

# SCS112: Structured Programming



## Final Term Project

Please read the instructions carefully:

- 1- Students per project is up to 5 students.
- 2- Choose one of the two problems in part II.
- 3- Submit a doc file that has both parts I & II.
- 4- On the cover page, write your **name(s) in arabic**, and **IDs in english, Faculty & University**.
- 5- Sample test cases are included for each function in each problem.
- 6- Failing to follow any of the above instructions may severely affect your grade.

### Part I:

Write documentation for your chosen problem in Part II. It should contain for each function the following:

1. Input of this function.
2. Output of this function.
3. Description for this function.

### Part II:

#### Problem 1: Sentence Editor:

Word editors allow users to write and edit text in many ways. The editors can automate some processing on the text to facilitate putting the text in some kind of format required by the user.

Write a program that takes a 1-line **sentence** from the user, then displays a list of options to manipulate that sentence where each option should call a function to do the job. Each of the functions accepts A C-string and its size, in addition to any other required arguments.

1. Encrypt that string by a certain key K, where K is an integer ranging from 1 till 100. Each character in the string is encrypted by adding K to that character. Return the encrypted string as a pointer. Validate the input key and return NULL if not in the correct range.

	C-string	K	Output
Test Case 1	The clown went to the party.	3	Wkh#forzq#zhqw#wr#wkh#sduw 1
Test Case 2	What is your name? My name is Ali	10	ark~*s}*âÿ *xkwol*Wâ*xkwo*s}*Kvs
Test Case 3	Hello everyone.	120	NULL

2. Decrypt the string by providing the key K, where each character will return to its original value. This function will take the encrypted string that was returned from Encrypt function, and the decryption key. It returns the decrypted string as a pointer. Validate the input key and display an error message if not in the correct range.

	Encrypted C-string	K	Output
Test Case 1	Wkh#forzq#zhqw#wr#wkh#sduw 1	3	The clown went to the party.
Test Case 2	Wkh#forzq#zhqw#wr#wkh#sduw 1	2	ü_T_Y_L/_J_Θ
Test Case 3	ark~*s}*âÿ? *xkwol*Wâ*xkwo*s}*Kvs	10	What is your name? My name is Ali

3. Capitalize where all alphabetical letters are converted to upper case. Return the converted string.

	C-string	Output
Test Case 1	What is your name? My name is Ali	WHAT IS YOUR NAME? MY NAME IS ALI
Test Case 2	Hello everyone.	HELLO EVERYONE.

4. Count words in the string. Words might be separated by a space, full stop, or question mark.

	C-string	Output
Test Case 1	What is your name? My name is Ali	8
Test Case 2	Hello everyone.	2

5. Sentence slicer which slices the sentences into words and returns them in a **2D array of characters**.

	C-string	Output
Test Case 1	What is your name?My name is Ali	{"What","is","your","name","My","name","is","Ali"}
Test Case 2	Hello everyone.	{"Hello","everyone"}

6. Get the average length of words in the string, you may use the sentence slicer, then return the average length of words.

	C-string	Output
Test Case 1	What is your name?My name is Ali	3.125
Test Case 2	Hello everyone.	6.5

7. Concatenate a new string to the current string. The returned string is the concatenated one.

	C-string	New String	Output
Test Case 1	The clown went to the party.	Everyone had fun.	The clown went to the party. Everyone had fun.

8. Search for a substring and if found, return the index of the first character of that substring in the string. If not found return -1.

	C-string	substring	Output
Test Case 1	The clown went to the party.	the	0
Test Case 2	The clown went to the party.	.	27
Test Case 3	The clown went to the party.	hello	-1

9. Find the frequency of a certain word in the string and print its occurrences as positions within the string. For example: The word “the” occurred 3 times, in positions 1,4,7 in the string, which means that the word “the” was the 1<sup>st</sup>, 4<sup>th</sup> and 7<sup>th</sup> word in the string. Positions can be returned in a 1D array. You may need to use the sentence slicer.

