

# GWV – Grundlagen der Wissensverarbeitung

## Tutorial 1 : Search Space design

### Formal Requirements

The tutors would like to spend their time on rating your solutions and not trying to find them or decipher them. Therefore, we have a few requirements which we ask you to adhere to. Otherwise, the tutor may subtract points.

Please hand in your solutions as **one PDF** file with the filename containing your names and the tutorial number like this:

`name1_name2_...nameN_TutorialX.pdf`

If you include images (in your one PDF file of course!), make sure that they are *easily* readable.

Use the following scheme for the subject of your email:

`[GWV] [GROUP] Tutorial X name1 name2... nameN`

where GROUP is one of {Mo12, Mo14, Di12}, X the tutorial number and `name1 name2 ... nameN` your names.

### Exercise 1.1 : (Search space properties)

A core capability a student of computer science should obtain is to characterise and to model an environment for applying an algorithm or in our case a knowledge-based method. Environments can be characterized by the following concepts:

- Fully observable  $\Leftrightarrow$  partially observable
- Discrete  $\Leftrightarrow$  continuous
- Deterministic  $\Leftrightarrow$  stochastic

For each distinction give a reason why the difference might be important when designing AI applications for the given environment. Identify problems that exist in environments of one type but not in the other. You can use simple examples of environments and tasks to explain these problems.

### Exercise 1.2 : (Search Space 1)

1. Imagine you have to design a route planner for public transport (German: Öffentlicher Nahverkehr). What would be the state-space (for the search algorithm) in this application? And what would be the semantics of nodes and edges in the graph representing the state-space? (3 Pt.)

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3

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2. You are given two jugs, a 4-liter jug and a 3-liter jug. Neither has any measuring markers on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 liters of water into the 4-liter jug?

Solve this riddle using your knowledge about searching gained so far. The following steps will guide you to a solution (and you should solve the riddle this way):

- (a) Develop a formal model of the problem and select appropriate methods to solve it.
- Define a model of the state of the two jugs. Give a complete listing of all possible states.  
*Hint: It is OK to assume that a jug can only contain a whole number of liters in any state to keep the state-space manageable.*
  - Define start and goal state of the search problem.
  - 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 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.
- (4 Pt.)
- (b) Imagine instead of water you would have to measure 2 liters of expensive wine, so wasting any liquid is not an option. Is the riddle still solvable? Why/Why not?
- (2 Pt.)

### Hints:

- Use this week's straightforward tasks to find a group of 3-4 people to team up with for the upcoming tutorials.
- The web site for this module is located at <http://nats-www.informatik.uni-hamburg.de/GWV1920/>

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Achievable score on this sheet: 12*