Logical Agents

The idea is we'd like programs that are able to "reason" about their environment.

To do this, we need to be able to represent the environment and then come up with algorithm to "reason" about this representation.

The representation of the environment is called a <u>Knowledge base</u> in AI.
We should consider this as a collection of statements which are true about the world.

Often knowledge bases are very similar to databases.

Two things we want to be able to do with a knowledge base.

- Tell it new facts (update/tell process)
- Ask questions about the world (query)

Knowledge bases might contain more than just facts (so can represent things more succintly)

Flies(x) :- bird(x)	:- means that if the right holds, then so does the left
bird(albatross)	this is a fact statement corresponding to a row in a table called bird.

If we ask the following

? – flies(albatross)	This should return yes

Most knowledge bases we will consider are based on some type of logic.

For each logic we need to specify two things.

- Syntax – How legal statement in that logic are created.
- Semantics – What is the meaning of the legal statement.

<u>Classical Logics</u>

1 Propositional Logic

Language consists of constants true and false
Variables (x1, …, xn, etc…)
(Intuition values range over True and False)
Connectives: (and, or, not)
Parenthesis

<u>Syntax:</u>
The following are propositional formulas

true
false
xi for any i
if φ and are propositional formulas, then so are

i) NOT(φ)
ii) (φ AND ψ)
iii) (φ OR ψ)

Example 1
((x1 AND x2) OR x3) is a propositional formula

Need to give semantics

Definition: A truth assignment (a model) is a function which maps variables to true or false.

Example 2
In Example 1 above, ν could be a truth assignment which maps x1 to true, x2 to false, and x3 to true.
We can now evaluate the value of the expression.
The true or false meaning of a propositional formula φ in a given model ν is defined by:

1. ν (xi) if φ is xi .
2. false if φ is NOT(ψ) and ν (ψ) is true
   true if φ is NOT(ψ) and ν (ψ) = false
3. false if φ is (ψ AND ς) and one of ν (ψ) or ν (ς) is false
   true otherwise
4. true if φ is (ψ OR ς) and one of ν (ψ) and ν (ς) is true
   false otherwise

Example 3, given ν as in Example 2 the $\nu(\varphi)$=true if φ is the formula of Example 1.