

UNIVERSITY OF PATRAS
DEPT. OF COMPUTER ENGINEERING & INFORMATICS
ARTIFICIAL INTELLIGENCE
1st Assignment

1. Consider the well-known problem of the two jugs: “There are two jugs with capacities of 4 and 3 liters respectively and a tap. Initially, the two jugs are empty. We want to isolate in one of the two jugs 2 liters of water. The allowed actions are: fill in a jug with water from the tap, pour the water from a jug onto the ground, pour the water from a jug to the other jug, partially or wholly”.

Do the following:

- a) Define a structure to represent a (random) state of the problem and then define, based on that, (a1) the initial state, (a2) the final state(s) and (a3) the transition operators.
- b) Specify the state space of the problem. Are there any unreachable states? If yes, can they be determined?
- c) Define a cost function $g(n)$ and a heuristic function $h(n)$.
- d) Apply the first three steps of the algorithms: (d1) beam search and (d2) branch and bound, giving graphical representation of the corresponding search tree.

2. Consider the well-known problem of the cannibals and missionaries: “There are three missionaries, three cannibals and a boat at the one side of a river. We want to transfer all of them to the opposite side using the boat. To move the boat at least one person is required and the boat can transfer at most two persons at a time. Also, the number of cannibals should never exceed the number of missionaries at a side”.

Do the following:

- a) Define it as a search problem, i.e. specify a way to represent a state and determine the initial and final states, the transition operators, a cost function $g(n)$ and a heuristic function $h(n)$, if possible.
- b) Which of the known algorithms should be used in order to find (b1) any solution, (b2) all the solutions, (b3) the shortest solution and (b4) the best solution. Justify your answers.
- c) Apply the first three steps of the algorithm suggested in (b4) by drawing the corresponding part of the search tree.