

# COGNITIVE ROBOTICS (25/07/2017)

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The exam will be graded IFF the following recommendations have been taken into account:

- Write clearly so that the teacher can easily understand your answers
- Write your name, surname, and student id on each sheet you deliver for evaluation
- For each exercise/question report clearly the number and sub-number (if present)
- You are not allowed to use any programmable device (e.g., smartphone, calculator, etc.)
- You can use pen or pencil, paper will be provided, you cannot use notes or books

## **Exercise 1 (Cognitive Architectures) (7 points)**

Two main paradigms for the design of cognitive systems have been presented during classes, the oldest one being the deliberative approach. Answer the following questions about it.

- a) What is planning? How it is related to the deliberative approach? Formalize a planning problem and its components.
- b) Using PPDL, define the planning problem of moving people using a lift. In the simplest case there is a lift that can move to different floors and transport one person at a time. People can be boarded, not boarded, or served if they have reached their destination. Develop problem and domain files in a situation with at least one lift, 4 passengers, and 4 floors, using STRIPS assumptions
- c) Consider a more realistic case where the lift can transport together many people having different enter and exit floors. Can STRIPS assumptions handle this situation? Why? How would you solve it?

## **Exercise 2 (Natural Language Processing) (4 points)**

Let's discuss about syntax-semantics mapping:

- a) Let's begin ordering, from the "deeper" to the "shallower", these terms (motivate the ordering): text, syntax, pragmatics, morphology, semantics, discourse, and orthography.
- b) Describe what syntax-semantics mapping is and what it is used for.
- c) What is POS tagging and how it is related to the syntax-semantic mapping?

## **Exercise 3 (Human Robot Interaction) (7 points)**

Design a trash bin which tries to convince a person to throw litter in it. In answering the following questions you should motivate your choices ... and aim at a convincing robot!

- a) Provide a sketch of the robot identifying actuators and relevant moving parts
- b) What kind of sensors/actuators might be needed to interact with the person and detect the trash is put in? Describe where to put them and explain why!
- c) What kind of emotional interaction could it show? Why?
- d) What channels could be exploited to induce such an interaction?

## **Exercise 4 (Neural Networks) (7 points)**

The hottest topic in machine learning these days is deep learning, let's spot differences!

- a) How does deep learning differ from classical learning with respect to feature representation?
- b) Deep learning employs neural networks, but these are not a new method; why were neural networks not obtaining such astonishing results so far?
- c) How Convolutional Neural Networks face the issues of image classification? Describe the issue/s too!
- d) How Long-Short Term Memories face the issues of recurrent networks? Describe the issue/s too!