

# General Purpose Propositional Logic Inference Engine

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## Problem Statement

Machines that can infer knowledge given a fact or series of facts are becoming increasingly important. This project solves the problem of inference using propositional logic as opposed to first order logic, and proof by contradiction using Java as the programming language.

## Existing resources and prior work

Knowledge base data structures and algorithms modified from: S. Cheng, A. J. Moon, Wumpus World: Logic and Partially Observable Environments, 2008, University of Waterloo, Canada.

Inference and resolution algorithms from: Artificial Intelligence: A Modern Approach, 3rd ed., S. Russel, P. Norvig, 2010, Pearson, USA

## Approach

For this exercise the programming language Java was used to implement all the classes and algorithms necessary. A small test bench for a Wumpus World was built to test the engine to see whether the engine inferred correctly by whether the agent behaved intelligently or not.

The knowledge base is a linked list structure containing trees of rules that contain facts in the leaves. For the inference the knowledge base is turned into its conjunctive normal form equivalent, the complementary of the fact being verified attached conjunctively, and a resolution algorithm run to resolve all the possible clauses. If the resolution contains an empty clause, then by proof of contradiction it has been shown that the fact in question can not possibly be false, so it must be true.

## Results

As it stands the engine is fully implemented and tests have shown it to infer correctly for simple things such as whether it has found gold or not. Important issues still open are inferring the locations of wumpuses and pits as these test most of the logical operators already implemented.