

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 PDDL, 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!