ESCOLA SECUNDÁRIA
DE EMÍDIO NAVARRO

REPÚBLICA
PORTUGUESA
EDUCAÇÃO

A rays / Lists

PROGRAMMING AND INFORMATION SYSTEMS - 1°THEAT THE

GPSI TECHNICAL PROFESSIONAL COURSE

"I think ninety-nine times and find nothing; I stop

thinking, I plunge into deep silence – and behold,

the truth is revealed to me."

(Albert Einstein)

Module 04
Static Data Structures

Introduction

An array is a static set of consecutive elements, all of the same type, that can be accessed individually from a single name and index.

Python does not have built-in support for Arrays, but you can alternatively use Lists instead.

Declaration of an array in Python:

NameStructure = [SetValues]

Where:

StructureName: represents the name of the Vector;

SetValues: Set of values   stored in each position of the vector.

Example:

car=["BMW","Peugeot","Mercedes","Ford","Renault"]

array initialization

An array can be initialized with a set of values:

arrayTest=[12, 3, 332, 23]

We can also initialize an array with a predefined number of elements.

In this case, we need to import the numpy library into the program and identify the number of elements we want. The initializations of vector elements will have to be set to 0's or 1's.

numpy library

Example: creating a vector with 5 elements

import numpy # import from numpy library.

data=numpy.zeros(5) # creation of a vector with the name data and it will start with 5 float/ int elements all with the value 0.

print(len(data)) # print the size of the vector (number of elements).

Printing the value of vector elements: is
given in data:
        print(data)

or

for i in range(0,len(data)):
        print(data[i])

Advantages of using arrays: Allows you
to keep the values   in memory; They
reduce the number of variables;

Caution:
Either during compilation or during execution, it is not checked whether the indexes used are in accordance with the declared dimension of the array. It is therefore possible to declare an array with, for example, 4 elements, and then try to access index 5, which will lead to memory access problems.

Activities proposal

1. On an airplane, luggage is transported in the order in which passengers arrive, at the check-in desk. Thus, bags are labeled with the passenger's name and placed in the hold in the order in which they are received. At the destination airport, the process is the opposite, that is, they leave in the reverse order in which they were placed. In this program you must create a routine that allows you to read the name of the 10 passengers in the order in which they arrive at Check-in and, at the end, have the list of names written in reverse so that at the destination airport the flight attendants can label the hold luggage in that order.

2. Anacleto Navarro is an ardent walker. This year he is thinking of going to Santiago de Compostela. As the journey is very long, he wants to divide the pilgrimage into 7 days. At the end of each day he wants to record the km's traveled so that at the end of the expedition he can know the total traveled. As Anacleto uses the same nickname we decided to help him in this quest. For this, it is necessary to develop a program that reads the kilometers traveled each day, stores the values   in an array and displays the total traveled at the end.

3. In the Italian city of Naples, traffic is chaotic. To minimize the constraints of this situation, the mayor intends to implement an environmental solution that blocks the entry of vehicles on alternate days (even or odd). At this moment, the municipal police records the number of cars entering the city every day of the week, to know on which days they should close traffic. In this program, you must create an array that allows you to read the number of cars entering the city, 6 days a week (from Monday to Saturday). After introducing the daily flow, the program must indicate how many cars entered on even days, how many entered on odd days and suggest the days that should be closed to traffic (even if this total is greater or odd if not)

4. ESEN intends to install a meteorological station on its school campus. In this space, the temperature recorded at each hour of the day is stored. Make a program that stores the temperatures of the day in an array and shows at the end the minimum and maximum temperature recorded.

5. Benefácio Navarro decided to invest part of its savings in shares. As you want to control the value of your portfolio (total value of shares) you want another Navarro to make you a program to record the purchase and sale price of n shares and show the accumulated amount at the end. For example for n=4

Purchase	300 €	400 €	200 €	100 €
Sale	340 €	320 €	500 €	120 €

Accumulated amount:(340-300)+(320-400)+(500-200)+(120-100) =**280 €**

6. In the school canteen it is necessary to prepare balanced diets. To ensure that the weekly menu is varied, the company responsible for its design wants to alternate between fish and meat dishes. In this exercise you will create a program to prepare the menu for the first 2 weeks of December. The program must store the name of the desired fish dishes in an array of 5 elements and in another array of 5 elements the name of the chosen meat dishes. Then you must register the dishes alternately in a 3rd array of 10 elements (ie one of meat, one of fish, one of meat, one of fish and so on) and display the menu for the first 10 days of December.

