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Q2

c) formulate and trace the constraint satisfaction procedure for solving the following cryptarithmetic problem

CLIMB + HIGH = MAKALU

=) TO Solve the cryptarithmetic problem CLIMB + HIGH = MAKALU:

Initial state

C_5	C_4	C_3	C_2	C_1
	C	L	I	M	B
	+	H	I	G	H
M	A	K	A	L	U

$\therefore C_5 = 1$, $C_4 = 1$

Now,

$M = 1$ So,

C	L	I	1	B
+	H	I	G	H
1	A	K	A	L	U

~~Now, C+H = U~~

~~So, since M+H = 0+9 = 9,~~

~~9 means, U must be 9.~~

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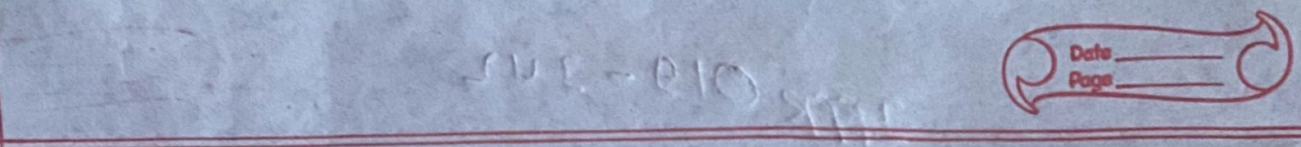

```
  C L I L B
+   H I M G
-----------
    L G
```

$C_4 = 1$

```
  C4 C3 C2 C1
   C  L  I  L  B
+  H  I  M  H
-------------
1  A  K  A  L  U
```

⇒ $C = 9, A = 0$

~~C5 C4~~

```
   9  L  I  L  B
+  H  I  M  H
-------------
1  0  K  0  L  U
```

⇒ $I = 5$

```
   9  L  5  L  B
+  H  5  M  H
-------------
1  0  K  0  L  U
```

⇒ $L = 8$

$H = 4$.

```
   9  8  5  L  B
+  4  5  M  4
-------------
1  0  3  0  8  U
```

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C=7, B=2, V=6

$$\begin{array}{r} 9\ 8\ 5\ 2\ 7 \\ +\ 4\ 5\ 7\ 4 \\ \hline 1\ 0\ 3\ 0\ 8\ 6 \end{array}$$

H/W

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Q4

d) Plateaux, peaks and ridges all cause problems for hill to climbing search.

=) In the context of hill climbing search algorithms, terms "plateaux", "peaks", and "ridges" collectively highlight challanges that arises due to the topographical features of search spaces.

① Plateaux (flat areas):
- Lack upward gradients
- Challenge hill climbing algorithms there's no directions for improvement.
- without a gradient to follow, algorith can becomes stuck in plateaux, unabl to proceed towards higher point in search space.

② Peaks (Optimal solutions):
- Represent high points in the search space.
- Algorithms might struggle if stuck on a local peak unable to explore further for a global optimum.

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③ Ridges (Elevated Regions):

- Extended elevated areas in the search space.
- Continous rise along a ridge can hinder exploration of alternative potentially better paths.

So, these above features creates difficulties for hill climbing algorithms by limiting gradient information, trapping them on local optima or hindering exploration along elevated regions.

Q2

(c) What is minimax search for game playing? Explain the minimax algorithm with a suitable example and discuss how alpha-beta pruning works

=) The minimax algorithm serves as a strategic decision-making approch employed in games involving two players, like chess or tic-tac-toe.

It's primary goal is to minimize potential losses in face of the worst-case scenario

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This algorithm operates on the assumption that the opponent will strategically make optimal moves to maximize their own advantages.

NO-1,

the explanation of minimax algorithm with the suitable example.

① ~~mini maximi~~

① minimax Algorithm.

- maximizing player (max)

A player whose or who seeks to maximize their score.

- minimizing player (MIN)

A player who seeks to minimize the score.

The algorithm alternates between these players exploring possible moves and assigning a value to each moves based on outcome of game. The maximing player aim to maximize the ~~Each~~ score, while minimizing players aims to minimize it.

Example:

In a game like Tic-Tac-Toe, the minimax algorithm guides the max player ("x") to make moves maximizing the changes of winning,

while the MIN player ("O") strategically selects moves to minimize 'X's chances of victory. This back-and-forth dynamic shapes their gameplay as each player aims to outmaneuver other, illustrating algorithm's approach to decision-making in two player games.

Alpha-Beta pruning is a crucial optimization technique employed in ~~ra~~minimax algorithm, particularly in two player games. By strategically discarding branches in the game tree that cannot impact the final ~~dis~~ decision, this technique significantly reduces number of nodes that need evaluation. The algorithm employs two critical parameters, Alpha and beta, respresenting the minimum score for maximizing player and maximum score for the minimizing player..

