United International University (UIU)

Dept. of Computer Science & Engineering (CSE)

Final Exam: Summer 2023

Course Code: CSE 3811, Course Title: Artificial Intelligence

Total Marks: 40 Duration: 2 hours

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

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1. In a neighborhood, 50% of the children admitted in the local hospital are suffering from dengue. Among them 60% are developing rashes. The probability of having rashes due to other diseases is 0.1. If a child develops rashes, find the child's probability of having dengue. **[3]**

2. A survey has been done on 200 children in a school on their preferences about sports. Half of the kids are juniors, and the other half are seniors. 40% of the junior kids are interested in playing football, 30% like basketball and the others like indoor games. Among the senior kids, the ratio of liking football, basketball and indoor games is 5:3:2.
   a. Based on this data, construct a full joint distribution among the two random variables Student category(C) and Sports(S). **[2]**
   b. Calculate the following probabilities from your table:
      i. Probability of a student being interested in indoor games. **[1]**
      ii. P(S|C=junior). **[2]**

3. Suppose there are two random variables Rich(+r, -r) and Successful(+s, -s). The following tables are given:

Rich	P(Rich)
+r	0.3
-r	0.7

Rich	Successful	P(Successful|Rich)
+r	+s	0.75
+r	-s	0.25
-r	+s	0.6
-r	-s	0.4

Find the following probability values from the table: **[1.5+1.5]**

a. P(Rich, Successful) b. P(Rich|-s)

4. You are analyzing the trend of people migrating between continents. You have calculated the transition probability of how the migration happens yearly shown in the table below.

Next Year → This Year ↓	Asia	North America	Europe
Asia	0.5	0.3	0.2
North America	0.2	0.6	0.2
Europe	0.2	0.3	0.5

a. Given this year (Year 1) someone is in Asia, what is the probability of being in Europe in Year 3? **[2]**

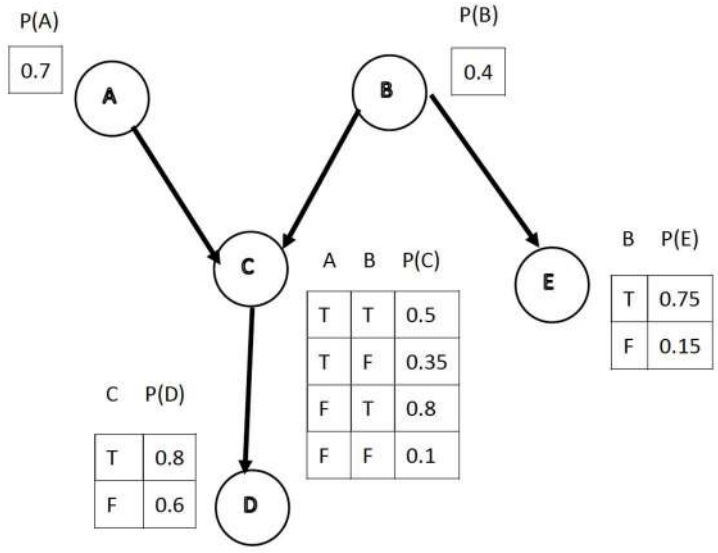
b. Determine the probability of being in any continent in the long run (stationary distribution). **[4]**

5. The following dataset contains four features and a label of some airplanes. The features are Engines, Seats, Body, Tail and the label is Company, which denotes which company has made the airplane.

Engines	Seats	Body	Tail	Company
Two	Many	Narrow	Conventional	Airbus
Two	Average	Narrow	Conventional	Airbus
Four	Many	Wide	Conventional	Airbus
Two	Average	Wide	Conventional	Boeing
Four	Many	Commuter	Conventional	Boeing
Four	Few	Commuter	Conventional	Airbus
Two	Average	Narrow	T-type	Airbus
Two	Many	Narrow	Conventional	Boeing
Two	Average	Wide	T-type	Boeing
Two	Few	Wide	Conventional	Boeing
Two	Few	Commuter	T-type	Airbus
Four	Average	Commuter	Conventional	Airbus

Use Naive Bayes classifier to determine the probability of an airplane with the features <Four, Average, Narrow, T-type> being a Boeing. Show details calculation. **[7]**

6. a. Consider the following Bayes Net with the given conditional probability tables:



Now find out the following probabilities: i. P(+b|+c,-d,-a) **[4]** ii. P(+a, -b, +c, -d, +e) **[3]**

b. If X is conditionally independent of Y given Z, how can you simplify P(x|z,y)? **[1]**

7. There are 4 features(outlook, temperature, humidity, windy) in the following table.

Sequence	outlook	temp	humidity	windy	play
0	sunny	hot	high	FALSE	no
1	sunny	hot	high	TRUE	no
2	overcast	hot	high	FALSE	yes
3	rainy	mild	high	FALSE	yes
4	rainy	cool	normal	FALSE	yes
5	rainy	cool	normal	TRUE	no
6	overcast	cool	normal	TRUE	yes
7	sunny	mild	high	FALSE	no
8	sunny	cool	normal	FALSE	yes
9	rainy	mild	normal	FALSE	yes
10	sunny	mild	normal	TRUE	yes
11	overcast	mild	high	TRUE	yes
12	overcast	hot	normal	FALSE	yes

Your task is to build a Decision tree based on this data to predict whether it is playable or not. Which should be the feature in the root node of the decision tree? Find the feature at the root node with proper calculation. Choose the other features randomly(no more calculation is needed) after the root node to build the tree. **[8]**