ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

QUIZ #3 **SUMMER SEMESTER, 2021-2022**

DURATION: 20 MINUTES **FULL MARKS: 15**

CSE 4803: Graph Theory

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

Answer **all 2 (two)** questions. Figures in the right margin indicate full marks of questions whereas corresponding CO and PO are written within parentheses.

Student ID:

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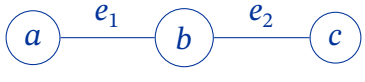
1. "In a separable graph G, the set of edges incident on the cut-vertex is a cut-set" - with a brief explanation, show that the statement is wrong by providing a counterexample. 4 + 1 (CO1) (PO1)
[There was a mistake in the original question. This was supposed to be the question. And the answer is given accordingly. However, the scripts will be marked based on the original question.]

Solution:



The given graph is separable because removing the vertex b will divide the graph into two components. Here, the edges incident on b are $\{e_1, e_2\}$. This set is not a cut-set because its proper subset $\{e_1\}$ and $\{e_2\}$ both are cut-sets.

Rubric:

- 4 points for the graph
- 1 point for the explanation

2. A tournament is going to be organized between 32 players. The organizers have slots to conduct at most 128 matches. For the sake of fairness, they want to make sure that some players do not group together and isolate an individual (or a small group of players).

   a) Formulate the problem as a graph by identifying the vertices and edges. 4 (CO2) (PO2)

Solution:

Each player can be considered as a vertex. Two vertices will be connected via an edge indicating a match between two players.

Rubric:

- 2 points for vertices.
- 2 points for edges.

b) Using graph theoretic approaches, determine the maximum number of matches each player can participate in while also ensuring fairness. 6 (CO3) (PO3)

Solution:

To ensure fairness, we need to have the maximum vertex connectivity in the graph representing the tournament. In a graph with n vertices and e edges, the maximum vertex connectivity possible is:

$$\left\lfloor \frac{2e}{n} \right\rfloor$$
$$= \left\lfloor \frac{2 \times 128}{32} \right\rfloor$$
$$= 8$$

Each player needs to play 8 matches.

Rubric:

- 2 points for identifying the requirement
- 4 points for answer