

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

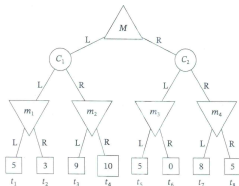
MID SEMESTER EXAMINATION  
 DURATION: 1 HOUR 30 MINUTES

WINTER SEMESTER, 2022-2023  
 FULL MARKS: 75

**CSE 4711: Artificial Intelligence**

**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. The symbols have their usual meanings.

1. The game tree for a game between Aafiya and Bashira is shown in Figure 1.



**Figure 1: Game Tree for Question 1**

Here, *L* indicates the action of going left and *R* indicates the action of going right. For the chance nodes, the probability of taking the action '*L*' is,  $P = 0.8$ . The values of the terminal nodes will be between 0 and 10 (inclusive). Aafiya moves first.

- |   |                         |
|---|-------------------------|
| a) Recommend the optimal action for Aafiya.   | 8<br>(CO3)<br>(PO3)     |
| b) Assume that we update the value of $t_5$ to 1. Determine the value for $P$ such that Aafiya takes the same action that you recommended in Question 1.a).   | 5<br>(CO3)<br>(PO3)     |
| c) "Even though the given game tree corresponds to an Expectimax problem, some leaf nodes can be pruned using Alpha-Beta Pruning" - Do you agree with the statement? If you agree, identify the nodes that can be pruned with brief explanation. If you do not agree, briefly explain your reasoning. | 1 + 4<br>(CO1)<br>(PO1) |
| d) Consider the general case where the terminal nodes can take on any real value between 0 and 10 (inclusive) instead of the given values. Does applying Alpha-Beta Pruning always result in the same outcome as of Question 1.c)? Justify your answer with appropriate reasoning and examples.       | 1 + 4<br>(CO1)<br>(PO1) |

2. Assume that six friends Rifat (*R*), Atiq (*A*), Farhan (*F*), Ishmam (*I*), Tabassum (*T*), and Sabrina (*S*) are standing in a queue, each occupying a unique spot among the six possible spots labeled 1 to 6. Farhan is standing in between Atiq and Ishmam. Sabrina and Rifat are standing next to each other. Tabassum is either at the front of the line or the back of the line. Sabrina has one person behind her.
- a) Formulate the scenario as a Constraint Satisfaction Problem (CSP) by identifying the variables, values, and constraints. Also, draw the corresponding constraint graph. 9 + 5  
(CO2)  
(PO2)
- b) Consider that you apply the unary constraints and then use Arc Consistency for binary constraints to remove the values from the domains of the variables. 13  
(CO1)  
(PO1)  
Determine the remaining values for each variable. You need to show the intermediate steps with a brief explanation.
3. a) Mr. Takaful's father had cancer. He knows that, even though cancer itself cannot be passed down from parents to children, there is 1% chance that the genetic change that increases the risk of cancer can be passed down (inherited). Mr. Takaful has 10M USD. He also knows that if he is diagnosed with cancer, he will lose all of his money. 7 + 5  
(CO3)  
(PO3)  
An insurance company comes to Mr. Takaful with a health insurance proposal. If he gives them an insurance premium of 5M USD, they will reimburse him 9M USD only if he gets diagnosed with cancer. Mr. Takaful's utility function is  $U(x) = \ln(1 + x)$ .
- i. Assume that you are a rational agent. Recommend whether Mr. Takaful should buy the health insurance or not.
- ii. Comment on why the insurance company is offering such a deal where they have a chance to lose 4M USD.
- b) Introspection is the process of examining or observing one's own mental and emotional processes. One of the desired characteristics of rational agents is that they need to be introspective so that can . To instill this characteristic into agents, scientists often try to understand how humans report on their own inner thoughts. But the task is difficult since it can be inaccurate. 4  
(CO1)  
(PO1)  
Discuss how someone can be wrong about what they are thinking.
- c) Formulate the following actors as agents by identifying their sensors, actuators, and environments: 3 × 3  
(CO2)  
(PO2)
- i. Microwave Oven
- ii. Chess Program
- iii. Autonomous Supply Delivery Plane