

SERIES NUM. 02

Exercise 01

Express the following sentences in the first-order predicate logic:

1. Ali's mother is married to Ali's father
2. Ali lives in a yellow house
3. If the car belongs to Ali, then it is green
4. Some people like snakes
5. All students take exams
6. If x is a parent of y, then x is older than y
7. If x is the parent of y, then x is a parent of y."
8. There exists someone to whom everyone is loyal."

Exercise 2: (The Chifoumi Game: a specific language)

Let's be a language with the following alphabet:

- Binary predicate symbols **Win** and **Lose**
- Object variables x and y
- The following 0-ary function symbols (terms): stone (pierre), rock, leaf, paper, scissors (ciseau)
- The logical connectors of predicate logic.

Question: Express the following sentences in predicate logic:

1. The leaf wins against the stone.
2. The leaf does not win against itself.
3. Each object can neither win nor lose against itself.
4. There are objects against which the leaf wins and there are others against which it loses.
5. Every object can win against someone.
6. There is an object that does not win against any object.
7. All objects have an object against which they do not win.
8. If there is an object against which all objects win then every object has an object against which it wins.

Exercise 3

Create the OR logic gate using a perceptron

Exercise 4

Create the AND logic gate using a perceptron

Exercise 5

Create the XOR logic gate using a simple perceptron then a MLP

Exercise 04

Given a threshold perceptron with the following initial parameters:

- $\varepsilon = 1$ (the threshold of the perceptron)
- $x_0 = 1$
- $w_0 = 0; w_1 = 1; w_2 = -1$

Using the perceptron learning algorithm based on Hebb's law, give the ideal values of the weights w_0, w_1, w_2 which allow one of the logic gates below to be realized for all inputs x_1, x_2

- a) A logic gate OR.
- b) A logic gate AND.