



# United International University (UIU)

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

### Final Exam: Spring 2019

Course Code: CSI 341, Course Title: Artificial Intelligence

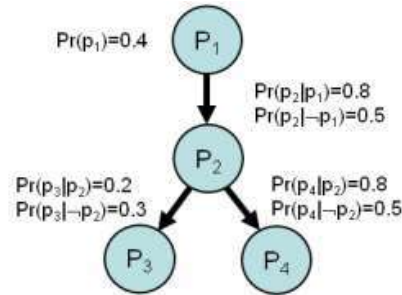
Total Marks: 40

Duration: 2 hours

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

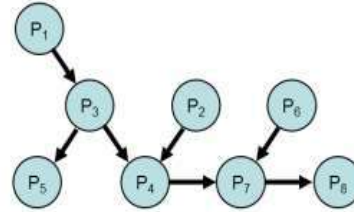
1. Given the following Bayesian Network, calculate the mentioned probabilities: [2+2+1]

- $\Pr(p_2 | \neg p_3)$
- $\Pr(p_1 | p_2, \neg p_3)$
- $\Pr(p_2)$



2. Given the following Bayesian Network with all Boolean random variables, answer questions a and b:

- Calculate the number of probability entries (total # of rows in all tables) required for this network. How many entries will be required if you constructed a full joint distribution table for the given random variables: [2]



- Determine if the following statements are True/False: [2]
  - $\Pr(P_8 | P_3, P_7) = \Pr(P_8 | P_7)$
  - $\Pr(P_3 | P_1, P_5) = \Pr(P_3 | P_1)$
  - $\Pr(P_4, P_2 | P_3) = \Pr(P_4 | P_3) \Pr(P_2 | P_3)$
  - $\Pr(P_5, P_4 | P_1) = \Pr(P_5 | P_1) \Pr(P_4 | P_1)$

3. Alice has two coins in her pocket, a fair coin (head on one side and tail on the other side) and a two-headed coin (head on both sides). She picks one at random from her pocket, tosses it and obtains head. What is the probability that she flipped the fair coin? [3]

4. A survey has been done on final year students of a university to assess their interest in final year project/thesis. The data obtained is as follows:

100 students participated in the survey, half of them male students. Among the male students 20 are interested in project, others in thesis. In the project group, 5 like software engineering, 10 like AI and the rest like networking. In the thesis group, 10 like software engineering, 15 like AI and the rest like networking. Among the female students 30 are interested in project. Among these 30 students, 12 like software engineering, 10 like AI and

the rest like networking. Among the female students interested in thesis, 10 like software engineering, 5 like AI and the rest like networking.

- a. Based on this data, construct a full joint distribution among the three random variables Gender(G), Subject(S) and Type of work(T). [3]
  - b. Calculate the following probabilities from your table:
    - i. Probability of a student being interested in thesis. [1]
    - ii. Probability of a male student not liking AI. [2]
5. Given the following data set, classify an Avg Sporty young man living in village to be a potential basketball player using Naïve Bayes classifier. [8]

Sl No.	Height	Sporty	Residence	Potential Basketball Player?
1	Tall	Yes	City	Yes
2	Tall	No	Village	No
3	Tall	No	Village	No
4	Avg	No	Village	No
5	Avg	No	City	No
6	Avg	Yes	City	Yes
7	Short	Yes	City	Yes
8	Short	Yes	Village	No
9	Tall	Yes	Village	Yes
10	Tall	No	City	No

6. M, S, and K, a gang of three UIU students like to visit each other's place each week in the following probability. [8]

Next week → This week ↓	M	S	K
M	1/5	2/5	2/5
S	1/5	1/5	3/5
K	2/5	1/5	2/5

Suppose, this week they are at M's house. Model the scenario as a Markov model.

- (a) Determine the probability of visiting K's house the week after next week. [4]
  - (b) Determine the probabilities of visiting each of them in the long-run (stationary distribution). [4]
7. The UIU sports ground is open for practice for all 7 days in the week. Only 4 sports team, T1, T2, T3, T4, and T5 are permitted to practice. T1 can only practice on Sunday, Tuesday, Thursday, and Friday, T2 can only practice on Sunday, Monday, Wednesday, Saturday, T3 can practice on any day except the days T1 can practice, T4 can practice on any day, T5 can practice Monday, Tuesday, and Friday.
- a. Formulate the problem as a CSP. [3]
  - b. Simulate one step using a local search technique. Do not forget to use a cost function. [3]