No of Pages :4 Course Code :18XW62

Roll No:
(To be filled in by the candidate)

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS, MAY 2022

MSc – SOFTWARE SYSTEMS Semester : 6

18XW62 ARTIFICIAL INTELLIGENCE

Time : 3 Hours **Maximum Marks :100**

INSTRUCTIONS:

1. Answer **ALL** questions. Each question carries 20 Marks.
2. Subdivision (a) carries 3 marks each, subdivision (b) carries 7 marks each and subdivision (c) carries 10 marks each.
3. Course Outcome : Table

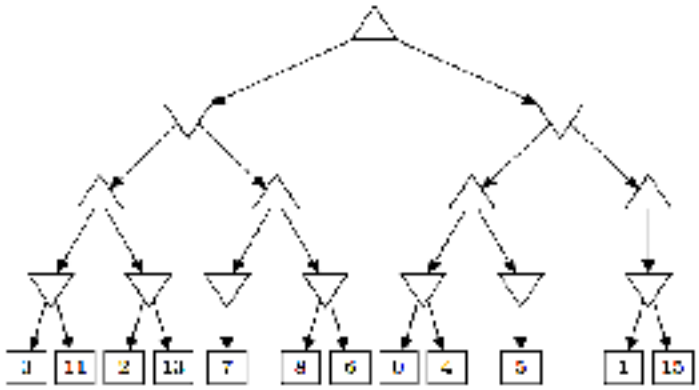
Qn.1	CO.1	Qn.2	CO.2	Qn.3	CO.3	Qn.4	CO.4	Qn.5	CO.5

1. a) Differentiate Stochastic and Deterministic environment. Give an example.

   b) i) Which of the following search techniques are complete and also optimal?

   Depth first Search, Iterative Deepening, A*, Depth limited search (3)

   ii) Perform alpha-beta pruning on the following tree. Assume that the nodes are expanded from left to right (4)



   c) Differentiate informed and uninformed search. Consider a state space where the start state is number 1 and the successor function for state n returns two states, numbers 2n and 2n+1.

   - Draw the portion of the state space for states 1 to 15
   - Suppose the goal state is 11. List the order in which node will be visited for breadth first search, depth limited search with depth limit 3 and iterative deepening search.

2. a) In constraint satisfaction problem why do we prefer the most constrained variable?

   b) i) Translate the following English sentences into first-order logic formulas: (3)

   - Every student takes a course.
   - Every student who takes Analysis also takes Geometry.
   - No student failed in Chemistry but at least one student failed in History

ii) Consider the following real variables from everyday life: (4)

X1: Income measured in Rupees.

X2: Speed measured in meters per second.

X3: A meal measured in how much you like to eat it.

X4: A traffic light measured in what colour is on

In each case, suggest a fuzzy variable corresponding to these real variables. For which of these four variables the use of a fuzzy variable is not practically feasible?

c) State principle of resolution. Apply resolution for the following sentences to answer the query "Is John happy"?

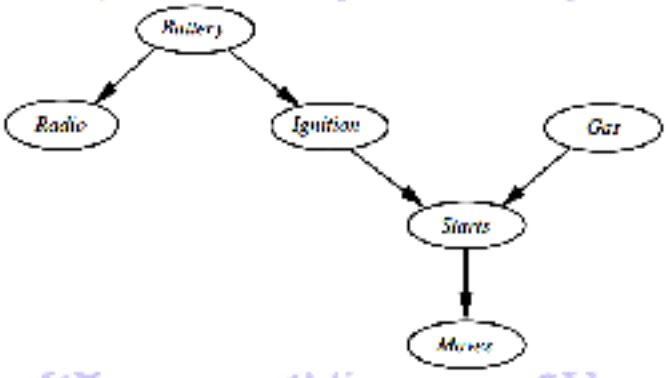
S1: Anyone passing his history exams and winning the lottery is happy.

S2: Anyone who studies or is lucky can pass all his exams.

S3 : John did not study but he is lucky

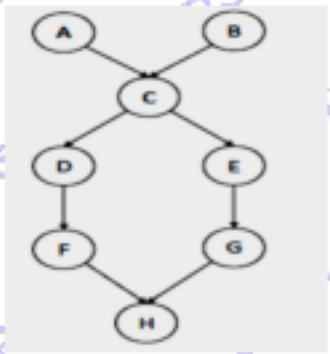
S4 : Anyone who is lucky wins the lottery

3. a) What is the significance of Markov blanket of a node? What is the Markov blanket of node 'Ignition'?

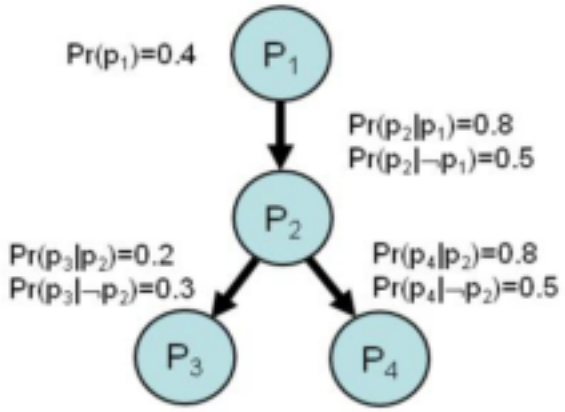


b) i) What do you understand by fuzzy implication? Consider two fuzzy sets A and B defined as A={(x1,0.1),(x2,0.8),(x3,0.3)} and B={(y1,0.5),(y2,0.8)}. Fuzzy implication (R) is defined as Imp(a,b)=min{1,1-a+b}. Calculate the value of Imp(x1,y1) and Imp(x3,y2). (3)

ii) What is d-separation? Find whether D and E are d-separated given evidence about both A and B? State reasons for your answer. (4)



