

PROGRAMMING I
Computer Engineering
January 17, 2017

EXERCISE 1 (1.5 points)

Calculate the temporal cost of the following algorithm. Calculate the temporal cost in terms of size and cost. Indicate how the solution is obtained.

```
#include <iostream>
using namespace std;

int calculate(int n);

main() {
    int n, cont;

    cout << "Enter n:";
    cin >> n;
    cont=1;
    while (cont<=n){
        cout << calculate(n);
        cont=cont+4;
        cout << cont;
    }
}
```

```
int calculate(int n){
    int i, j, k, acu;

    acu=1;
    for (i=1; i<=n; i++){
        for (j=1; j<=n; j=j+2){
            if (i/2>acu)
                acu=acu*n;
            else {
                cout << j;
            }
        }
    }
    return acu;
}
```

EXERCISE 2. (1.5 points)

We want to design a number encoding system that given a number it transforms the number as following: It must take each digit and add a certain increment value. The new number is encoded using the new digits in reverse order. For example, given the number 234 and an increment of 5, the new number would be encoded as 987. It must be taken into account that if adding the increment the resulting number is greater than 9, it will have to be transformed into its corresponding one digit number: number 10 becomes 1, 11 becomes 2 and so on. For example, given the number 258, and an increment of 6, the encoded number would be 528. Design a module that takes as an input a natural number and a certain increment value. It must return the encoded number. The increment number is an integer number between 0 and 9 (it is not necessary to validate it).

Important: Arrays and data structures cannot be used for storing data.

EXERCISE 3. (2 points)

Implement a module that takes as an input two matrices of integer numbers. Both matrices are already filled with integer numbers. The first matrix has a size $M \times N$ ($M > 3$, $N > 3$) and the second one has a size of 3×3 (rows x columns). The module must check if the second matrix is contained in the first matrix. If that check succeeds, it must return (not display) the coordinates of the first matrix where the second matrix starts (upper left corner). For example, given the two following matrices, the module will return 0 1, row 0, column 1. If the second matrix is not contained in the first one, the module will return -1 -1.

4	6	7	9
0	1	6	6
2	3	5	7

6	7	9
1	6	6
3	5	7

EXERCISE 4. (2 points)

Write a recursive module that given a natural number displays its corresponding binary number. For example, given the number 12, it will display 1100.

Important: this exercise must be implemented in a recursive way.

EXERCISE 5. (1+0.75+1.25 points)

A cinema wants to store information about the movies that are shown every year. For each movie the cinema stores the following information: id, name, genre (horror, action, comedy, animation), number of viewers, and critic reviews (the number of reviews is variable since the movies that are considered for an award are evaluated by more film critics than other movies, each movie has a maximum of 15 reviews). The critic review is a number between 0 and 10. Moreover, the cinema wants to store information about critics: id, name, e-mail and name of the journal where the critic works.

- a) Design the data structures that are necessary to store the information above described. A cinema stores a maximum of 50 movies per year and only stores information for 20 critics.
- b) Design a module that displays a list with the names of the horror movies that have had more than 500 viewers. The module must work even if there are less than 50 films in the cinema database.
- c) The cinema wants to determine if there is a relation between critic reviews and the number of viewers. Design a module that returns the name of the movie with the largest amount of viewers and a Boolean variable that indicates if that movie is the one with the highest review score (calculate the average review score). This module must also return the name of the critic that entered the worst review score for that movie (if there are multiple critics that entered the same score, the module will return the first one). The module must work even if there are less than 50 films in the cinema database.

You can use the following functions. `strcpy()` and `strcmp()` if you find that it is needed.

- To copy two strings you can use the following function `strcpy(dst_string, src_string)` where the first parameter is an array of characters where you are going to copy the source array of characters. The second parameter is the array of characters that you are going to copy.
- To compare two array of characters you can use the following function: `strcmp(string1, string2)`. It returns 0 if both array of characters or strings have the same content.