United International University
Department of Computer Science and Engineering
CSI 341 Artificial Intelligence,
Final Assessment, Spring 2021
Total Marks: 40, Time: 1 hour 30 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.

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1. It is estimated that 50% of emails are spam emails. Some software has been applied to filter these spam emails before they reach your inbox. A certain brand of software claims that it can detect 99% of spam emails, and the probability for a false positive (a non-spam email detected as spam) is 5%. Now if an email is detected as spam, then what is the probability that it is in fact a non-spam email? [5]

2. Suppose you are trying to divide 8 children in three groups depending on their interests. The three groups are painting, music and book reading. There are a few conditions for this grouping:

   Student 1 likes painting.
   Student 4 doesn't like book reading.
   Student 3 and 5 want to be in the same group.
   Student 4 and 7 wants different groups.
   Student 8 wants to be in the same group as student 4.
   Student 5 will either be in the book reading group or in the painting group.

   Formulate this problem as a CSP. Draw the constraint graph. Show the steps followed by backtracking search algorithm and derive a solution. [4+2+5=11]

3. Suppose you are trying to analyze the weather pattern of a certain region. The transition matrix for the change of weather per day has been estimated in the following table:

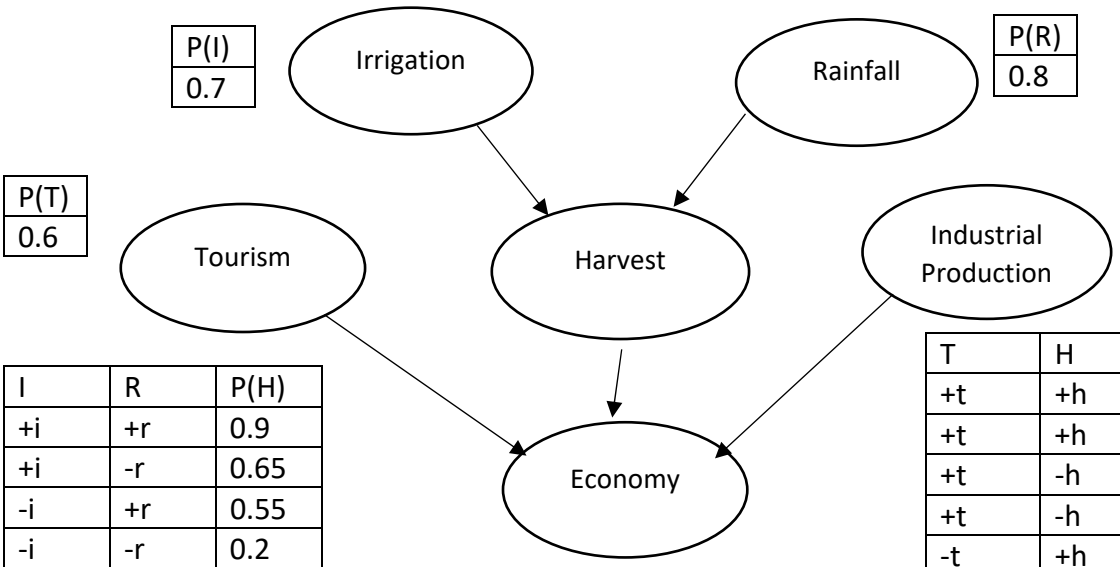
Next→ Present↓	Sunny	Overcast	Rainy
Sunny	0.7	0.2	0.1
Overcast	0.25	0.5	0.25
Rainy	0.1	0.25	0.65

Suppose today is a sunny day.

i) Modeling the scenario as a Markov model, determine the probability of having overcast weather the day after tomorrow. [3]

ii) Determine the probability of the weather being sunny, overcast or rainy in the long-run (stationary distribution). [6]

4. Consider the following bayes net:



I	R	P(H)
+i	+r	0.9
+i	-r	0.65
-i	+r	0.55
-i	-r	0.2

T	H	P	P(E)
+t	+h	+p	0.85
+t	+h	-p	0.7
+t	-h	+p	0.65
+t	-h	-p	0.5
-t	+h	+p	0.8
-t	+h	-p	0.75
-t	-h	+p	0.4
-t	-h	-p	0.15

i) Find the probability P(-i, +r, +h, +t, -p, -e). [2]

ii) Find the probability P(+t|+r, -p, +e). [6]

5. Consider the following data collected from city schools to determine whether a student is suitable to play in the football team or not. Use Naive bayes classifier with Laplacian smoothing (k=1) to determine whether a student with the features <14, Short, High, High> is likely to be selected for the football team or not. [7]

Age	Height	Speed	Stamina	Selected for football team
12	Tall	High	High	Yes
13	Average	High	Low	No
12	Short	Normal	High	No
14	Tall	High	Low	Yes
13	Tall	Normal	High	Yes
14	Short	Normal	Low	No
12	Average	High	High	Yes
13	Short	High	Low	No
14	Tall	Normal	High	Yes
14	Average	Normal	Low	No