

**AI2 Module 4**  
**Tutorial 1: Notes on Solutions**  
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## 1 Agent Types and their Environments

### 1.1 Find Common Sense Agents

There are many possible answers to this question. Here are some suggestions.

**Examples:**

**simple reflex:** Venus Fly Trap

- environment: The bogs of North and South Carolina, USA
- percepts: light, fly touching a trigger hair twice
- actions: move towards sun, close trap immediately after double touch
- model: none
- goals: none
- utilities: none

**model-based reflex:** Fly

- environment: meadows, houses, etc.
- percepts: light changes through eye facets, legs touching the ground, temperature change
- actions: flap wings, walk around, suck food, land on venus fly traps, etc.
- model: short history of previous environmental situations and actions, state of hunger, tiredness, fear, *etc.*
- goals: none
- utilities: none

**goal-based:** Autopilot in airplane

- environment: airplane control
- percepts: height, speed, position (GPS), radar control from airport
- actions: change positions of flaps/elevator/aileron
- model: model of world for navigation, history of actions, self-model of position, orientation and control settings.
- goals: reach given target position/height/speed
- utilities: none

**utility-based:** Taxi Driver Agent

- environment: city traffic

- percepts: 7 senses
- actions: control car, talk to passenger
- model: world model for navigation, history of recent actions, has passenger paid, *etc.*
- goals: reach provided destination
- utilities: try to reach goal as fast as possible or travel least distance.

**learning:** Taxi Driver Agent able to update Knowledge

- environment: as before
- percepts: as before, plus receives directions from passenger
- actions: as before, plus can update model of world
- model: as before,
- goals: as before, plus increase Knowledge
- utilities: as before, plus maximise Knowledge

## 1.2 The DVD Playing Agent

a) The DVD player is a model-based reflex agent.

b)

- environment: Living room, usually private use. From time to time users give input via buttons or remote control.
- percepts: pressed buttons, remote control signals, push of front loader.
- actions: open and close front loader, put information on display, play DVD, output sound and video signals
- model: various depending on DVD type, e.g. disc loaded or not, current position in film, user preferences on language, subtitles or not, ...
- goals: none
- utilities: none

## 2 The Wumpus World

### 2.1 Propositional Rules

a)

- $\neg(W_{i,j} \wedge P_{i,j})$
- $V_{i,j} \Rightarrow OK_{i,j}$
- $W_{i,j} \Rightarrow (S_{i,j} \wedge S_{i-1,j} \wedge S_{i+1,j} \wedge S_{i,j-1} \wedge S_{i,j+1})$

## 2.2 Changing Wumpus World

a) New variables:

**bomb:**  $BO_{i,j}$  for all  $i, j \in \{1, \dots, n\}$  on a  $n \times n$  board.

**sound:**  $T_{i,j}$  for all  $i, j \in \{1, \dots, n\}$ .

b)

- $S_{i,j} \Leftrightarrow (W_{i-1,j} \vee W_{i+1,j} \vee W_{i,j-1} \vee W_{i,j+1})$   
is still valid because the new hazard does not interfere with the wumpus and its stench.
- $OK_{i,j} \Leftrightarrow (\neg W_{i,j} \wedge \neg P_{i,j})$   
Not valid anymore because there might also be a bomb. Revised version:

$$OK_{i,j} \Leftrightarrow (\neg W_{i,j} \wedge \neg P_{i,j} \wedge \neg BO_{i,j})$$

c)

- There is a ticking sound on squares adjacent to a bomb.  
 $BO_{i,j} \Leftrightarrow (T_{i-1,j} \wedge T_{i+1,j} \wedge T_{i,j-1} \wedge T_{i,j+1})$
- If the agent is, for instance, facing north in square  $(i, j)$  and the square north of it contains a bomb, and the agent knows that the wumpus is in some square next to the bomb then it should shoot a bullet.

$$\begin{aligned} & NORTH_{i,j} \\ & \wedge BO_{i,j+1} \\ & \wedge (W_{i-1,j+1} \vee W_{i+1,j+1} \vee W_{i,j+2}) \\ & \Rightarrow SHOOT \end{aligned}$$