National University of Computer and Emerging Sciences, Karachi

FAST School of Computing

Midterm-II Examination, Fall-2022

November 02, 2022, 08:30 AM – 09:30AM

Course Code: CS1005	Course Name: Discrete Structures
Instructor Names: Mr. Shoaib Raza, Ms. Bakhtawer, Ms. Safia, Ms. Fizza Aqeel, Mr. Fahad Hussain and Mr. Sudais	
Student Roll No:	Section No:

Instructions:

- Return the question paper together with the answer script. Read each question completely before answering it. There are **3 questions** written on **2 page.**
- In case of any ambiguity, you may make assumptions. However, your assumptions should not contradict any statement in the question paper.
- Attempt all the questions in given sequence of the question paper. Show all steps properly in order to get full points.

Total Time: 01 Hour **Maximum Points**: 24

Figure # 1

Question # 1: **[CLO -1, C2]** **[4 x 2 = 08 points]**

(a) Let $x_n = 2^n + 5.\ 3^n$ for x = 0, 1, 2, 3… Show that $a_4 = 5a_3 - 6a_2$

(b) Find the sum of number between 250 and 1000 which are divisible by 17.

(c) Draw the directed graph for R_1 o R_2. Consider the relation R_1 = {(4, a), (4, b), (5, c), (6, a), (6, c)} from X to Y and R_2 = {(a, l), (a, n), (b, l), (b, m), (c, l), (c, m), (c, n)} from Y to Z where X = {4, 5, 6}, Y = {a, b, c} and Z = {l, m, n}.

(d) Prove or disprove that the less than (a<b) relation on Set A = {1, 2, 3, 4} is a partial order relation. Discuss all properties.

Question # 2: **[CLO -2, C3]** **[4 x 2 = 08 points]**

(a) For given pair of graph G and G1 in Figure # 1. Determine whether G and G1 are isomorphic. If they are, give function F: V(G) →V(G1) that define the isomorphism. If they are not, give an invariant for graph isomorphism that they do not share.

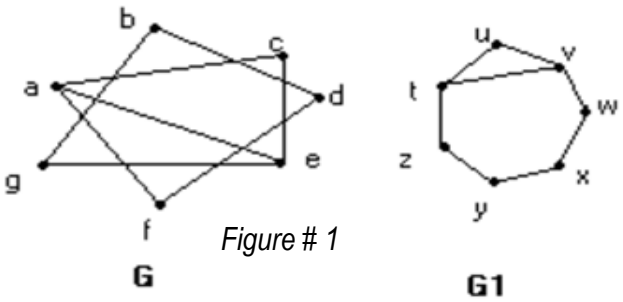

Figure # 1

(b) Consider the Graph given in Figure # 2. With the indicated link costs, use Dijkstra shortest-path algorithm to compute the shortest path from a to all other nodes. Use table given below for computation.

N	D(b)	D(c)	D(d)	D(e)	D(f)
a	-	-	-	-	-

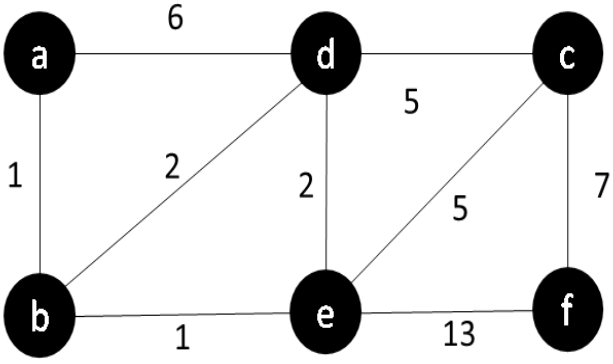

Figure # 2

(c) Determine whether the graph G in Figure # 3 has an Euler circuit OR an Euler path. Construct such a circuit or path when one exists. If no Euler circuit or path exists, provide the proper reason.

(d) Determine whether the graph G in Figure # 3 has Hamilton circuit OR Hamilton path. Construct such a circuit or path when one exists. If no Hamilton circuit or path exists, provide the proper reason.

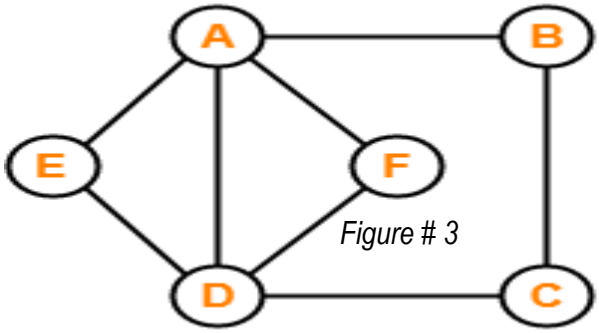

Figure # 3

<u>Question # 3:</u> **[CLO -2, C3]** **[4 x 2 = 08 points]**

(a) Use Kruskal algorithm to find a minimal spanning tree for the graph given in Figure # 4. Indicate the order in which edges are added to form the tree.

(b) Calculate the regions for a graph given in Figure # 4 using Euler Formula.

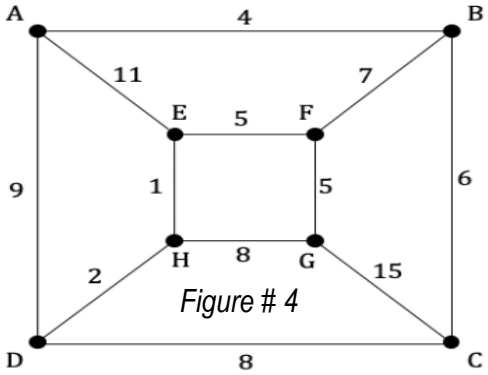

Figure # 4

(c) Show step by step inorder traversal of the tree given in Figure # 5.

(d)
(i) Determine whether tree given in Figure # 5 is a Full m-ary tree or not? Give reason.
(ii) Determine whether tree given in Figure # 5 is a Balanced m-ary tree or not? Give reason.

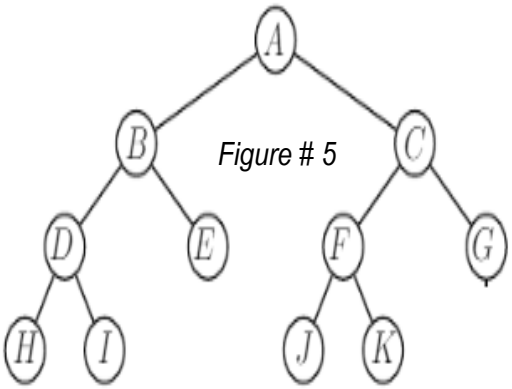

Figure # 5

BEST OF LUCK ☺