

Genetic Algorithms (5 points):

- To be able to apply genetic algorithms to a given problem, what must first be defined?
 - Codification rule of the individuals
 - Fitness function
- What is the concept of the 'biased lottery wheel' in genetic algorithms?
 A method which selects individuals for reproduction. Some individuals have more probability to be selected than others
- Suggest typical values for rates to be applied for:
 - The selection: 0.5
 - The mutation: 10^{-3}
- Write the general structure of a genetic algorithm

Algorithm:

- Build an initial population of solutions
- Assess of the adaptation of initial population
- Do While a stopping criterion is not satisfied
 - Select a portion of the population to reproduce (parents)
 - Crossing the selected parents
 - Mutate some children resulting from reproduction
 - Assess the adaptation of new individuals (children)
 - Replace the initial population by a new one selected from parents and children (generally, the most adapted) + possibly new ones.
- End
- The result is the remaining population called optimum solutions (ordered by adaptation degree)

End

Multilayer neural networks (5 points)

- Add comments in the empty boxes of the following table:

| | Regression | Classification |
|----------------|--|--|
| Supervised | There are learning examples, target is a real. | There are learning examples, target is a label of a class. |
| Not supervised | / | No learning examples. Classes are discovered by the learning process. |

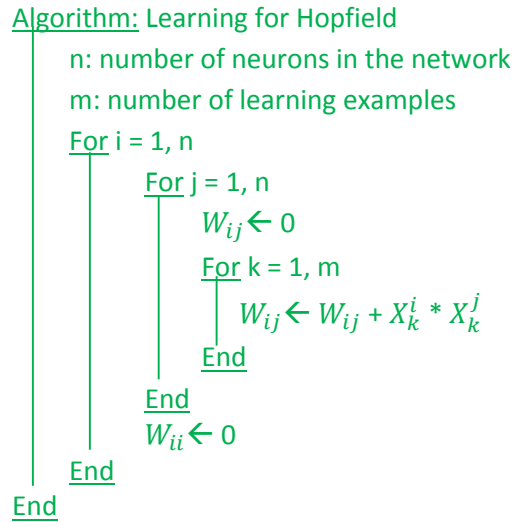
- Which Matlab tool would you recommend to a beginner in order to create a neural network as :
 - MLP network: `nnstart`
 - Hopfield network: `nntool`

□ **Hopfield network – Learning (4 points) :**

Write a learning algorithm for a Hopfield network based on the principle seen in class.

Notation conventions (required) :

- X_k^i : element # i of sample vector # k
- W_{ij} : Weight of neuron j to neuron i



□ **Hopfield network – Final state (6 points) :**

Write the algorithm for calculating the final state of a Hopfield network.

Notation conventions (required) :

- S_i^t : State of the neurone i at time t
- W_{ij} : Weight of neuron j to neuron i

