University of Saida Dr Moulay Tahar *Academic year: 2025-2026*
Faculty of sciences *Promotion: 1 st M1-IA-PA*
Computer science department *Module: Basics of artificial intelligence*

Final Exam

Duration : 1h :30 *Dr.MENAD*

Exercice 1: (3,75 points)

1. What is the difference between parameters and hyperparameters?
2. List the most important hyperparameters in a neural network.
3. What is the difference between a gene, a chromosome, and an individual?
4. Why is an activation function essential in a neural network?
5. Give three application domains of image recognition.
6. Does the robot cleaner use sensors? Give examples.
7. What is a Markov chain**?**

Exercise 2: (7 points)

Consider the graph below where the nodes represent cities and the stops represent roads with their cost:

Nodes	Heuristic h(n)
S	10
A	9
B	7
C	8
D	4
E	3
G	0

S → A : 2
S → B : 6
A → C: 3
B → C: 1
B → D: 4
C → E: 6
D → G: 5
E → G : 2

- Draw the graph?
- Use the A* algorithm to find the shortest (cheapest) path through the node to go from S to G.

Exercise 3 (9,25points):

We wish to maximize the following function : $f(x)=x^2$; where x is an integer between

[0, 31].

The initial population (generation 0) contains 4 individuals:

Individual	Chromosome
A	10110
B	01101
C	11001
D	00111

1. Convert each chromosome into an entire x.
2. Calculate the value of the objective function $f(x)=x^2$ pour chaque individu.

We select the two best individuals from the population as the starting solution. Apply the different operators of the genetic algorithm over four generations:

a) Crossing (2rd point in the first iteration, 4th point in the second iteration, 3nd point in the 3rd iteration, and 3rd point in the 4th iteration)

b) Mutation (3st bit in the first iteration, and 1rd bit in the second iteration, 2th bit in the third iteration, and 3rd bit in the fourth iteration)

c) Selection (justify your selection for each iteration).

Choose the optimal solution from all the solutions generated in the different iterations. Justify your choice.