Artificial Intelligence

Exercise Sheet 1

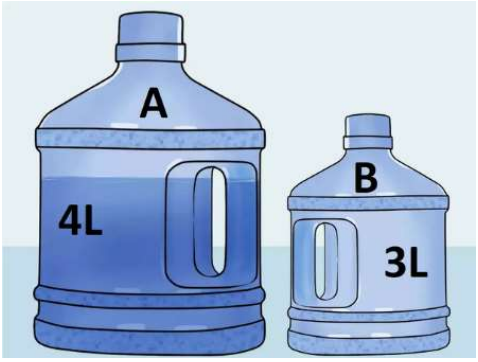
Formulation of Search Problems and Problem Solving using Uninformed Search

1. Problem Formulation and Solution Search

1.1 Two Buckets Problem

Two buckets, of capacities c1 (e.g. 4 liters) and c2 (e.g. 3 liters), respectively, are initially empty. Buckets do not have any intermediate markings. The only operations you can perform are:

- Fill (completely) a bucket
- Empty a bucket.
- Pour one bucket into the other (until the second one is full or until the first one is empty).



The aim is to determine which operations to carry out so that the first bucket contains *n liters* (e.g. 2 litres).

a) Formulate this problem as a search problem by defining the state representation, initial state, operators (their name, preconditions, effects, and cost), and objective test.
b) Solve the problem, by hand, using tree search.
c) Using a programming language of your choice, solve the problem by applying:
   (c1) Breadth-first search strategy.
   (c2) Depth-first search strategy (limited depth).
   (c3) Iterative deepening strategy.

1.2 Missionaries and Cannibals Problem

Three missionaries and three cannibals are on one of the banks of the river with a boat that only takes one or two people. The boat cannot travel the river alone. The goal is to find a way to get the six to the other bank of the river without ever leaving more cannibals than missionaries on one of the banks (even at the instant they leave/join the boat) during the process.

a) Formulate this problem as a search problem by defining the state representation, initial state, operators (their name, preconditions, effects, and cost), and objective test.
b) Solve the problem, by hand, using tree search.
c) Using a programming language of your choice, solve the problem by applying:
   (c1) Breadth-first search strategy.
   (c2) Depth-first search strategy (limited depth).
   (c3) Iterative deepening strategy.