Foundations of Artificial Intelligence

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Contents

1 Course introduction

There will be no online streaming. The course topics are basically the same as the previous editions of the course so you are welcome to watch the existing recordings that will be available throughout this course. The list of links to the recordings is available on the course page.

For the topics that are not covered by previous year recordings, or they have substantially updated, we will provide additional recordings. Note that these are not new topics. They were already included in the course plan last year, but we were unable to include them during the previous edition.

The course calendar is available on the instructors' WeBeep pages (https://webeep.polimi.it/)

1.1 Evaluation

Evaluation is based on closed-book written exams with open questions and numerical problems. The evaluation assigns up to 32 points The laude (30 e lode) is assigned when students receive 32 points in the written exam.

Sample exams are available on the WeBeep pages of the course. The course is quite new so older exams are partially representative of the questions you should expect in the exam. The textbook is also a good source of problems and exercises. Students can reject the assigned grade and repeat the exam. All the five exams will be in presence only. There is no other way to pass the exam or increase the grade assigned to the written exam

2 Lecture 2

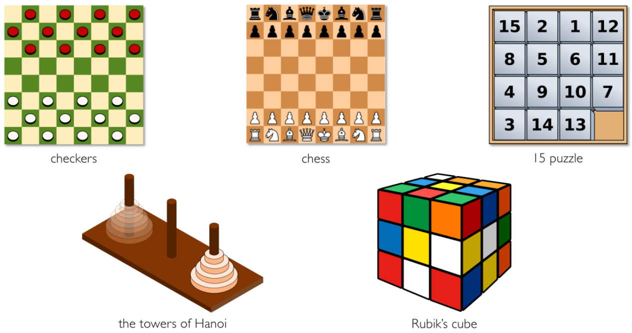
3 Problem solving by search

Problem formulation: Several real-world problems can be formulated as search problems. In a search problem, the solution can be found by exploring different alternatives.

Problem-solving agents are examples of goal-based agents

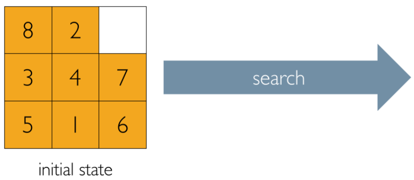
- Problem formulation
- Searching the solution
- Execute the solution

You have to start from a feasible situation, for example in the 8 problem not all configurations are solvable.



Examples of search problems.

3.1 Eight puzzle

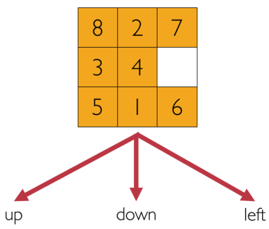


3.1.1 The states

We define a state as a feasible configuration of the 8 tiles on the 3x3 grid. The search for a solution is represented by a sequence of states in the state space.

3.1.2 The action() function

For the 8-puzzle we can define a function actions(s). The function actions(s) returns, given a state s, the actions that are applicable in that state. An action is represented by the movement of the blank position. In this case, actions(s) returns {up, down, left}



3.1.3 The result() function

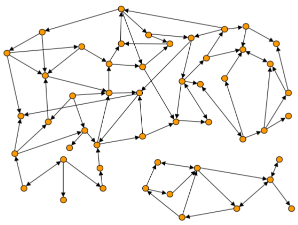
For the 8-puzzle, we can define a function result(s,a) that given a state s and an action a applicable in s, returns the state s' reached by executing a in s. State s' is a successor of s.

3.2 Search problems

A set of states S and an initial state s_0. The function actions(s) that given a state s, returns the set of feasible actions. The function result(s,a) that given a state s and an action a returns the state reached. A goal test that given a state s return true if the state is a goal state. A step cost c(s,a,s') of an action a from s to s'.

3.2.1 The state space

The space state is a directed graph with nodes representing states, arcs representing actions. There is an arc from s to s' if and only if s' is a successor of s



The solution to a search problem is a path in the state space from the initial state to a state that satisfies the goal test

Difference between the search tree and the state space. The state space is not saved anywhere, the search tree instead is saved and even represent a trace of state which correspond to the solution of the problem.

Question at the end of the lecture on why don't we always use the graph search rather than the tree search. The answer is that we have the closed list to mantain and if we use it with graph it becomes too big during the match duration. While the tree is very less expensive and it is more feasible.