1 Artificial Intelligence (SBH)

Consider the standard $3 \times 3$ sliding blocks puzzle.

![Sliding blocks puzzle](image)

The aim is to find a sequence of moves that re-arranges the puzzle to the state shown on the right, where each move involves sliding a single square into the empty space.

(a) Explain in detail how this problem can be treated as a planning problem by translating it into a Boolean satisfiability (SAT) problem. Your answer should address the following issues, and in each case should provide specific examples of the SAT representation:

(i) The representation of the start state and goal state. [4 marks]

(ii) The representation of the relevant actions using successor-state axioms. [4 marks]

(iii) The need for precondition axioms. [2 marks]

(iv) The need for action-exclusion or state-constraint axioms, and why one might be preferred over the other. [3 marks]

(v) The algorithm that can be used to employ a SAT-solver to solve a given sliding blocks problem, and the method for extracting a solution. [3 marks]

(b) You do not have a SAT-solver available. You do however have a solver for general local search problems. Explain how you might use the latter to solve the SAT problem obtained in Part (a). [4 marks]