UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

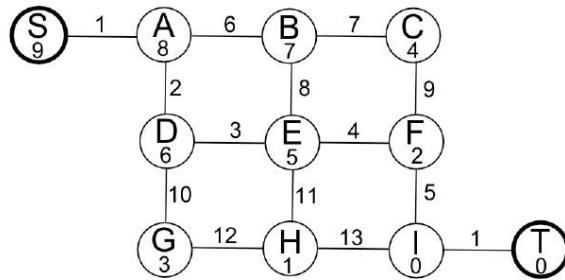**Course: Artificial Intelligence**   **Semester: IV**
Program: B.Tech CSE LL.B (Hons.) (Cyber Law / IPR)   **Time   : 03 hrs.**
Course Code: CSEG2031   **Max. Marks: 100**

Instructions:

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	You have met a person who claims to be your distant cousin, with a common ancestor named "RAMESH". You would like to verify his claim. Determine whether goal-driven or data-driven search would be preferable for solving above problem. Justify your answer.	04	CO1
Q 2	Figure shows the game tree of a two-player game; the first player is the maximizer and the second player is the minimizer. What is the expected value of the node labeled R?	04	CO2
Q 3	Find the route between S and T using Branch and Bound. Repeat the search using A* with the Heuristic values. Is the same route received? Justify your answer	04	CO3

Q 4	Illustrate Natural Language Processing with the help of an example.	04	CO4
Q 5	How Artificial Intelligence is related to human based nature? Develop PEAS description for the following task environment: • Shopping for used AI books on the Internet	04	CO1

SECTION B
(4Qx10M= 40 Marks)

| Q 6 | Let A and B be two binary random variables independent events with probabilities P (A = 1) = 0.1 and P (B = 1) = 0.4. Let C denote the event that at least one of the events A and B is on, i.e., C=A OR B, and let D be the event that exactly one of the events A and B occurs, i.e., D = A XOR B.

a) Compute P(D\|A)
b) Prove that A and D are not independent | 10 | CO2 |
| Q 7 | A candy manufacturer interviews a customer on his willingness to eat a candy of a particular color or flavor. The following table shows the collected responses: | 10 | CO3 |

Color	Flavor	Edibility
Red	Grape	Yes
Red	Cherry	Yes
Green	Grape	Yes
Green	Cherry	No
Blue	Grape	No
Blue	Cherry	No

a) What is H (edibility | color)?

b) Which feature (color or flavor) has the larger mutual information with edibility? Draw the decision tree for predicting edibility that maximizes the information gain.

Q 8	The sales of a company (in million dollars) for each year are shown in the table below.		

x (year)	2005	2006	2007	2008	2009
y (sales)	12	19	29	37	45

a) Find the least square regression line $y = ax + b$.
b) Use the least squares regression line as a model to estimate the sales of the company in 2012.

OR

Consider the search graph below, where S is the start node and G1, G2, and G3
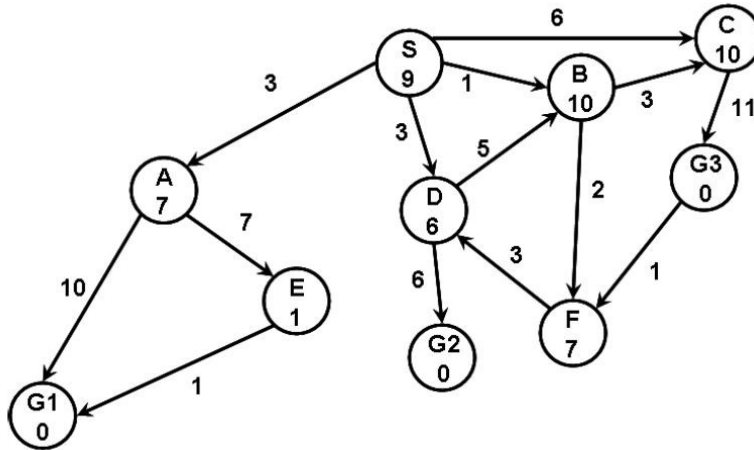
are goal states. For each of the three search strategies below, indicate which of the goal states is reached:
 • Breadth-first search
 • Uniform Cost Search
 • A* Search

(marks: 10, CO4)

| Q 9 | Solve the following Cryptarithmetic Problem:

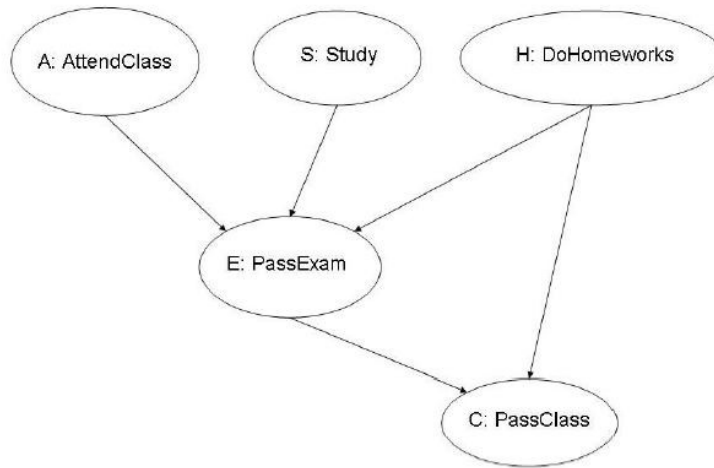 • If EVER + SINCE = DARWIN then D + A + R + W + I + N is? | 10 | CO1 |

SECTION-C
(2Qx20M=40 Marks)

Q 10	Write down the joint distribution as it factorizes according to the graph below.		

a) Use variable elimination and your result from the previous question to write down the expression for the probability of passing the class, given that you attend class and study, but don't do the home works.

b) Use the following CPTs for the graph of question 1 to compute $P(A|C,H)$.

$P(A) = 0.5$, $P(S) = 0.7$, $P(H) = 0.9$

A	S	H	$P(E|A, S, H)$
0	0	0	0.2
0	0	1	0.5
0	1	0	0.4
0	1	1	0.8
1	0	0	0.3
1	0	1	0.7
1	1	0	0.6
1	1	1	0.9

E	H	$P(C|E,H)$
0	0	0.1
0	1	0.4
1	0	0.3
1	1	0.9

OR

A constraint satisfaction problem (CSP) has four variables V1, V2, V3, V4, each with domain {1, 2}. The constraints for the problem require that given any three variables exactly one must have the value 1.

a) Explain how this problem can be represented as a CSP that uses only binary constraints. Illustrate your answer by giving a graph representing the problem.

(Right column values for this row: **20** , **CO2**)

Q 11	(a) If A and B are independent then ~A is independent of ~B. Show the calculation in support of your answer.		
	(b) Two students and B are both registered for a certain course. Student A attends the class 80% of the time. Student B attends the class 60% of the time. . Suppose there is also a student C who always comes to class if and only if student A or student B (or both) show up. You know that C came to class, what is the probability of A coming if you know that B showed up too?	**20**	**CO3**