

Example 1

I. Describe and (preferably) draw the main differences between:

a) simple reflex agents	b) agents that keep track of the world	c) goal-based agents	d) utility-based agents
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II. Classify the following systems into one of above given classes a) - d), like, for example, 1a (*not correct* :-) etc. :

- 1) complex decisions making systems
- 2) planners
- 3) belief networks
- 4) systems, using situation calculus and diagnostic or causal rules
- 5) theorem provers
- 6) searching systems
- 7) production systems

Example 2

Often we say that the space complexity of breadth-first search is $O(b^d)$ and the space complexity of depth-first search is $O(bl)$. What do b, d and l stand for?

Example 3

Suppose that you have the following small family tree in *Prolog*:

```
parent(philip,charles).
parent(philip,anne).
parent(charles,william).
```

Further, you have the following recursive definition of **ancestor**:

```
ancestor(X,X).
ancestor(X,Z) :- parent(X,Y),ancestor(Y,Z).
```

Now a user comes and issues the query: `?- ancestor(A,B).`

Each time that *Prolog* returns an answer, the user inputs ";" i.e. asking for another possible answer. What answers does *Prolog* return, and what is their exact order?

Example 4

Consider the following set of rules that describe when a person can vote in a presidential election:

```
R1: IF ?x was born in the US THEN ?x is an American
R2: IF ?x received US citizenship THEN ?x is an American
R3: IF ?x's age >= 18 THEN ?x is an adult
R4: IF ?x is American AND ?x is an adult THEN ?x can vote
```

Assume that the operator ">=" is a basic operator for the inference engine. The working memory contains the following assertions:

```
A1: Bill's age is 16.
A2: Sue received US citizenship.
A3: Bill was born in the US.
A4: Sue's age is 20.
```

Use backward chaining (*BC*) to determine whether or not Bill can vote. Construct a tree showing the steps followed by *BC* and show when and how the working memory is updated during the depth first search. Mark tree edges with the numbers of applied rules.

Example 5

For the below given table of examples find the best attribute for the root node of a corresponding decision tree and justify your solution. Available attributes are *texture*, *temperature* and *size*, the corresponding classification is under the column *class*

texture	temperature	size	class
Smooth	cold	large	yes
Smooth	cold	small	no
smooth	cool	large	yes
smooth	cool	small	yes
smooth	hot	small	yes
wavy	cold	medium	no
wavy	hot	large	yes
rough	cold	large	no
rough	cool	large	yes
rough	hot	small	no
rough	warm	medium	yes