

Exercise assignment for the course *Introduction to AI (Part I)* in the *Bachelor of AAI* at *Rosenheim University of Applied Sciences*

Assignment 07 - Propositional Logic

Task 1

Three boxes are presented to you. One contains gold, the other two are empty.

Each box has imprinted on it a clue as to its contents; the clues are:

- Box 1 "The gold is not here"
- Box 2 "The gold is not here"
- Box 3 "The gold is in Box 2"

Only one message is true; the other two are false. Which box has the gold?

Formalize the puzzle in Propositional Logic and find the solution using a truth table.

Task 2

The Labyrinth Guardians

You are walking in a labyrinth and all of a sudden you find yourself in front of three possible roads: the road on your left is paved with gold, the one in front of you is paved with marble, while the one on your right is made of small stones. Each street is protected by a guardian. You talk to the guardians and this is what they tell you:

- *The guardian of the gold street:* "This road will bring you straight to the center. Moreover, if the stones take you to the center, then also the marble takes you to the center."
- *The guardian of the marble street:* "Neither the gold nor the stones will take you to the center."
- *The guardian of the stone street:* "Follow the gold and you'll reach the center, follow the marble and you will be lost."

Given that you know that all the guardians are liars, can you choose a road being sure that it will lead you to the center of the labyrinth?

If this is the case, which road you choose?

Provide a propositional language and a set of axioms that formalize the problem and show whether you can choose a road being sure it will lead to the center.

Task 3

Define a propositional language which allows to describe the state of a traffic light on different instants.

With the language defined above provide a (set of) formulas which expresses the following facts:

1. the traffic light is either green, or red or orange;

2. the traffic light switches from green to orange, from orange to red, and from red to green;
3. it can keep the same color over at most 3 successive states.

Task 4

- a) Reduce to Conjunctive Normal Form (CNF) the formula $\neg(\neg p \vee q) \vee (r \Rightarrow \neg s)$
- b) Reduce to CNF the formula $(\neg p \Rightarrow q) \Rightarrow (q \Rightarrow \neg r)$