

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

QUIZ 2**DURATION: 20 MINUTES****SUMMER SEMESTER, 2021-2022****FULL MARKS: 15**

CSE 4803: Graph Theory

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. You are given three vessels A , B , and C of capacities 8, 5, and 3 gallons, respectively. A is filled, while B and C are empty. Your task is to divide the liquid in A into two equal quantities by pouring the liquid from one vessel to another. You cannot use additional tools.

With a brief explanation, answer the following questions:

- a) Formulate the problem as a graph by identifying the vertices and edges.

6
(CO2)
(PO2)

Solution:

Let a , b , and c be the amounts of liquid in A , B , and C , respectively. We have $a + b + c = 8$ at all times. Since at least one of the vessels is always empty or full, at least one of the following equations must always be satisfied: $a = 0$, $a = 8$; $b = 0$, $b = 5$; $c = 0$, $c = 3$. Using this condition, we can create vertices, each representing a state describing the amount of liquid in each of the 3 vessels. We will put a directed edge from one vertex to another, if a state transition is possible by pouring liquid from one vessel to another.

Rubric:

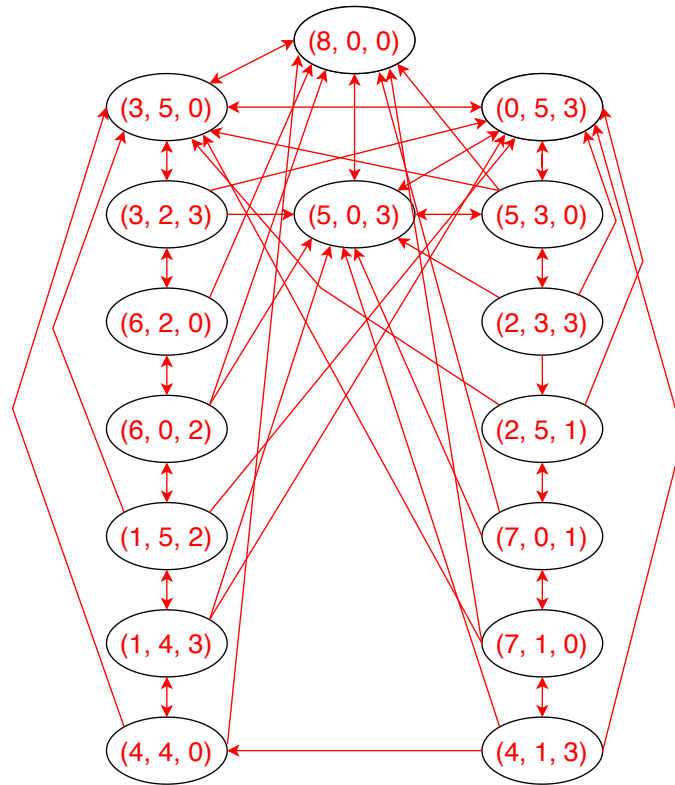
- 3 points for vertices
- 3 points for edges

- b) Draw the (possibly partial) graph and find a solution to the problem.

9
(CO3)
(PO2)

Solution:

The graph representation may look like the following:



From the graph, one of the possible solution is: $(8, 0, 0) \rightarrow (3, 5, 0) \rightarrow (3, 2, 3) \rightarrow (6, 2, 0) \rightarrow (6, 0, 2) \rightarrow (1, 5, 2) \rightarrow (1, 4, 3) \rightarrow (4, 4, 0)$.

Rubric:

- 5 points for drawing a partial graph
- 4 points for the solution