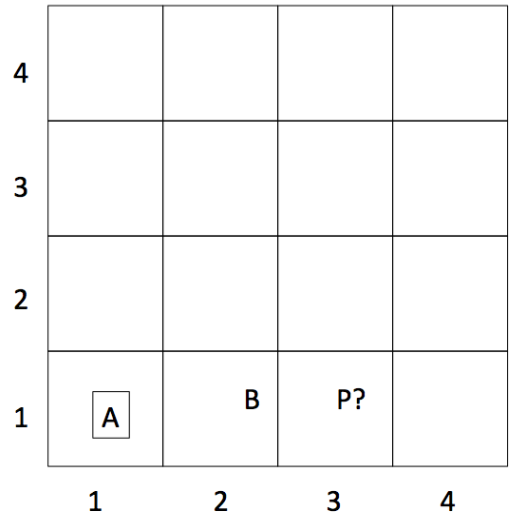
CS 3600 – Introduction to AI

Resolution

Consider the Wumpus world problem below. The world is a 4 x 4 grid with the agent in (1, 1). The Agent's knowledge base is given, where Bij means breeze in location (i, j), and Pij means pit in location (i, j).



¬P11
¬P21
¬P12
¬B11
¬B12
B21
B11 ↔ (P12 ∨ P21)
B21 ↔ (P11 ∨ P22 ∨ P31)
B12 ↔ (P11 ∨ P22 ∨ P13)

The Agent wants to know if there is a Pit in location (3, 1), i.e., P31.

Use Resolution to determine whether P31 is entailed by the knowledge base.

1. Convert the formulae in the knowledge base to conjunctive normal form.

2. Negate the conclusion and convert the conclusion to conjunctive normal form.

3. Draw out the resolution search space. Use the following heuristic:

Prefer clauses derived from the conclusion from smallest to largest (# of literals).
Next prefer clauses not derived from the conclusion, from smallest to largest.
Break ties in alpha-numeric order, e.g., B11, B12, B13, …, B21, B22, …, P11, P12, …

1. Convert the formulae in the knowledge base to conjunctive normal form.

¬P11

¬P21

¬P12

¬B11

¬B12

B21

B11 ↔ (P12 ∨ P21) becomes:
¬B11 ∨ P12 ∨ P21
¬P12 ∨ B11
¬P21 ∨ B11

B21 ↔ (P11 ∨ P22 ∨ P31) becomes:
¬P11 ∨ B21
¬P22 ∨ B21
¬P31 ∨ B21
¬B21 ∨ P11 ∨ P22 ∨ P31

B12 ↔ (P11 ∨ P22 ∨ P13) becomes:
¬B12 ∨ P11 ∨ P22 ∨ P13
¬P11 ∨ B12
¬P13 ∨ B12
¬P22 ∨ B12

2. Negate the conclusion and convert the conclusion to conjunctive normal form.

¬P31

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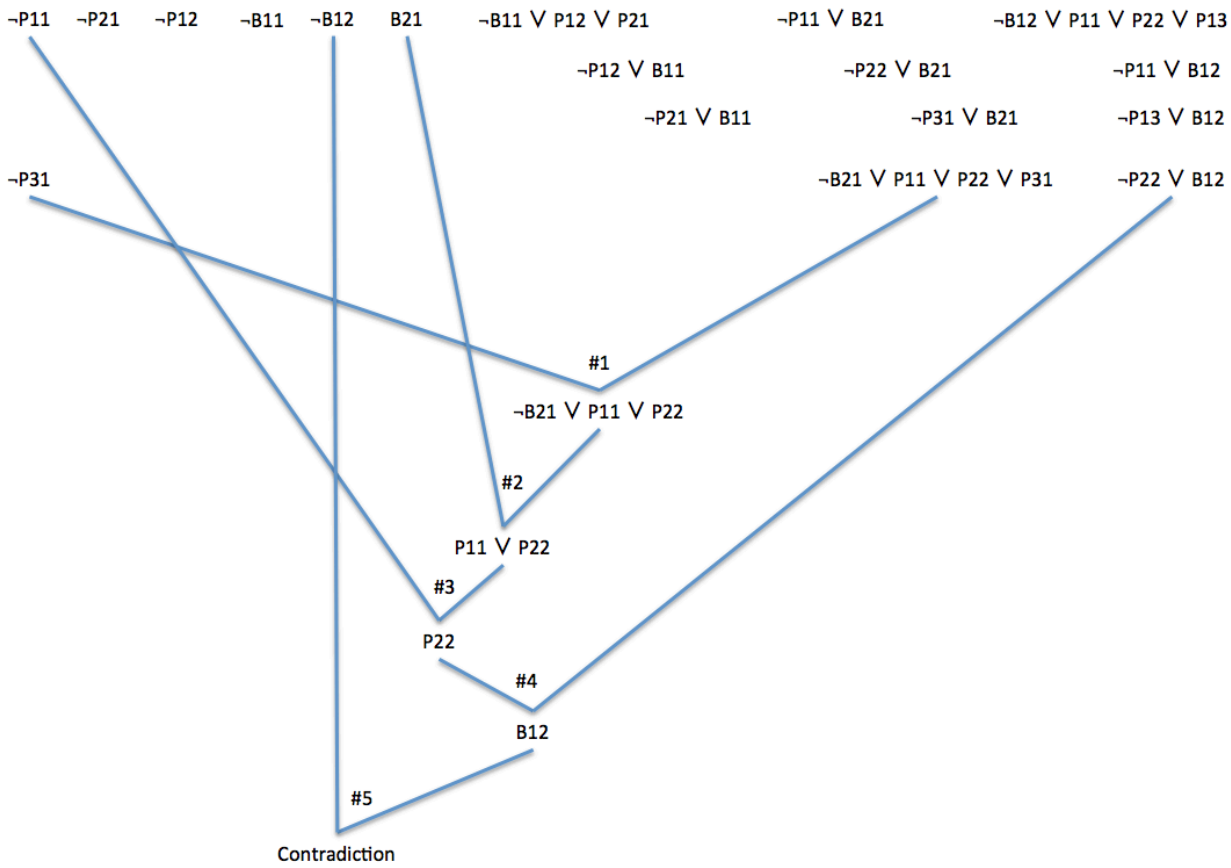

(I give the ordering of resolutions I used based on my interpretation of the heuristic. Other paths to contradictions exist as well.)