During search process, if a branch's evaluation produces value worse than the current Alpha or Beta values, it gets pruned.

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Q2

d) Prove that "Fido will die" ~~for~~ from the statements that "Fido is a dog. All dogs are animals. All animals will die" using resolution refutation

=) To prove that "fido will die", from the statements that "fido is a dog", All dogs are animals. All animals will die" using Resolution refutation.

$$\forall x \, (Dog(x) \rightarrow Animal(x))$$

$$\neg Dog(x) \vee Animal(x)$$

Now, for each dog (x),
Therefore, if we have eight dogs, we would have eight clauses

(1) fido is a dog
$\neg$ fido $\vee$ Dog

(2) All 8 dogs are animals

$\neg Dog_1 \vee Animals_1, \; Dog_2 \vee Animals_2 \; \ldots \; \neg Dog_8 \vee Animals_8$.

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3) All Animals will die

$\neg Animal \vee Die$

Now, let's negate.

'fido will die'

$(fido \rightarrow Die)$,

which is equivalent to

$fido \wedge \neg Die$.

Convert this negated conclusion to Clause form

fido, $\neg$ Die.

Now add all clause together.

$\neg fido \vee Dog$

$\neg Dog_1 \vee Animal_8, Dog_2 \vee Animal_2 \rightarrow \neg Dog_8 \vee Animal_8$

$\neg Animal \vee Die$

fido

$\neg$ Die.

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Q3

a) What is machine learning? Discuss the difference between Regression, Classification and Clustering in machine learning?

=> Machine learning is a part of artificial intelligence that focuses on developing algorithms and the models that enable computer learning ~~to~~ from the data and make the predictions or decisions without being explicitly programmed.

The difference between regression, classifications and clustering in ML.

	Regression	Classification	Clustering.
1)	predict continuous output based on input features.	predict category or class based on past observations	group similar data point into clusters.
2)	predicting a numerical value given characteristics	sorting items into predefined categories based on attributes	organizing a table of data into groups based on similarities without predefined tables
3)	It input features and target values	It input features and classes	input features only.

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	Regression	Classification	Clustering
4)	It is continuous	Discrete (categories/classes)	no predefined labels.
5)	~~mat~~ metrics like mean squared error	Accuracy, precision, Recall, f1-score	Internal (cohesion, seperation.
6)	It is used as stock price prediction, sales forecasting	It is used as Image classification, sentiment analys	It is used as Anomaly de tc on Custore segmentat
7)	predicting house prices based on size, location etc.	Identifying spam emails is based on content and features	Grouping customers base on purchasing behavior.

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Q3
d)
Ans:-

Q4
c) Intelligent Agent and Rational Agent

An Intelligent agent is a system that perceives its environment and takes actions to achieve specific goals. It can be anything from a simple automated system to complex artificial intelligence.

On the other hand, a rational agent is an intelligent agent that makes decisions to achieve the best outcome based on its knowledge and reasoning. Rationally involves choosing actions that maximize the expected performance measure, considering the information available.

d) Partition Semantic Networks.

=> A Partition Semantic network is a type of knowledge representation system that organizes information into distinct partitions or categories. Each partition contains concepts related to a specific domain or topic. This helps in structuring and managing knowledge making it easier to navigate and retrieve information.

The partitions are interconnected through semantic relationships, providing a comperehensive view of relationship between different concepts within particular knowledge domain.

Q3

d)

=> Solution:

Hight	weight	T-Shirt size
1.52	55	S
1.58	59	S
1.54	62	M
1.63	62	M
1.60	63	L
1.65	65	L

According to the question. we know.
test value is Height = 1.56 and.
weight = 64 kg.

Let, suppose the value of K = 3

So, now,

Hight	weight	$\sqrt{(\text{Height}-1.56)^2+(w-64)^2}$ distance
1.52	55	$(9.64)\sqrt{(1.52-1.656)^2+(55-65)^2}$
1.58	59	5.416
1.54	62	3.162
1.63	62	6.325
1.60	63	2.236
1.65	65	3.162

now, again.
Sorting above according to the negative.

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Height	weight	distance	T-Shirt size
1.52	55	9.611	S
1.63	61	6.325	M
1.58	59	5.416	S
1.54	62	3.162	M
1.65	65	3.162	L
1.60	63	2.236	L

By Choose K=3,

now, Consider the three smallest distance.

So,	1.60	63	L
	1.65	65	L
	1.54	62	M

where,

majority of 'L' is two and 'M' is one

So, the predict T-shirt size as 'L' for the height 1.58 meters and weight of 60kg is 'L'