



United International University (UIU)

Dept. of Computer Science & Engineering (CSE)

Final Exam: Fall 2019

Course Code: CSI 341, Course Title: Artificial Intelligence

Total Marks: 40

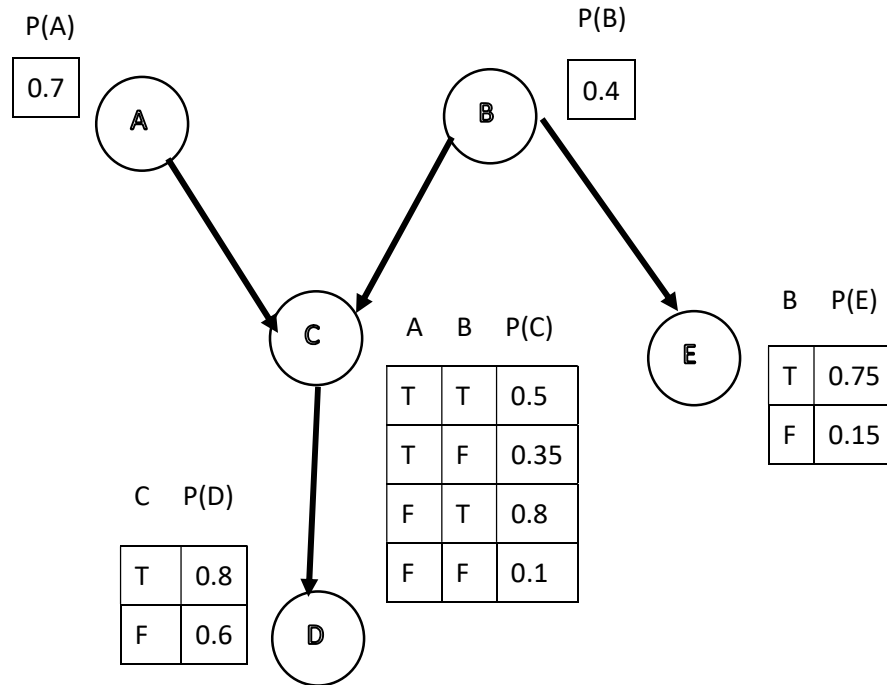
Duration: 2 hours

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

1. There are two boxes containing coins. The first box contains 60 gold coins and 40 silver coins. The second box contains 30 gold coins and 70 silver coins. One of the two boxes is randomly chosen (both boxes have probability 0.5 of being chosen) and then a coin is picked up at random from the chosen box. If a silver coin is picked up, what is the probability that it comes from the first box? [3]
2. A survey has been done on UIU students to assess their interest in hostel accommodation. The data obtained is as follows:

200 students participated in the survey, half of them male students. Among the male students, 50 were juniors(first and second year) with 70% interested in hostel accommodation and the rest were seniors with 60% interested in hostels. Among the females, 60 were juniors with 80% interested in hostels and the rest were seniors with 50% interested in hostels.
 - a. Based on this data, construct a full joint distribution among the three random variables Gender(G), Category(C) and Interest in hostel accommodation(H). [3]
 - b. Calculate the following probabilities from your table:
 - i. Probability of a student being a junior. [1]
 - ii. Probability of a female student not being interested in hostels. [2]
3. Draw the Bayesian Network that corresponds to this conditional probability: [3]
 $P(H \mid E, F, G) P(G \mid D, F) P(F \mid D, E) P(E \mid C) P(D \mid B, C) P(C \mid A) P(B \mid A) P(A)$

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



Now find out the following probabilities:

- $P(+b|+c,-d,-a)$ using inference by enumeration.
- $P(-c|-d,+e)$ using variable elimination.

[3]

[3]

5. You have collected data on the employees of an office to determine their eligibility for achieving bonus. The collected data is given below:

Performance Rating	Skillset	Relationship with Manager	Bonus
High	High	Good	Yes
High	Low	Good	Yes
Low	Low	Bad	No
Low	Low	Good	No
High	Low	Good	Yes
Low	Low	Bad	No
Low	High	Bad	No
Low	Low	Good	No
High	Low	Bad	No
High	High	Bad	Yes

Determine whether an employee with the features {Performance Rating=Low, Skillset=High, Relationship with Manager=Good} will receive bonus or not using Naive Bayes Classifier. Use Laplacian smoothing with $k=1$.

[6]

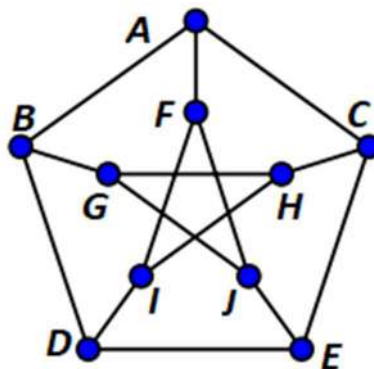
6. You are analyzing the trends in motorbike sales for a specific showroom. For this, you have calculated the probabilities of the showroom selling some particular brand of motorbike every 35 minutes. The probabilities of selling a specific brand 35 minutes later given what is sold at this moment is given in the table below.

35 minutes later	Gixer	FZS	Pulsar
Now			
Gixer	$1/7$	$2/7$	$4/7$
FZS	$2/7$	$3/7$	$2/7$
Pulsar	$4/7$	$1/7$	$2/7$

- Suppose a customer bought a Pulsar right now. Modeling the scenario as a Markov model, determine the probability that a customer will buy a Gixer 2 hours later. [4]
- Determine the probabilities of buying each brand of motorbike in the long-run (stationary distribution). [4]

7. Use minimum remaining values heuristic while solving the following constraint satisfaction problems.

- You want to color the vertices of the graph shown below with the colors red, green and blue in a way that adjacent vertices have different colors. Constructing this problem as a CSP, show the steps followed by the backtracking algorithm. [2+3]



- Suppose that a delivery robot must carry out a number of delivery activities, a, b, c, d, and e. Suppose that each activity happens at any of times 1, 2, 3, or 4. Let A be the variable representing the time that activity a will occur, and similarly for the other activities. Suppose the following constraints must be satisfied:
 Activity b cannot be done at time 3.
 Activity c cannot be done at time 2.
 Activity a and d must be done at the same time.
 Activity a and b cannot be done at the same time.
 Activity c must be done before activity d.

Show the steps followed by the backtracking algorithm.

[3]