جامعة العربي بن مهيدي - أم البواقي
كلية العلوم الدقيقة، علوم الطبيعة والحياة
قسم الرياضيات والإعلام الآلي
ماستر **بنى موزعة** – **سنة أولى**
إمتحان في مادة **الذكاء الإصطناعي** - **تصحيح**

لغة الإجابة إختيارية :
عربية، إنجليزية أوفرنسية

اللقب ثم الإسم : .....
الفوج : .....
الإمضاء : .....
الرقم التسلسلي **لموقع الجلوس** : .....

☐ Genetic Algorithms (5 points):

1. To be able to apply genetic algorithms to a given problem, what must first be defined?
   - Codification rule of the individuals.....
   - Fitness function.....
2. 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.....
   .....
3. Suggest typical values for rates to be applied for:
   - The selection: 0.5 .....
   - The mutation: 10^{-3} .....
4. 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) + possibely new ones. .....
   - End.....
   - The result is the remaining population called optimum solutions (ordered by adaptation degree) .....

   End

☐ Multilayer neural networks (5 points)

1. 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.

2. 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

```
Algorithm: Learning for Hopfield
    n: number of neurons in the network
    m: number of learning examples
    For i = 1, n
        For j = 1, n
            W_ij ← 0
            For k = 1, m
                W_ij ← W_ij + X_k^i * X_k^j
            End
        End
        W_ii ← 0
    End
End
```

☐ 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

```
Algorithm: Final State of Hopfield
    n: number of neurons in the network
    Stop ← false
    t ← 1
    Initialize S_i^0
    Do While ¬ Stop
        Stop ← true
        For i = 1, n
            x ← 0
            Pour j = 1, n
                x ← x + S_j^(t-1) * W_ji
            End
            S_i^t ← (If x > 0 Then 1 Else If x < 0 Then -1 Else 0)
            If S_i^t ≠ S_i^(t-1) Then Stop ← false
        End
        t ← ++
    End
End
```