Roll Number:_____

Thapar Institute of Engineering & Technology, Patiala

Department of Computer Science and Engineering

END SEMESTER EXAMINATION

B.Tech COE (2nd Year)
Time: 3 Hrs
MM: 80
Date: 16/05/23

Semester - IV (2022/23)
Course Code: **UCS411**
Course Name: **Artificial Intelligence**
Name of Faculty: SWT, JYT, ABJ, VAS, GVJ

Q.1 A U = {flee, snur, thinga} Where F(x): x is a flee S(x): x is a snur T(x): x is a thinga 6
Translate the following sentence into predicate logic.

1. Nothing is a snur.
2. If any flee is a snur then it is also a thinga."
3. Some flees are thinga.

Q.1 B Show a conceptual dependency representation of the following sentence. 4

1. Yesterday, Hema ate the ice-cream with a spoon
2. Amit killed Rahul by throwing stones at him.

Q.2 Using LISP, Write the function *nth*, which takes a positive integer *N*, and a list *L*, and returns the element at the *N*th position in the list. (Yes, I know that *nth* is built into CL, but pretend it isn't for this problem.) You may assume that 1 <= *N* <= length of the list. In other words, don't worry about an out-of-bounds index. Your function must be recursive. 10
Eg. (nth 2 '(joe bob bill)) => bob

Q.3 Consider the following information about John, Mary, Frank, Jane, sports, and friendships. 10

Golfers like swimmers. Skiers like golfers. Mary likes John. John is a skier. Frank is a golfer. Jane is a swimmer. If X Likes Y, and Y Likes Z, then X Likes Z.

a) Use the predicates likes/2, golfer/1, swimmer/1, skier/1, mary/0, john/0, frank/0, and jane/0 to translate the above information in PROLOG clauses. The clauses should be ordered exactly according to the order of the above sentences.

b) Assuming your clauses are in the database in the proper order, show PROLOG's response to the following query. (Ask for every solution and explain your answer carefully.) ?- likes(mary, X).

Q. 4 For the following examples, determine their type of their task environments in terms of: Agents, Deterministic, Episodic, and Static in TABULAR form. 10
Examples: 1) Image Analysis 2) Interactive English Tutor 3) Crossword-Puzzle 4) Medical Diagnosis 5) Chess with a clock

Q. 5 Consider the following 3-SAT problem with six clauses: 10
$F=(a \vee b \vee c) \wedge (\neg a \vee \neg b \vee c) \wedge (\neg b \vee \neg d \vee \neg e) \wedge (\neg a \vee \neg c \vee \neg e) \wedge (\neg c \vee \neg d \vee \neg e) \wedge (\neg b \vee \neg c \vee \neg d)$. Using initial candidate solution as (11111), show first two iterations of simulated annealing using T=100000 and ΔT=1000. Accept every good move and accept a bad move if the probability is greater than 40%.

Q6. What is a decision tree and for which kind of problems decision trees are most suitable? Use the dataset below to learn a decision tree that predicts the output (Yes or No), based on the given three attributes T1, T2, T3. 10

Sample	T1	T2	T3	Output
1	True	Hot	High	No
2	True	Hot	High	No
3	False	Hot	High	Yes
4	False	Cool	Normal	Yes
5	False	Cool	Normal	Yes
6	True	Cool	High	No
7	True	Hot	High	No
8	True	Hot	Normal	Yes
9	False	Cool	Normal	Yes
10	False	Cool	High	Yes

Determine the followings: -

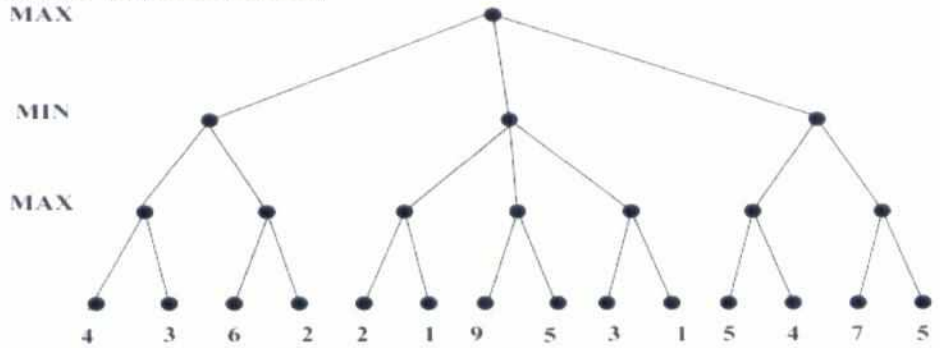
a) Entropy of the Output variable =?

b) *Gain* $(S, T3)$ =?

c) *Gain* $(S_{True}, T2)$ =?

d) Final Decision Tree.

Q.7 Apply alpha-beta pruning on the following tree by showing all intermediate values. Draw a cross on the pruned branches. 10



Q.8 A Suppose you are given the following set of data with three Boolean input variables a, b, and c, and a single Boolean output variable K. According to the naïve Bayes classifier, calculate: 5

a	*b*	*c*	*K*
1	0	1	1
1	1	1	1
0	1	1	0
1	1	0	0
1	0	1	0
0	0	0	1
0	0	0	1
0	0	1	0

a) P(K=1|a=1∧b=1∧c=0).

b) P(K=0|a=1∧b=1).

c) P(K=0|a=1∧b=1).

d) P(K=1|a=1∧b=1∧c=0).

e) In an unrelated example, imagine we have three variables X, Y, and Z. Imagine I tell you the following P(Z∧X)=0.2, P(X)=0.3, and P(Y)=1. Do you have enough information to compute P(Z|X∧Y)? If not, write "not enough info". If so, compute the value of P(Z|X∧Y) from the above information.

Q.8 B Define the following planning problem in Planning Domain Description language (specify predicates, objects, initial state, goal specification, action schemas). There are three locations, L1, L2, and L3, and two boxes, B1 and B2. A robot can push a box x from location y to location z, provided the box and the robot are at y and y is different from z. A robot can move from x to y if it is at x and x is different from y. The actions are: Push(x, y, z) (push x from y to z) and Move(x, y) (move from x to y). In the initial state, B1 is at L1 and B2 is at L2, and the robot is at L3. The goal is to have all boxes at L3. 5