

Foundations of Artificial Intelligence

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Exercise Sheet 10

Due: Tuesday, July 13, 2010

Exercise 10.1 (Wumpus World & Resolution)

Consider the following situation in the wumpus world:

1,3	2,3	3,3
1,2 S	2,2	3,2
1,1	2,1 B	3,1

Cells that are marked grey have already been visited while all others have not. The percepts in the cells are marked by the letters B (*breeze*) and S (*stench*).

- Formalize the general connection between breeze and pits using propositional logic. To do so, use 9 propositional variables $B_{i,j}$ and 9 propositional variables $P_{i,j}$.
- Show by *resolution* that, in the given situation, cell (3,1) contains a pit. That is, show that $\text{KB} \models P_{3,1}$ while the knowledge base KB contains the logical expressions of part (a) and the percepts of the agent. Take into account that cells that have been visited do not contain pits. If necessary, transform the knowledge base into clause form.

Exercise 10.2 (Davis-Putnam Procedure)

Use the Davis-Putnam procedure to compute models for the following clause sets or to prove that no model exists. Whenever possible, apply the *pure symbol heuristic* (i.e. assignment of the corresponding value to variables always occurring with the same polarity) and *unit propagation*. At each step, indicate which rule you have applied.

- $\{\{P, \neg Q\}, \{\neg P, Q\}, \{Q, \neg R\}, \{S\}, \{\neg S, \neg Q, \neg R\}, \{S, R\}\}$
- $\{\{P, Q, S, T\}, \{P, S, \neg T\}, \{Q, \neg S, T\}, \{P, \neg S, \neg T\}, \{P, \neg Q\}, \{\neg R, \neg P\}, \{R\}\}$

Exercise 10.3 (Modeling in First-Order Logic)

Represent the following sentences in first-order logic, using a consistent vocabulary.

- Some students attend an AI exercise group.
- Every student who attends an AI exercise group passes the AI exam.
- There is exactly one AI exercise group held in English.

The exercise sheets may and should be handed in and be worked on in groups of three (3) students. Please fill the cover sheet¹ and attach it to your solution.

¹<http://www.informatik.uni-freiburg.de/~ki/teaching/ss10/gki/coverSheet-english.pdf>