GWV – Grundlagen der Wissensverarbeitung

Tutorial 2: State Spaces

Class Exercise 2.1: (Peg Solitaire)

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In peg solitaire (depicted above), you need to clear the board (with only one peg left) by repeatedly jumping with one peg over another one, removing the latter from the board. Construct an appropriate state space for the game.

Characterize the state space w.r.t. its properties.

Ca. 30 min.

Class Exercise 2.2: (Disease spreading)

Diseases need some way to spread. In a hospital, there is a disease A spreading. You currently have thirty people showing symptoms. You assume that the disease can spread from one person to another if both are in the same room for some time and one of them is infected. We further assume that exactly one person introduced A to the hospital. The symptoms of A only become visible one to two days after the person has been infected. Unfortunately, the hospital has to move patients from time to time but you know which patient was in which room for each given day.

How could you answer these questions using search?

- Define the state space.
- Who could have introduced A to the hospital?
- Who could already be infected without showing symptoms?
- Is the observation that a specific patient X showing symptoms consistent with the assumed way of infection?

Exercise 2.3: (State Space Construction 2)

of
6

In the game Scotland Yard[1], Mister X has to evade several detectives using different means of transportation (and spending tickets). We use the board and the transportation rules but discard everything else from the game: Suppose (against the rules of the game) you as Mister X have a fixed amount of steps A before the detectives may move a fixed amount of steps B each (and that is all – no more steps afterwards and the game is over!). Mister X and the detectives start at different but known positions on the board.

How would you find a place to go where the detectives can't reach you? Formalize your answer, including the state space(s) (state definition(s), start state(s), goal state(s) and transitions between states).

Exercise 2.4: (State Space Construction 3)

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Characterize the state space, the start(s), the goal(s), the actions and properties of the state space and select an appropriate search strategy for the following problems:

- Placing furniture in a flat. There are different kinds of furniture you can put in a set of places. Try to find an optimal placement, e.g. no door should be obstructed and the chairs should be near the table.
- Construction Site planning. When building a house, you can e.g. only paint the walls after the walls have been built and so on. In addition, several people may work on site at the same time on different parts of the house. We need a plan on who is doing what and when to build the house as fast as possible.
- An elevator has to transport people in a sensible way. Suppose you have an elevator and several people want to use it, standing in different floors. What should the elevator do?

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Achievable score on this sheet: 12

[1] `https://en.wikipedia.org/wiki/Scotland_Yard_(board_game)`