Informatics 2D. Tutorial 5
Resolution and Situation Calculus

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Week 6

1 Resolution

From “Horses are animals” it follows that “The head of a horse is the head of an animal”. Demonstrate that this inference is valid by carrying out the following steps:

1. Translate the premise and the conclusion into the language of First-Order Logic. Use three predicates: HeadOf(h, x) (meaning “h is the head of x”), Horse(x), and Animal(x).
2. Negate the conclusion, and convert the premise and the negated conclusion into Conjunctive Normal Form.
3. Use resolution to show that the conclusion follows from the premises.

2 Situation Calculus

Last week you learnt about the frame problem and you were shown how it can be fixed by adding frame axioms.

Consider the following predicates and functions:

1. At(sq, s) means that the agent is at square sq in situation s.
2. Heading(dir, s) means that the agent is facing in direction dir in situation s.
3. Next(sq1, dir, sq2) means that square sq2 is adjacent to square sq1 in direction dir.
4. Result(act, s) is the situation resulting from executing the action act in situation s.
5. Turn(x) is the action of turning x where x ∈ {left, right}.
6. Shoot is the action of shooting once forward.
7. \( \text{Newdir}(\text{dir}1, x, \text{dir}2) \) means that \( \text{dir}2 \) is the new direction the agent will face if it is facing in direction \( \text{dir}1 \) and turns \( x \in \{\text{left, right}\} \).

8. \( \text{Wumpus}(sq, s) \) means that the Wumpus is in square \( sq \) in situation \( s \).

In the following we assume that the action \( \text{Shoot} \) only has an effect in directly adjacent squares.

a) Formalise a precondition and an effect axiom for the Wumpus World that best describes the action \( \text{Turn}(x) \).

b) Formalise a precondition and an effect axiom that best describes the \( \text{Shoot} \) action in the Wumpus World.

c) Formalise a frame axiom that best describes the \( \text{Shoot} \) action in the Wumpus World. You only need to do this for the \( \text{Wumpus} \) fluent.