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ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION
DURATION: 1 HOUR 30 MINUTES

SUMMER SEMESTER, 2021-2022
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 whereas corresponding CO and PO are written within parentheses.

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1. a) "If every vertex of a simple graph G has degree 2, then G is a circuit." — Do you agree with the statement? Justify your answer. 6
(CO1)
(PO1)
- b) Three actors and their managers are on one side of a river, along with a boat that can hold one or two people. The goal is to take all of them to the other side of the river. In one move, one or two people can use the boat (given it is on their side) to go to the other side of the river. However, the managers are jealous. On any side, no actor can be in the presence of another manager unless their own manager is also present.
 With a brief explanation, answer the following questions:
- i. Formulate the problem as a graph by identifying the vertices and edges. 6
(CO2)
(PO2)
- ii. Recommend a solution to the problem using graph theoretic techniques. 10
(CO3)
(PO3)
2. a) Show that any two simple connected graphs with n vertices, all of degree two, are isomorphic. 7
(CO1)
(PO1)
- b) In a round-robin tournament every player plays against every other player. You are asked to schedule a tournament of 144401 players. Each player can play at most two matches per day.
 Determine the number of days required to finish the tournament in the shortest possible time. 12
(CO3)
(PO3)
3. a) Determine the relationship between the following pairs: 7 × 3
(CO1)
(PO1)
- i. Minimum Vertex Cover and Independent Set
- ii. Maximum Matching and Minimum Vertex Cover
- iii. Edge Cover and Maximum Matching
- b) Assume that we have N engineering students who will graduate soon. After graduation, the students want to get into one of the top M engineering universities to continue their higher studies. Each student has created a list of k ($1 \leq k \leq M$) universities among the M universities based on their preference. Analyzing their choices, you found that each university appears exactly in k different lists.
- i. Formulate the problem as a graph by identifying the vertices and edges. 6
(CO2)
(PO2)
- ii. Show that it is possible to assign all the students to one of their preferred universities, while also ensuring that no two students go to the same university. 7
(CO1)
(PO1)