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ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION SUMMER SEMESTER, 2022-2023

DURATION: 1 HOUR 30 MINUTES FULL MARKS: 75

CSE 4803: Graph Theory

Programmable calculators are not allowed. Do not write anything on the question paper.

Answer **all 3 (three)** questions. Figures in the right margin indicate full marks of questions with corresponding COs and POs in parentheses.

1. Consider the maze in Figure 1 where the numbers represent the corridors on each side of the maze. Suppose, you start from *1* and are supposed to find your way to the center labeled as *'Destination'*. 7×5 (CO1) (PO1)

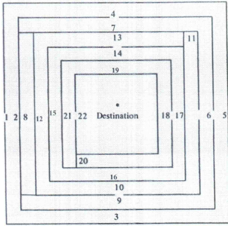

Figure 1: A drawing of a maze for Question 1

a) Formulate a graph to appropriately represent the maze shown in Figure 1.

b) Determine whether the graph from Question 1.a has a Unicursal line.

c) Justify whether the graph from Question 1.a is an Euler graph. If it is not, how can you make it Euler?

d) Determine whether the graph from Question 1.a has a Hamiltonian path.

e) Find the center(s) of the graph from Question 1.a.

f) How many edges must be removed to make the graph from Question 1.a a spanning tree? Draw one such spanning tree.

g) Considering the spanning tree from Question 1.f, draw one fundamental circuit and one fundamental cut-set.

2. Answer the following questions: 2 × 10 (CO1) (PO1)

   a) Prove that there can be no path longer than a Hamiltonian path (if it exists) in a graph.

   b) Prove that if a connected graph is arbitrarily traceable, it is an Euler graph.

3. Answer the following questions: 4 × 5 (CO1) (PO1)

   a) Show that, in a group of seven people, it is impossible for every person to be friends with exactly three other people.

   b) Justify whether a connected graph with more than six odd-degree vertices can be decomposed into only three paths.

   c) Is a vertex v of a graph G a cut-vertex if G is arbitrarily traceable on v?

   d) Prove that every vertex in a circuit has degree 2.