United International University (UIU)

Dept. of Computer Science & Engineering (CSE)

Final Exam: : Trimester: Spring 2021

Course Code: CSE 2213, Course Title: DISCRETE MATHEMATICS

Time:1 hour 30 min Total Marks: **40**

Answer all the questions. Figures are in the right-hand margin indicate full marks.

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

Question 1.

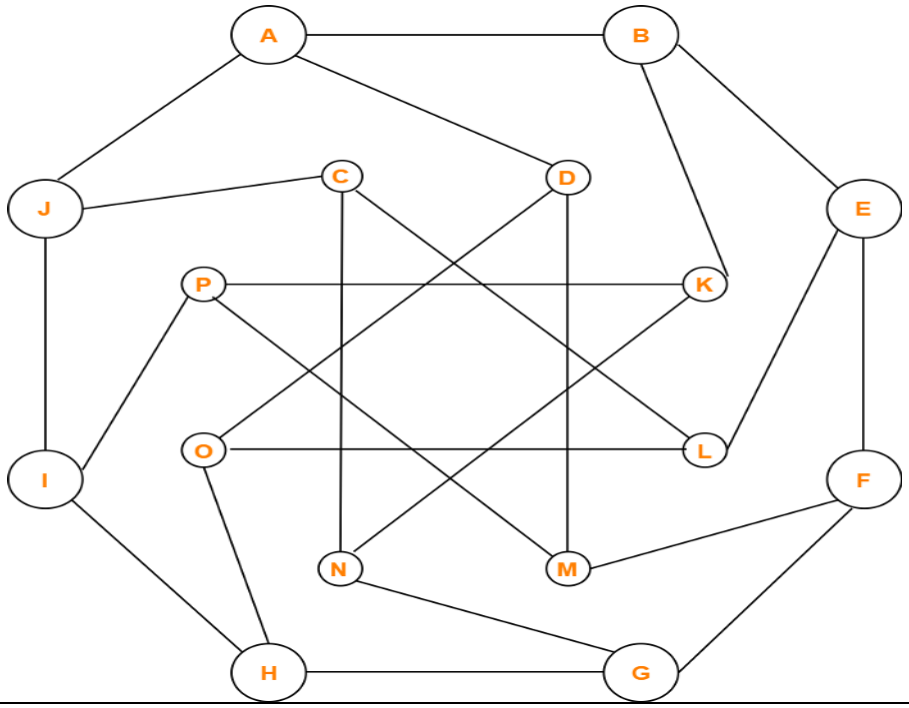
a) A simple undirected graph $G = (V, E)$ has $\sum_{v \in V} \deg(v) = 60$. In this graph, 4 vertices have degree 6, x vertices have degree 3, and 12 vertices have degree 2. What are the total number of vertices and edges of the graph? [2.5]

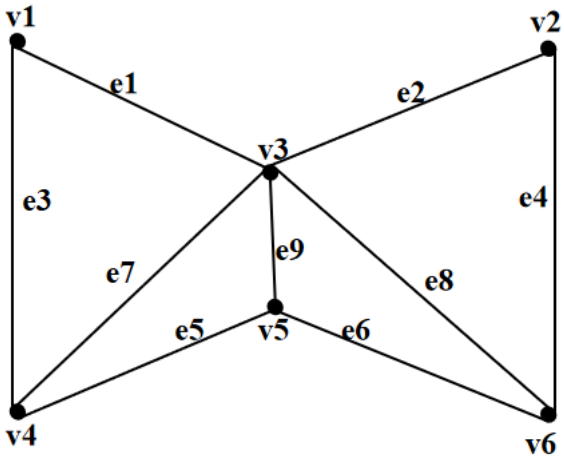
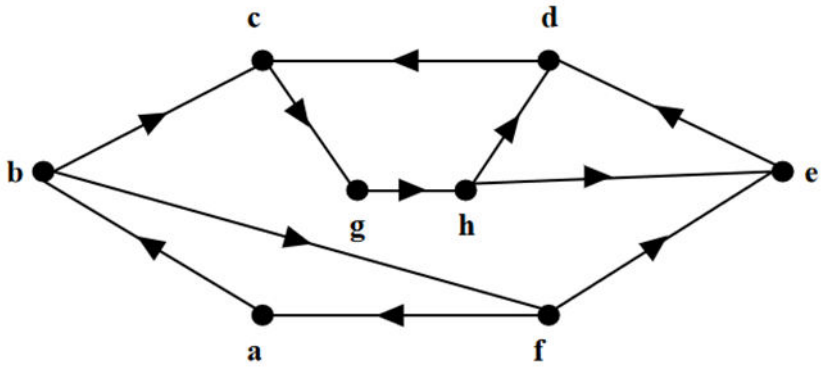
b) A connected directed multigraph with loops has 6 vertices and 11 edges. Let the vertices be a, b, c, d, e and f respectively. The in-degree and out-degree of the vertices are shown below in a table: [2.5]

Vertex (v)	$deg^-(v)$	$deg^+(v)$
a	1	2
b	2	2
c	2	1
d	4	1
e	1	2
f	1	3

Is the above description valid? Give explanation for your answer.

c) Use two-coloring method to determine whether the graph is bipartite or not? [5]



Question 2.		
a)	Show the incidence matrix representation of the following graph.  	[2.5]
b)	Determine whether the following graph is strongly connected and if not, then find the strongly connected components of the graph.  	[2.5]
c)	Draw a directed graph represented by the given adjacency matrix and answer the following questions. $\begin{array}{c} \\ a \\ b \\ c \\ d \\ e \\ f \end{array} \begin{array}{c} \begin{array}{cccccc} a & b & c & d & e & f \end{array} \\ \begin{pmatrix} 0 & 1 & 0 & 0 & 1 & 2 \\ 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 3 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 \end{pmatrix} \end{array}$ Write down the paths from **d** to **a** from the graph having the length of 3 or less.	[3+2=5]
Question 3:		
a)	i. Construct a binary search tree from the following sequence of numbers: 50, 30, 90, -10, 120, -40, 70, 60, -20, 80.	[2]
b)	i. Draw an ordered rooted tree (T) from the following expression: $2 + 3/(2 - 1) + \ 5 \ * (4-1)$ ii. Find the prefix expression from the above rooted tree (T) and find the result from the prefix expression.	[2+2+2=6]
c)	Calculate the number of total edges in a full 3-ary tree with 24 internal vertices.	[2]

Question 4:		
a)	There are 64 districts in Bangladesh. At least how many students must be enrolled to United International University so that we can ensure that there are at least 20 students from the same district?	[2]
b)	Calculate how many ways the letters of the word "ARISTOTLE" can be arranged, if – (i) The T's are not together. (ii) The vowels are together. (iii) The consonants are together.	[2+1+1=4]
c)	You have to make a string of length 7, using lowercase letters only. Here are some conditions on the strings: (i) The first letter can be any lowercase letter. (ii) A vowel must be followed by a consonant, and vice versa. (For example, if the first letter is a vowel, then the second one must be a consonant, and the third letter must be a vowel, and so on. Similarly evaluate the case of the first letter is a consonant.) (iii) A letter can be used as many times as possible. How many such strings are there?	[4]