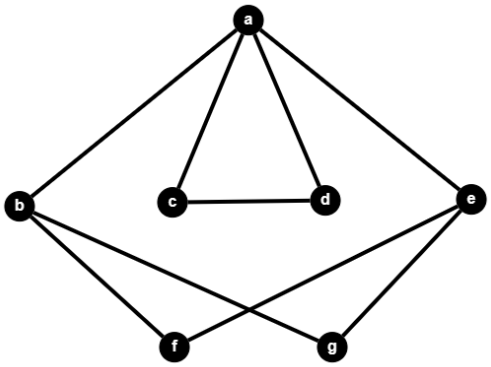


3 a. Given below is the incidence matrix of a graph. Calculate the degree of all its vertices from the incidence matrix. 2.5

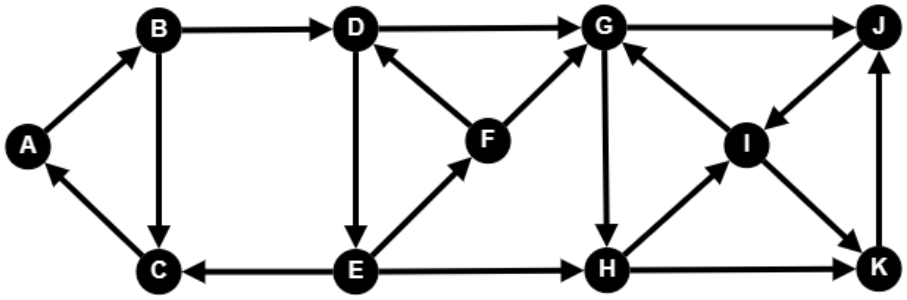
	a	b	c	d	e	f	g	h
v_1	1	1	1	0	0	0	0	1
v_2	1	0	0	1	0	1	0	0
v_3	0	1	0	1	1	0	0	0
v_4	0	0	0	0	1	1	1	1
v_5	0	0	1	0	0	0	1	0

b. Determine whether the following graphs are isomorphic or not. 2.5



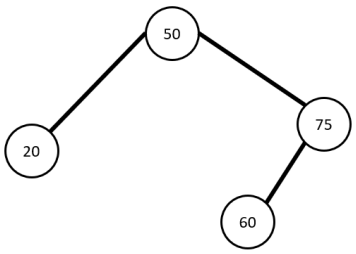


c. Observe the following graph: 4+1



i. Find out the strongly connected components of this graph.
ii. Is the graph weakly connected? Mention the reason.

4 a. Insert the following data in the given binary search tree: 100, 95, 25, 30,10, 5, 55 4



After the insertion, traverse the tree using in-order and post-order traversal methods and write down the sequence of vertices obtained from both the traversals.

b. Represent the following expression using an expression tree. 3

((y + 2) ^ 3) ∗ (x − (y + 3)) – 8

Determine the prefix version of the above expression.

c. Suppose that someone starts a chain letter. Each person who receives the letter is asked to send it on to four other people. Some people do this, but others do not send any letters. How many people have seen the letter, including the first person, if no one receives more than one letter and if the chain letter ends after there have been 400 people who read it but did not send it out? How many people sent out the letter? 3