# United International **University (UIU)**

## Dept. of Computer Science & Engineering (CSE)

### Final Exam: Summer 2021

**Course Code: CSI 341, Course Title: Artificial Intelligence**

Total Marks: 25          Duration: 1 hour 15 minutes

**Answer all questions**. Marks are indicated in the right side of each question.

[Any examinee found adopting unfair means will be expelled from the trimester/program as per UIU disciplinary rules. ]

**For question 2, 3, 5 and 6 consider the following:**

X = (your_student_id % 2) + 1
Y = (your_student_id*2)%2 + 1
Z = (your_student_id % 3) + 1

1. Suppose, there are five teams in a competition. You are trying to assign a flag color for each team. There are six flags of six different colors available (Red, Blue, Green, Yellow, Purple and White). Each team must have a distinct flag color. However, each team has provided their preference which must be followed. They are:
   Team 1 wants to use Purple or White.
   Team 2 wants to use Blue or White.
   Team 3 wants to use Purple or Blue.
   Team 4 club wants to use Red, Green or Blue.
   Team 5 is okay with any color except Yellow.

   Formulate this problem as a CSP. Draw the constraint graph. Show the steps followed by backtracking search algorithm and derive a solution.          **[5]**

2. You are asked to analyze the migratory patterns of Pelicans. The birds are found in **Region 1 and Region 2**. Currently, the distribution is 60% and 40% respectively. The transition matrix for the birds' probabilities of moving between the Regions at each year has been estimated in the following table:
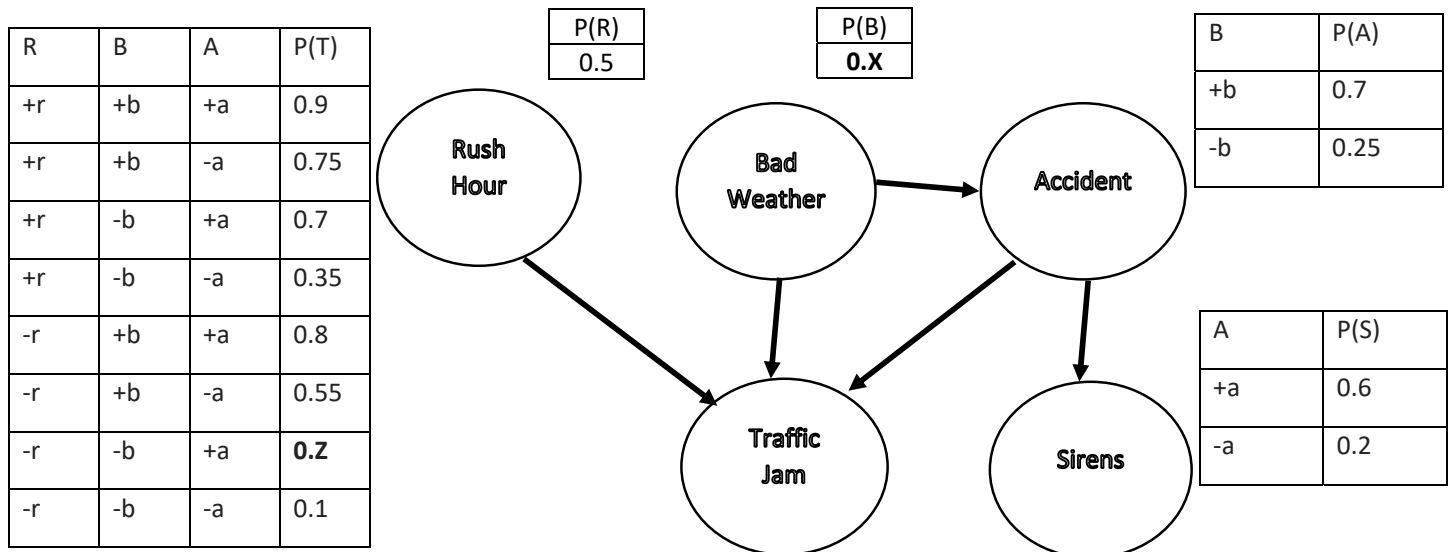
| Next year → <br><br> This year ↓ | Region 1 | Region 2 |
|---|---|---|
| Region 1 | 0.8 | 0.2 |
| Region 2 | 0.6 | 0.4 |

   (a) Suppose a Pelican is in **Region X** in this year (2021). Modeling the scenario as a Markov model, what is the probability of that Pelican to be in **Region Y** in 2023?          **[2]**

   (b) Determine the proportion of Pelicans in each Region in the long-run (stationary distribution)          **[2]**

3. Three factories produce door locks to supply the market. Factory A produces 20%, Factory B produces 50% and the rest come from Factory C. **X%** of the locks produced in Factory A, **Y%** of the locks produced in Factory B and **Z%** of the locks produced in Factory C are defective. A lock is selected at random in the market and found to be defective. What is the probability that this Lock was produced by Factory B?          **[2]**

4. Since the pandemic situation has improved, UIU CSE is considering taking physical classes. So a survey has been done on 500 students to find out if they are interested in physical class. Half of the participants were seniors(3rd and 4th year) and the other half juniors. The following is the survey result :

   Among the seniors, 180 live in Dhaka city and 120 of them are interested to go back to physical class. 40 of the seniors who live outside Dhaka want to remain online. Among the juniors, 200 live in Dhaka and half of them want physical class. 20% of the juniors living outside Dhaka want to remain online.

   a. Your first task is to find three variables, C(category), L(location) and T(type of class). Find the full joint distribution table P(C, L, T) **[3]**

   b. Find P(T|L). **[2]**

5. Consider the following bayes net and calculate the probability of a person being in an accident given it was not rush hour and there was no traffic jam. **[4]**

| R | B | A | P(T) |
|---|---|---|------|
| +r | +b | +a | 0.9 |
| +r | +b | -a | 0.75 |
| +r | -b | +a | 0.7 |
| +r | -b | -a | 0.35 |
| -r | +b | +a | 0.8 |
| -r | +b | -a | 0.55 |
| -r | -b | +a | **0.Z** |
| -r | -b | -a | 0.1 |

| P(R) |
|------|
| 0.5 |

| P(B) |
|------|
| **0.X** |

| B | P(A) |
|---|------|
| +b | 0.7 |
| -b | 0.25 |

| A | P(S) |
|---|------|
| +a | 0.6 |
| -a | 0.2 |

Rush Hour

Bad Weather

Accident

Traffic Jam

Sirens

6. Consider the following data collected from an online survey to understand whether a person travels on holidays or not. Use Naive bayes classifier with Laplacian smoothing (k=1) to determine whether Mr. Ahmed with the features **<Z, Y, High>** travels on holidays or not. **[5]**

| Age Group | Income Group | Stamina | Travels on holidays |
|-----------|--------------|---------|---------------------|
| 1 | 1 | High | Yes |
| 1 | 2 | High | No |
| 1 | 1 | Normal | No |
| 2 | 1 | High | Yes |
| 2 | 2 | Normal | Yes |
| 2 | 2 | Low | No |
| 3 | 1 | High | Yes |
| 3 | 2 | Low | No |
| 3 | 2 | Normal | Yes |
| 3 | 1 | Low | No |