Tutorial series N°6

Exercise 1:

Declare types that allow storing:

1. A date (day, month, year)
2. A football player characterized by his name, nationality, and date of birth.
3. A set of 11 football players.
4. A football team with its name, players, as well as the points earned, goals scored, and goals conceded in the current season.
5. A list of *N* football teams.
6. A sports tournament described by a name, a list of participating teams, a start date, and an end date.

Exercise 2:

Let $A(x_A , y_A)$, $B(x_B , y_B)$ and $C(x_C , y_C)$ be three points in the plane, with $x_A \neq x_B$ and $x_A \neq x_C$. These three points are said to be aligned (belong to the same line) if and only if the leading coefficient (slope) of line (AB) is equal to the leading coefficient of line (AC).

The slope of line (AB), denoted as m_{AB} , is given by:

$$m_{AB} = \frac{y_B - y_A}{x_B - x_A}$$

Write an algorithm to:

- Propose the most suitable data structure to represent a point in the plane.
- Read the coordinates of three points A, B, and C and determine if these three points are aligned. If the points are not aligned, the algorithm should calculate the distance between each pair of points.

  Remember that the distance between two points $A(x_A , y_A)$ and $B(x_B , y_B)$ is calculated as:

  $$d(A,B) = \sqrt{(x_B - x_A)^2 + (y_B - y_A)^2}$$

  It is assumed that there is a predefined algorithm function called **`sqrt`** that calculates the square root of a number.

Exercise 3:

Consider a car park composed of 30 cars, each represented by its: License Plate Number, Brand, Maximum Speed, and Color.

To model the problem, we consider the car park as an array of records, where each record represents a car.

a) Write an algorithm that allows to enter the information of all the cars in the park and then display and calculate the number of cars registered in Guelma.
b) Modify the algorithm to calculate and display the number of cars registered by province (wilaya).

Additional exercises

Exercise 4:

The medical claim form contains the following information regarding the insured person: last name, first name, date and place of birth, personal address, employer's name and address, and the payment method.

The date of birth and the address are themselves composed information. The date of birth consists of three values: day, month, and year, and the address consists of three values: street, city, and postal code.

Describe these types.

Exercise 5:

Let *D1* and *D2* be two variables of type Date. This type is composed of three values: day, month, and year.

Write an algorithm that allows to enter two dates, *D1* and *D2*, and determine if date *D1* is strictly earlier than date *D2*.

Exercise 6:

A circle is defined by its center and its radius. The center of the circle is a point characterized by its coordinates in the plane.

Write an algorithm that:

- Defines data structures describing a point and a circle.
- Reads information about a set of circles and the coordinates of a point and then displays all the circles containing this point.

Exercise 7:

Let there be an array of products. The maximum number of products is 100. A product is defined by its reference, label, color, price, and stock quantity.

Write an algorithm that allows to:

- Prompt the user to enter a number $n \leq 100$.
- Fill the array with *n* products, with their characteristics entered by the user.
- Calculate and display the average stock quantity.
- Calculate and display the reference of the product with the highest price.

Exercise 8:

A record type, called **Father**, describes a real-world father. Thus, a father is characterized by his name (string), date of birth (string), the number of his children (integer), and the list of the names of his children (an array of strings).

Write an algorithm to declare an array of *N* elements of type **Father**, read its elements, display them, and then display the total number of children, fathers with no children, and the father who has the greatest number of children.