1. Assess the validity of the following generalised resolution rule (where more than two literals appear with different signs in the two clauses making up the premise)

\[ A \lor B \lor C; D \lor \neg B \lor \neg C \]

\[ \underline{A \lor D} \]

2. Convert the following simple knowledge base to CNF. Then use resolution to show that the knowledge base implies R.

\[ P \lor Q \]
\[ P \Rightarrow R \]
\[ Q \Rightarrow R \]

3. Can you decide (using models) whether unicorns are mythical?

*If the unicorn is mythical, then it is an immortal animal, but if it is not mythical, then it is a mortal animal. If the unicorn is either immortal or a mammal, then it is horned. The unicorn is magical, if it is horned.*

4. Translate the following set of sentences to CNF and then decide with resolution whether

\[ \neg A \land \neg B \]
\[ A \leftrightarrow (B \lor E) \]
\[ E \Rightarrow D \]
\[ C \land F \Rightarrow \neg B \]
\[ E \Rightarrow B \]
\[ B \Rightarrow F \]
\[ B \Rightarrow C \]

5. A simple two-player game has a board of four adjacent squares. Both players have one marker and start out at opposite ends of the board. If a marker is adjacent to the other marker it can jump over the marker. Otherwise, markers can move to the left and to the right (unless the move would remove them from the board. Draw the complete game tree, using the following conventions:

(a) Each state is written in the form \((i, j)\) with components indicating the position of the markers.
(b) Put terminal states into square boxes.
(c) Mark loop states in double square boxes. Annotate their values with a question mark
Mark nodes with its backed-up minimax value. How can you handle the question mark values?
Explain why the standard minimax algorithm would fail in this game. Show that A has a winning strategy.

6. Use hill climbing to find the value in \{(x, y) \mid x, y \in \{-5, -4, \ldots, 4, 5\}\} that maximizes

\[-93x - 14x^2 + 10x^3 - 148y + 123xy - 68x^2y + 20x^3y + 6y^2 + 22xy^2 - 29x^2y^2 + 10x^3y^2\]