



- 2.1** The stone puzzle is characterised as follows. Two white stones and two black stones are initially positioned on a board, as illustrated below. The board is composed of a single row of five squares, each of which can be either empty or hold one stone. The white stones can only move to the right and the black stones only to the left, either into an immediately adjacent empty square or by jumping over an adjacent stone of opposite colour into an empty square.



The problem is to exchange the respective positions of the white and black stones, moving them one at a time according to the rules above. Answer the following to solve this puzzle using a problem-solving approach:

- Give a well-defined formulation of the problem in terms of states, operators, goal test predicate, and path cost.
  - Give a concise representation of the search space, including only valid, reachable states, and ignoring symmetric portions of the space. Identify and highlight the solution path.
  - Determine the average branching factor of the search space, the depth of the solution, and the overall space complexity of the search. State accordingly which search algorithm is the most suitable.
- 2.2** The chain problem consists of re-arranging a set of chains of various lengths into another set as required. In the example shown below, the initial set comprises four non-circular chains of three links each, while the final set consists of a single circular chain of twelve links. The two possible operations consist of opening a closed link and closing an open link, respectively, as illustrated. Open links can be added to a non-circular chain at either end or else join both ends into a circular chain. Closed links can be removed without restriction.

Formulate this problem as a formal search problem for a problem solving agent.

