Logic based agents

Knowledge Base

- "sentences" not so apt
- Axioms and Inferences
- Representations:
  e.g. Fido is_a Dog; Dog is_a_kind_of Mammal, etc
- Associated with it but not part of it: Inference rules
- As usual, percepts are inputs, actions are the result
- Declarative versus Procedural

Example: the Wumpus world

- Apparently a wumpus is supposed to be some kind of dangerous monster
- A 4×4 grid or "rooms" representing a dark cave
- We (the agent) are exploring it
- Gold to be found in one room
- Some rooms (prob = 0.2) will contain deep pits: fatal to fall into
  but never at the start room [0, 0], facing East.
- One room (never the start) contains the wumpus: fatal to encounter
- Agent has a gun but only one bullet
- That is the Environment, for example:

3				Pit
2	Wumpus	Gold	Pit	
1				
0	Start		Pit	
	0	1	2	3

- Actions:
  Forward
  TurnLeft90
  TurnRight90
  Shoot, only in a straight line
  Grab, to pick up the gold, when you are in the same room as it
  Exit, only from [0, 0] to get out of the cave
- Sensors give these percepts
  If adjacent to the wumpus: Stench
  If adjacent to a pit: Breeze
  If in the same room as the gold: Glitter
  If you walk into a wall: Bump
  If you kill the wumpus: Scream
- Performance measure
  +1000 for escaping with the gold
  -1000 for getting killed
  -1 for each action taken
  -10 for firing the gun

At start [r=0,c=0], inputs = { }, deduce [0,1] and [1,0] must be safe. Forward
at [0,1], inputs = {Breeze}, deduce [1,1] or [0,2] must have pit, Left Left Forward
back at [0,0], only safe room reachable is [1,0], Left Forward
at [1,0], inputs = {Stench}, deduce wumpus in [2,0] and no pit in [1,1],

therefore pit in [0,2]. So [1,1] is safe, Right Forward

- The facts don't change but our knowledge of them does, monotonically

Fundamental logic

- Syntax defines what the Well-Formed Formulæ (always wff) are
- Semantics defines the truth of each wff in each Model
- Model = possible world
- Every wff is either true of false in every model
- If a wff w is true in a model m, then m Satisfies w
- Entailment: $\vdash$syntactic, $\models$ semantic
- A $\models$ B means in every model where A is true, B must also be true
- A $\vdash$ B means that B can be derived from A by following the rules
- Inference discovers wffs that are entailed by existing known wffs.
- Soundness: inference algorithm can only find true things
- Completeness: anything that's true can be inferred
- Gödel (or Goedel)