United International University
Department of Computer Science and Engineering

CSI 341:Artificial Intelligence Final Exam : Summer 2018

Total Marks: 40 Time: 2 hours

There are FOUR questions. Figures in the right-hand margin indicate full marks.

1. You are analyzing the protein eating habit of a regular person in dinner. The probabilities of having a type of protein for dinner tomorrow given what one ate today is given in Table 1.

Next Day → Today ↓	Meat	Fish	Egg
Meat	1/7	4/7	2/7
Fish	2/7	2/7	3/7
Egg	4/7	2/7	1/7

Table 1

Suppose someone had Meat for dinner today.

(a) Modeling the scenario as a Markov model, determine the probability of having Fish for dinner the day after tomorrow. [4]

(b) Determine the probabilities of having each type of protein in the long-run (stationary distribution) [4]

2. (a) Suppose you are designing a CSP for a job shop scheduling problem with five jobs namely J1, J2, J3, J4 and J5. The required time to complete each job is given in Table 2. In the job shop scheduling problem, the task

Job	1	2	3	4	5
Required Time (mins)	10	5	15	10	20

Table 2

is to order or schedule the jobs.J1 has to be completed before starting all other jobs. J2 has to be completed before starting J3 and J4. J4 and J5 cannot be done parallelly (one has to be completed before the other can be started.) All jobs must be completed within one hour. Formulate the problem as a CSP. Clearly mention the required variables, domains and constraints. [4]

(b) You want to color the vertices of the graph shown in Figure 1 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 with the minimum remaining values heuristic. [4]

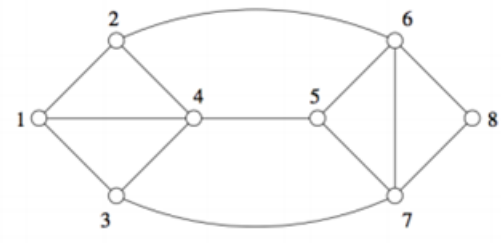


Figure 1

3. (a) Draw a Bayes net over the random variables {A, B, C, D} where the following conditional independence assumptions hold. $A \perp B$, $A \not\perp D|B$, $A \perp D|C$, $A \not\perp C$, $B \perp C$, $A \perp B|D$ and $B \perp D|A, C$. [3]

(b) Why are Bayesian Networks preferred? [1]

(c) Consider the following Bayesian Network and find the following. [4]

i. compute the probability that a student who did well on the test actually understood the material, that is, compute $P(+u|+e)$.

ii. P$(+i|+e,+h)$.

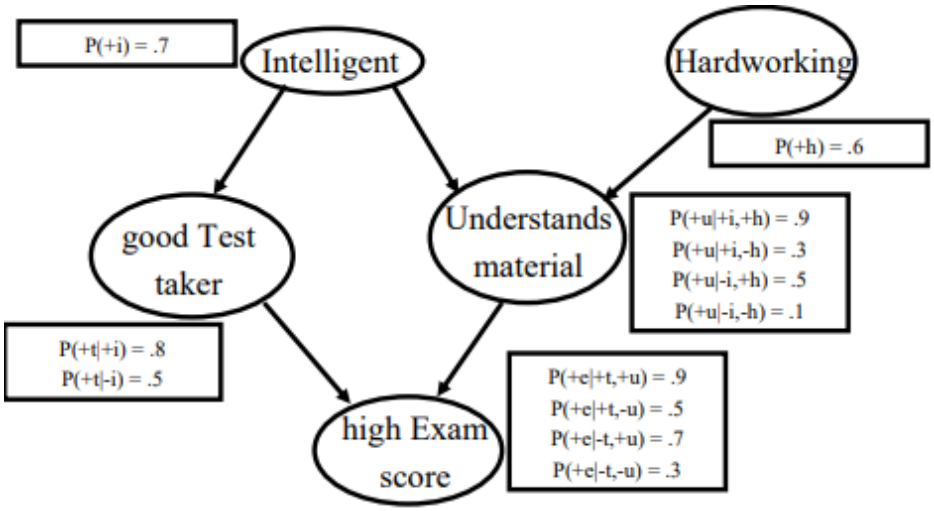
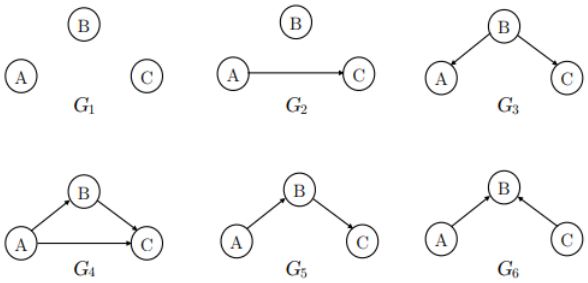


Figure 2

4. (a) For the following questions, consider the following six directed acyclic graphs.



i. For which of the graphs the joint distribution $P(A, B, C)$ can be represented by the product $P(A|B, C)P(B|C)P(C)$? Explain your answer. [3]

ii. For which of the graphs the joint distribution $P(A, B, C)$ can be represented by the product $P(C|B)P(B|A)P(A)$? Explain your answer. [3]

(b) In a certain community, 36 percent of the families own a dog, and 22 percent of the families that own a dog also own a cat. In addition, 30 percent of the families own a cat. What is the conditional probability that a randomly selected family owns a dog given that it owns a cat? [2]

chills	runny nose	headache	fever	flu?
Y	N	Mild	Y	N
Y	Y	No	N	Y
Y	N	Strong	Y	Y
N	Y	Mild	Y	Y
N	N	No	N	N
N	Y	Strong	Y	Y
N	Y	Strong	N	N
Y	Y	Mild	Y	Y

5. (a) Consider the above data. For a new data instance with chills=Y, runny nose = N, headache=mild, fever=Y, do you believe the persons symptoms have the flu? Draw the Naive Bayesian Network used to solve. [5]

(b) What are the assumptions and limitations of Naive Bayesian Classifier? [3]