

# GWV – Grundlagen der Wissensverarbeitung

## Tutorial 1 : Search Space design

### Exercise 1.1 : (Search space properties)

- **Fully observable  $\Leftrightarrow$  partially observable**



In a fully observable environment all required information is available to the AI in order to solve the problem whereas in a partially observable environment, not all required information is available and thus the AI has to cope with incomplete data.



Fully observable: Image recognition

Partially observable: Self-driving cars

- **Discrete  $\Leftrightarrow$  continuous**

In a discrete environment there is a finite amount of possibilities the AI has to take into account whereas in a continuous environment, the AI has to deal with newly incoming data and adapt to new input(s).



Discrete: Chess

Continuous: Vital signs in patients

- **Deterministic  $\Leftrightarrow$  stochastic**

In a deterministic environment, the next state can be predicted based on the current state and the agent's action whereas in a stochastic environment, this prediction is impossible due to different probabilistic possibilities for the next state - i.e., some randomness is involved in determining the next state.



Deterministic: Chess

Stochastic: Poker

### Exercise 1.2 : (Search Space 1)

1.

The state space consists of:



- Bus, train, subway, etc. stops, represented by nodes in the graph
- Bus, train, subway, etc. lines, represented by edges in the graph where the first and last stop of a line are part of the nodes; edges belonging to a particular line should be labeled, f.e. colored, in order to discern different lines; edges can also be weighted in order to mark properties such as length, cost, etc. of sections of the line(s)
- Intersections where it's possible to switch between (different) lines



2.

a)



- Define a model of the state of the two jugs. Give a complete listing of all possible states.

{Jug3, Jug4}



Possible states:

{0,0},{0,1},{0,2},{0,3},{0,4},{1,0},{1,4},{2,0},{2,4},{3,0},{3,1},{3,2},{3,3},{3,4}

- Define start and goal state of the search problem.

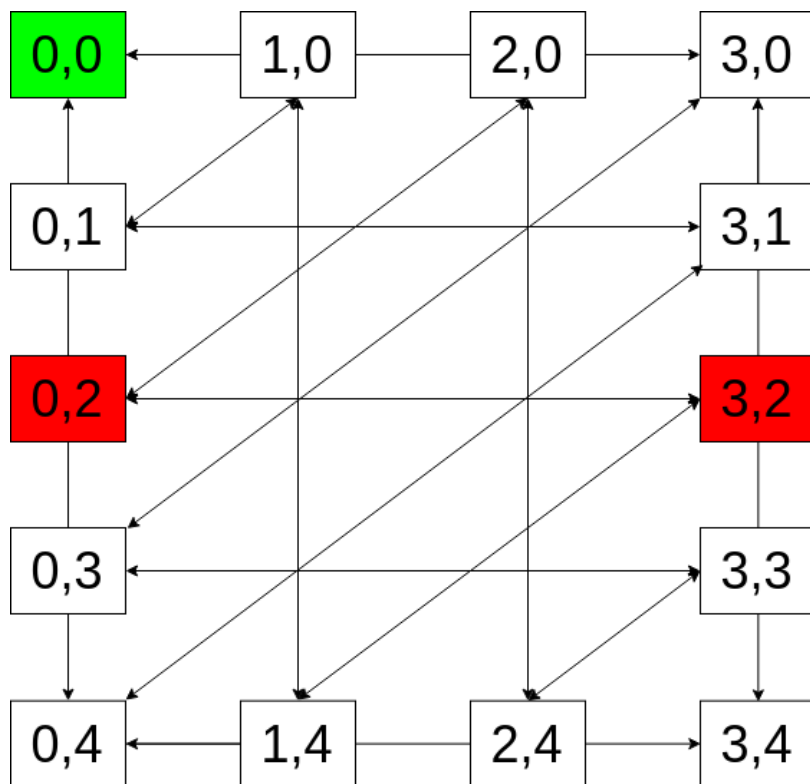
Start: {0,0}

Goal: {0,2},{3,2}



- Define the possible transitions between states. These transitions represent actions that you could perform with the two jugs like filling one jug to its top either from the pump or the other jug, filling one jug completely into the other if this is possible, emptying one jug into the drain and so on. Remember that neither of the water jugs has measuring markers on it.

Green: Start  
Red: Goal



b)

Assuming you have to pour the liquid down the drain in order to empty it, the riddle is impossible to solve without wasting wine.



However, if there was a way to preserve the wine instead, f.e., by pouring it into a barrel, it would be possible.