7. A campsite intends to manage the spaces available for parking. The tents are placed in lots numbered from 1 to 20. The manager wants to pay 10 credits to whoever makes him a program that controls the park's capacity. The application must initialize an array with the number of available batches and fill it with "False" values   since when it is opened none of the batches is occupied. Then it must repeatedly accept registrations from campers until it is full. THE

registration is done by indicating the lot number that, if it is free, must be passed in the array to be "true" once it becomes busy. If the batch is already occupied, a message should be given warning that the batch is already occupied. At the end of each registration, the program must indicate the capacity available, showing the number of seats that are still empty.

8. Write a program that reads two vectors of n elements each (integers) and determines a third one with 2n elements that contains the elements of the first vector interleaved with those of the second vector, but in the reverse order of the original. Show the final vector on the monitor. For example, for n = 4 elements, we have:

vector x = [**1 3 5 7**]

-final vector = [**1836547two**]

vector y = [**2 4 6 8**]

9. The Dakar is about to begin, an endurance race made up of several stages. The organization invited the 10th D team to create a program that registers the number of the winning driver at each stage. After being stored in an array the winners of the N stages of this race, the program must indicate the number of the pilot who won more stages as well as which stages he won.

10. Basketball is a very physical contact sport. In each game, the faults of each player are recorded, and on the fifth fault the athlete is excluded from the game. Furthermore, for every 7 fouls that the team counts among its players, there is a penalty that results in a free throw for the opposing team. In this program, your mission is to create a program that allows you to store in an array of 10 elements (as many as the number of players in a team) the faults that each player accumulates.
The foul is registered by indicating the player's number. The program must ask continuously, until the game is over, the number of the player who is fouled. After reading the player's number, the number of fouls must be increased. Whenever a player reaches 5 fouls, a message must appear to notify the table of this fact. For every 7 faults made by the team as a whole, the program must notify the table with a message to warn of this fact. The program must end by pressing the "0" key, which happens when the game ends. At this moment, the number of fouls that each player has made and the total that the team has accumulated during the game must be shown.

11. Classes are not always homogeneous. Students' grades often vary greatly, which reflects their diversity. In this program you must read and store in an array the N classifications obtained by a given class and calculate the greatest difference between the scores of its students. If the difference is greater than 10, it must be concluded that the class is

heterogeneous (ie diversified); otherwise it is considered homogeneous. In addition to the difference, you must write the corresponding message.

Ex: A[0] A[1] A[2] A[3] A[4]

    6   12 16 9   19

Biggest difference = 13

Heterogeneous Class

12. Every year a parish in Viseu organizes a procession in honor of its patron saint. Two volunteers carry a litter that must go as straight as possible. In order for the litter to be stable, the organization intends to choose two people with similar heights. To help the manufacturing committee, it makes a program that reads and stores the height of N candidates in an array and at the end shows the smallest difference between 2 heights, indicating the numbers of the volunteers that were chosen to transport the litter.

Ex: A[0]   TO 1]   A[2]   A[3]   A[4]

1.70 1.83 1.76 1.92 1.85 smallest difference = 2 cm.

Volunteers 1 and 4

13. In a vector of N elements, determine the values   greater than the adjacent values, that is:

v[i-1] < v[i] > v[i+1].

Ex: A[0]   TO 1]   A[2]   A[3]   A[4]   A[5]   A[6]   A[7]   A[8]   A[9]

    15   31   23   15   75   23   41   15   31   85

Values   greater than adjacent values: 31 75 41

14. Read an unordered vector A of N integers and display the vector in the same sequence, ignoring duplicate values. The number of elements remaining (M) is also shown.

Ex: A[0]   TO 1]   A[2]   A[3]   A[4]   A[5]   A[6]   A[7]   A[8]   A[9]

    15   31   23   15   75   23   41   15   31   85

The resulting vector would be:

    15 31   23   75   41   85

M = 6

15. Given an NxM matrix of integer elements, determine the average value of its elements, the maximum value and the minimum value.

16. Write a C# program that reads a two-dimensional array of integer values   with N rows and M columns and swaps the rows and columns of the array.

17. Write a program that performs the product between two matrices: A[mxn] and B[nxp]. Consider two user-supplied arbitrary dimensional matrices.

GOOD WORK! YOU ARE ABLE! BUILD YOUR KNOWLEDGE...

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