**I**ndexing Arrays

In this activity we practice how to use indices to manipulate arrays, select interesting elements, etc. In the process we will also learn how to read data from a file.

Indices are a very powerful mean of manipulating structures with multiple elements, like arrays, lists, tuples. We use indices to select specific elements of an array. The syntax for that it the use of brackets. For example a line in python like this:

```
print(arr[4])
```

tells python that we want the $5^{\text{th}}$ element of the array `arr`.

A line like

```
print(arr[4:7])
```

instead tells python to write out all the elements of `arr` between the $5^{\text{th}}$ and the $7^{\text{th}}$. Remember here that python indices start from 0 and so the $5^{\text{th}}$ element has index 4.

Indexing is also useful in `for` and `while` loops. For example the code block:

```
for i in range(arr.size):
    print('The '+str(i)+'th element of the array arr is:',arr[i])
```

prints out all the elements of the array `arr` preceded by a string of text that tells you what element is being printed.

**Activity we will do together:** the file linked a `file1.txt` in the Canvas class page contains the names of 400 individuals and their age, as two columns. Write a python script that reads the name and age of each individual, searches for those who have 15 years, and, for each of them, prints out something like:

```
Anna has 15 years
```

**Activities that you will do as a pair:**

1. Modify the previous code to print out all the individual names that have between 15 and 17 years, both included

2. Modify the previous code to print out all the individuals that are 15 years old and whose name begins with the letter "A"

3. Consider now the file `file2.txt`. This time it contains three colums: names, ages, and heights (in cm). Write a **n**ew python script that reads the name, age, and height of each individual, searches for those who have 15 years, and are taller than 175 cm and, for each of them, prints out something like:

   ```
   Anna has 15 years and is 182 cm tall
   ```

4. Add a comment to every line of your last script

5. <u>Challenge Activity</u>: Consider now the file file3.txt. This was created by a sloppy instructor. It contains an image of dimension 20x20. However, the instructor just wrote all the 400 data points on top of each other. Write a python script that reads the file, rearranges it in a 20x20 array, and displays it using the matplotlib script plt.pcolormesh(). It shoud be an arrow pointing up. If it points in any other direction, try again!

6. <u>Extra Challenge Activity</u>: Consider now the file file4.txt. It contains the position of an oscillating string at different times. It contains an array of times in the first row, an array of x positions (along the string) in the first column and a square array of y positions (displacements) everywhere else. Write a python script that reads the data from the file and plots the string position every ten recorded times.