

Due: September 14

Note: for those who have not used LISP before, there will be a LISP Tutorial on Tuesday Sept 7 at 6:15 in CBS 703.

Note: This assignment assumes you have knowledge of AI search techniques. If you have not, you should read a chapter in an introductory AI text.

Write a program that can compute whether a proposition follows from a set of facts in a knowledge base. In this assignment we will be working with a very restricted knowledge base consisting only of *Horn Clauses* involving atomic propositions. Propositions can be any legal LISP atom, and a Horn Clause is a list of form

$$(X \Leftarrow Y_1 \dots Y_n)$$

which means that if Y_1 through Y_n can be shown to be true, then X is true.

We can assert that certain propositions are unconditionally true simply with a Horn clause with no right hand side. For example

$$(X \Leftarrow)$$

states that X is true.

1. Write a function called `ASSERT` that takes a Horn clause and adds it to the knowledge base. e.g., `(ASSERT '(X \Leftarrow Y))` will add the Horn clause $(X \Leftarrow Y)$ to the knowledge base. Make sure your `ASSERT` function verifies that its argument is a legal Horn clause and do not add the clause to the data base if it is not. In your documentation, describe the range of inputs that are rejected by your function, and why. You should reject all clauses that are either ill-formed syntactically, or that you know would never be needed to contribute to any proof.

2. Write a function `PROVE` that takes a takes a proposition and returns `T` or `NIL` indicating whether the proposition follows from the knowledge base. For example, `(PROVE 'X)` should return `T` only if X follows from the knowledge base. For full credit, your function should be guaranteed to terminate no matter what the clauses are added to the database (using your `ASSERT` function), and return `T` if and only if the proposition truly follows from the knowledge base.

Example Session:

```
> (ASSERT '(X  $\Leftarrow$  Y Z))
```

```
OK
```

```
> (ASSERT '(Y  $\Leftarrow$  Z))
```

```
OK
```

```
> (PROVE 'X)
```

```
nil
```

```
> (ASSERT '(Z  $\Leftarrow$ ))
```

```
OK
```

> (PROVE 'X)
T

In your documentation, argue why your PROVE program will terminate not matter what the contents of the database.

You will need to hand in your program for automatic testing. Instructions for this will be available shortly on the course website. In addition, there will be notes on programming style and documentation.

Policy on Assignments

Assignments are due by 5 PM, and should be placed in the TA's mailbox (Note also the mailroom is usually locked at 5). Late assignments will be assessed at 10% penalty for each 24 hours (or portion thereof) after the due date.