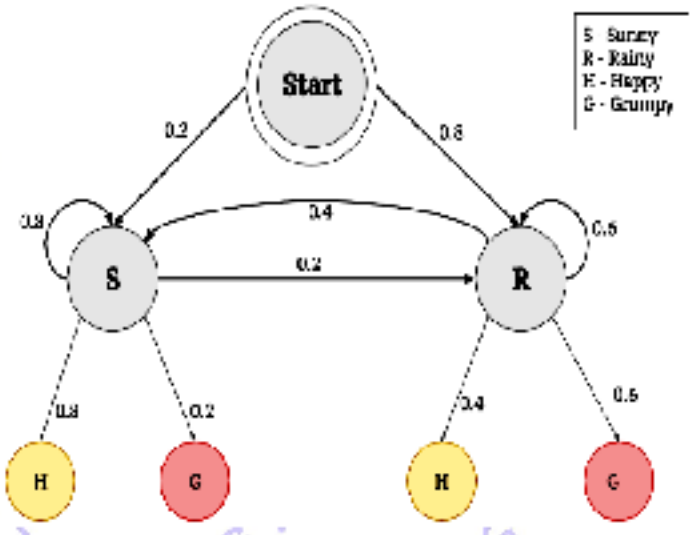
c) Consider the Bayesian network given below:



Calculate Pr(¬p3) using enumeration and variable elimination.

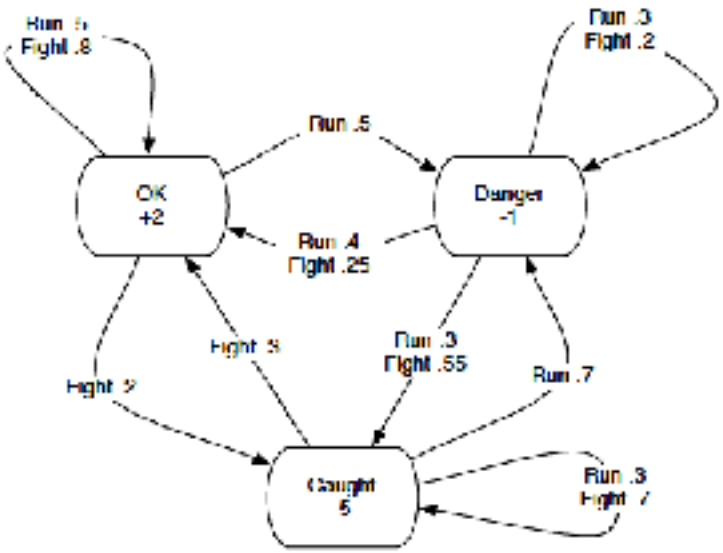
4. a) Assume there are two types of conditions: (S)inus congestion and (F)lu. Sinus congestion is caused by(A)llergy or the flu. There are three observed symptoms for these conditions: (H)eadache, (R)unny nose, and fe(V)er. Runny nose and headaches are directly caused by sinus congestion (only), while fever comes from having the flu (only). For example, allergies only cause runny noses indirectly. Assume each variable (S, F, A, H, R, V) is Boolean. Draw Bayesian network representation for this.

b) Discuss in detail the different components of Hidden Markov model (HMM).



Apply forward algorithm to find the probability of the observation "Happy Grumpy"

c) Describe 5 tuple representation of MDP. Consider the following MDP. A boy is being chased around the school yard by bullies and must choose an appropriate action as per the graph of MDP given below:

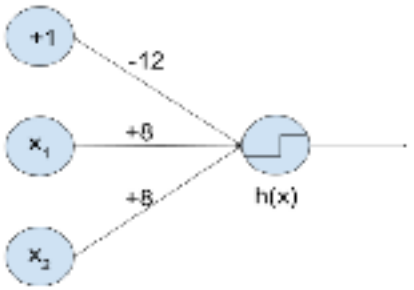


The actions are taken with equal probability. The values given along edges correspond to transition probabilities. Identify states, actions, rewards and write transition probabilities in the table given below:

s	s'	P(s, a, s')

5. a) Differentiate Exploration and Exploitation in Decision making.

b) i) Consider the following neural network which take two binary valued inputs x1, x2∈ {0, 1} and the activation is the threshold function (h(x) = 1 if x > 0; 0 otherwise). (4)



Does it compute AND gate, OR gate? How?

ii) Write the Bellman equations for state value function and state action value function. By taking an action from the state 'S', you will endup in 3 states S_1, S_2, and S_3 with probabilities p_1, p_2, p^3 respectively. Write Bellman equation for state value function (3)

c) Differentiate the document representation for Bernoulli NB classifier and Multinomial NB classifier. Consider the following documents and the query.

D1: "Algorithm Data Analysis Data " : C1

D2: "Algorithm Data Analysis File Data Analysis" : C1

D3: "Data Analysis Algorithms Data " : C1

D4: "Data File Algorithm File System" : C2

Query: "Data System File System"

Apply Multinomial NB classifier to classify the query.

FD/RL /END/