CI Final Exam
Date: 7/1/2021
Duration: 15h to 16:30h

Answer the exam in three different page sets: questions from 1 to 2, 3 to 5 and 6 to 8. Do not forget to write your name in ALL the sheets.

1. What is the main limitation of ANFIS? Explain this limitation and how it can be overcome.

2. Explain Zadeh's extension principle. Support your description with a graphical figure.

3. In Multi-layer Perceptrons, why do you typically prefer activation functions that are differentiable (or non-differentiable in just one point)?

4. Give an explanation about why the test data should not be used in the model selection process? Is that always feasible and reasonable in practice? If not, in which situations it is not feasible or not reasonable in practice?

5. What is the difference between Zero-padding = valid and Zero-padding = same in the convolution operation? Give an example of each scheme for an input of size 28x28 and a convolution with a filter 4x4 and stride = 1.

6. Genetic Algorithms (GAs) and Evolution Strategies (ESs) are two families of evolutionary algorithms. Enumerate four distinguishing features (differences) between GAs and ESs, the ones that you consider the most relevant.

7. NSGA-II is an evolutionary algorithm for multi-objective optimization that was described in class.

   a) Give a high-level and summarized description, using your own words, of how NSGA-II obtains the next population P_{t+1} of candidate solutions from the current population P_t. Optionally, you may support your description with a graphical figure.

   b) When the algorithm stops, how would you select in the final population the individual to be returned as solution? In which case all the individuals in the population would be equally valid as solutions?

8. In Genetic Programming, if strong typing is introduced (i.e. different data types are considered), then

   a) how is the random generation of programs affected?

   b) which are the constraints that must be applied in that case to crossover and mutation operators?