

**Subject(s):**

- Arrays.
- Strings

## Part 1

1. Implement a program that allows you to add the price of products to an array (with a maximum of 10 positions) and calculate its total.
2. Implement a program that reads an array of characters and then encrypts that array with a default value. In this technique, called Caesar's Cipher, each character is replaced by another one shifted a certain number of positions to the left or right. Example considering a displacement value of 4 positions.

**Original:** ABCDEFGHIJKLMNOPQRSTUVWXYZ  
**Cipher:** EFGHIJKLMNOPQRSTUVWXYZABCD

3. Implement a program that fills each position of a 4x5 matrix with whole values entered by the user. You should then read another value from the user and indicate how many times there is in the matrix.
4. Implement a program that fills each position of a matrix (3x3 whole elements) with a value entered by the user. You must indicate which is the largest and which is the smallest of the values saved in the matrix, and you must print all the contents of the matrix in the exemplified way:

```
3 8 1
7 4 2
5 1 9
```

5. Implement a program that reads two strings and check if they are equal.

## Part 2

1. Implement a program that stores in an array 10 values requested from the user, and return the highest even value entered. If it does not exist, you must inform the user.
2. Implement a program that stores in an array N (set a value) positions, the first N prime numbers.
3. Implement a program that, given a square matrix of dimension N, stores and writes its transposed matrix. Note: The transposed matrix **A[N][N]** is a **B[N][N]** matrix where **B[i][j] = A[j][i]** for **i, j = 0 .. N-1**. Example:

$$\begin{array}{ccc}
 \mathbf{A} = & 2 & -8 & 5 \\
 & -3 & 1 & 4 \\
 & 7 & -2 & 3
 \end{array}
 \quad
 \begin{array}{ccc}
 \mathbf{B} = & 2 & -3 & 7 \\
 & -8 & 1 & -2 \\
 & 5 & 4 & 3
 \end{array}$$

4. Implement a program that, given a square matrix of dimension N (a constant defined by you), store and write that matrix with a 90 degrees clockwise rotation. Do not use any matrix or auxiliary vector. Example:

$$\begin{array}{ccc}
 \mathbf{A_{initial}} = & 1 & 2 & 3 & 4 \\
 & 7 & 8 & 9 & 0 \\
 & 1 & 1 & 1 & 1 \\
 & 3 & 3 & 3 & 3
 \end{array}
 \quad
 \begin{array}{ccc}
 \mathbf{A_{final}} = & 3 & 1 & 7 & 1 \\
 & 3 & 1 & 8 & 2 \\
 & 3 & 1 & 9 & 3 \\
 & 3 & 1 & 0 & 4
 \end{array}$$

5. Implement a program read a string and invert its content.

### Part 3 (optional)

1. Your expiration calculation program is a success. This time the company "XPTO, Lda." wants the expiration calculation not to be limited to one month and to be extended to 12 months of the year. Therefore, the concepts and suggestions of interaction are maintained as in the previous version. Users' suggestions:

- It should be possible after the expiration calculation to make another calculation without the program ending. It should only be left if the user chooses this option.
- In the options to choose it should be possible to redo the question when the value entered by the user is incorrect.
- It should be possible for the user to abort the expiration calculation on any question.

Concepts:

- a) Position: E-Employee, C-Chief, A-Administrator
- b) Basic salary: E-40 EUR/day, C-60 EUR/day and A-80 EUR/day
  - i. Bonus of 5% of salary if you work more than 20 days in that month.
  - ii. Bonus of 2% of the salary if you work more than 17 days in that month.
  - iii. No bonus if you work 17 days or less.
- c) Food allowance: 5 euros/day for employees and 7.5 euros/day for bosses and administrators.
- d) IRS retention:
  - i. 10% if the month's salary is less than 1000 euros.
  - ii. 20% if the month's salary is over or equal to 1000 euros and under 2500 euros.
  - iii. 30% if the month's maturity is over or equal to 2500 euros.
- e) Social Security:
  - i. Administrators - 9% employee charge and 21% employer charge.
  - ii. Others - 11% of the employee and 23.75% of the employer.

The operating requirements become the following:

- a) The user must be requested the code and name of the employee as well as his/her position.

- b) The number of days he worked in each month of the year must be requested and stored.
- c) It must be calculated and stored for each month:
  - i. the gross amount (Base + Bonus) to be received from the salary.
  - ii. total food allowance.
  - iii. value of the IRS retention to be delivered to the state.
  - iv. total amount to be delivered to Social Security (both charges).
  - v. net amount to be received by the employee.
  - vi. total charge with salaries, subsidies, and taxes that the company will have.
- d) Additionally, it should be presented at the end:
  - i. total net amount received by the employee in the 12 months.
  - ii. total charge with salaries, subsidies, and taxes that the company will have in the 12 months.