

BRAC UNIVERSITY**Department of Computer Science and Engineering**

Examination: Semester Final
Duration: 1 Hour 40 Minutes

Semester :Spring 2023
Full Marks: 40

CSE 422: Artificial Intelligence

Answer 4 out of 5 from the following questions

Name:	ID:	Section:
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1. CO4

Animal	Weight (Kg)	Color	Pet?
Dog	12	Black	No
Cat	8	Orange	Yes
Dog	17	White	No
Dog	13	Orange	Yes
Rat	4	White	Yes
Rat	5	White	Yes
Dog	18	Black	No
Cat	11	Orange	No
Cat	9	Black	Yes
Rat	6	White	Yes

An animal is considered heavy if it weighs more than 10kg. Now, answer the following questions:

- Is dog conditionally independent of heavy if the color is black? **Show** full calculation. 4
- Given a heavy weighted orange cat, is it more likely to be pet or not? **Apply** naïve bayes theorem to solve it. (No need to show learning phase) 6

2. CO5

Alpha	Beta	Y
Yes	Yes	No
Yes	Yes	No
No	Yes	Yes
No	No	Yes
No	No	Yes
Yes	No	No
Yes	Yes	No
Yes	Yes	Yes
No	No	Yes
No	No	Yes

- Assume this is a binary classification problem where Y is the output label and Alpha, Beta are the input features. Now if you were asked to **Apply** ID3, then find out which of the two given features would be more appropriate as the root node of the equivalent decision tree. 4
- Suppose you are given 2 scenarios involving two coins, A and B. In the first scenario, you flip coin A five times. The observed outcomes of coin A are H, T, T, T, T where H = heads and T = tails. Now in the 2nd scenario, you flip coin B five times as well. The first 3 outcomes of coin B are H, T, and T. Now mathematically **Solve** what should be the outcomes of the 4th and the 5th flip for coin B such that the second scenario would showcase a higher amount of uncertainty than the first. 4
- Suppose a 3rd feature called Gamma is added in the given table. This feature is a continuous variable. In this scenario, is the feature fit enough for the ID3 algorithm? If not, then **Explain** what kind of changes to the feature you propose. 2

Set A

3. CO4

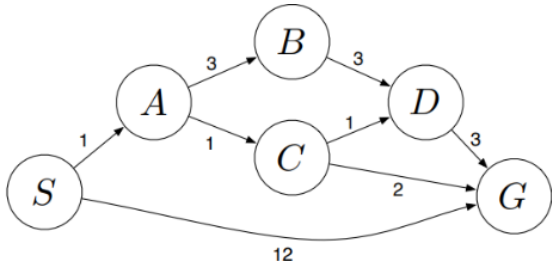
Covid-19 tests all over the world aren't 100% accurate. A patient is actually positive in 85% of the cases when the test comes out positive. And a person is actually positive in 10% of the cases when the test comes out negative.

- Of all the people who tested for Covid-19, 70% of them actually had the disease. If 1000 people participated in the tests, **Calculate** the probability of a person's test results being positive. 4
- Ignore all the information given in part a. In addition, you are given that, of all the people who tested for Covid-19, 70% of them came positive. If a random person is chosen who is actually a Covid-positive, which one is more likely? Did they come out positive or negative in the tests? **Explain** mathematically. 6

4. CO3

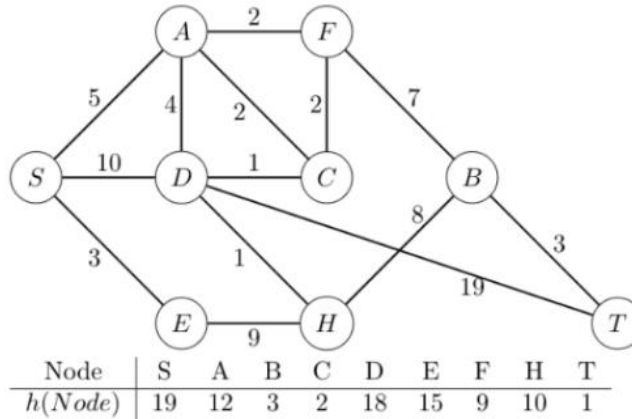
- Suppose you have to schedule semester final exams for a university in terms of CSP. **Identify** and **Explain** the domain, variables, constraints, goals properly. 7
- Explain** the problems in backtracking and discuss the solution briefly. 3

5. CO2



Node	h1	h2
S	5	4
A	3	2
B	6	6
C	2	1
D	3	3
G	0	0

- For the graph above, where S is the start node and G is the goal node, which of the two heuristic sets, h1 and h2, is admissible? Which of them is consistent? **Analyze**. 4



- For the graph above and the heuristic function given, **Use** A* algorithm on the graph. In what sequence will the nodes be explored? Which heuristics values in this table are inadmissible? Here, S is the starting node and T is the goal node. In case any tie occurs, expand the node that comes first alphabetically. 6