	C-string	substring	Output
Test Case 1	The clown went to the party to entertain the children.	the	[1,5,9]
Test Case 2	The clown went to the party.	part	NULL

Notes: - Calling some of your functions to help in the task of other functions is encouraged.

- It's better if you work on C-Strings in your functions but you may convert to string object if needed.

Write a main function to use these functions after reading the C-string from user. Assume that the C-string has words separated by a **space**, a **full stop** or a **question mark** only. Your main will call all of the required functions.

## Problem 2: Statistical Calculator

In statistics, the terms mean, median, mode, and range describe properties of statistical distributions. These values along with others are used to manage systems by planning capacity, balance load and many other useful tasks.

You are required to write the following functions, where each function accepts arguments as the following:

- A) An integer that indicates the number of elements in the array
- B) An array of integers

Write a main function to use these functions after reading the array size and elements from user. Assume that the array will always contain non-negative values. Your main will call all of the required functions.

### 1. Mode Function:

In statistics, the mode of a set of values is the value that occurs most often or with the greatest frequency.

The function should determine the mode of the array. That is, it should determine which value in the array occurs most often. The function should return the mode value. If the array has no mode (none of the values occur more than once), the function should return -1.

	Array Size	Array	Output
Test Case 1	7	2 2 6 3 5 1 4	2
Test Case 2	6	20 14 18 23 30 25	-1

Test Case 3	8	99 0 11 11 100 58 70 99	99
Test Case 4	10	1 1 1 5 5 3 3 3 3 8	3

## 2. Median Function:

In statistics, when a set of values is sorted in ascending or descending order, its median is the middle value. If the set contains an even number of values, the median is the mean, or average, of the two middle values. This function should determine and return the median of the array.

	Array Size	Array	Output
Test Case 1	7	2 2 6 3 5 1 4	3
Test Case 2	6	20 14 18 23 30 25	21.5
Test Case 3	8	99 0 11 11 100 58 70 99	64

## 3. Mean Function:

This function returns the average of the array elements.

	Array Size	Array	Output
Test Case 1	7	2 2 6 3 5 1 4	3.29
Test Case 2	6	20 14 18 23 30 25	21.67
Test Case 3	8	99 0 11 11 100 58 70 99	56

## 4. Sort Function:

This function to sort the array. Your function will have 2 modes, ascending and descending. The mode is a Boolean passed to the function. You will use this function to be able to get the Median.

	Array Size	Array	Output
Test Case 1	7	2 2 6 3 5 1 4	1 2 2 3 4 5 6
Test Case 2	6	20 14 18 23 30 25	14 18 20 23 25 30
Test Case 3	8	99 0 11 11 100 58 70 99	0 11 11 58 70 99 99 100

## 5. Range Function:

This function returns the difference between the highest and lowest elements in the array.

	Array Size	Array	Output
Test Case 1	7	2 2 6 3 5 1 4	5
Test Case 2	6	20 14 18 23 30 25	16
Test Case 3	8	99 0 11 11 100 58 70 99	100

## 6. Element Frequency:

This function takes the array and its size and returns a 2D array that has each element and its frequency in the original array. For example if the original array is {3,6,1,8,1,2,3,1,9}, the output array will be {{3,2},{6,1},{1,3},{8,1},{2,1},{9,1}}

	Array Size	Array	Output
Test Case 1	7	2 2 6 3 5 1 4	2 6 3 5 1 4 2 1 1 1 1 1
Test Case 2	6	20 14 18 23 30 25	20 14 18 23 30 25 1 1 1 1 1 1
Test Case 3	8	99 0 11 11 100 58 70 99	99 0 11 100 58 70 2 1 2 1 1 1
Test Case 4	10	1 1 1 5 5 3 3 3 3 8	1 5 3 8 3 2 4 1

### 7. Element Circular Shifter:

This function accepts an int array, the array size, and a positive integer **N** as arguments. The function should make a circular right shift of N elements, where the N elements are shifted to the right and inserted from the left. So for N times, element (size-1) of the argument array should be copied to element 0 of the new array after shifting all elements by 1 place to the right. For example if the input to the function is ([1,2,3,4,5,6,7,8,9], 9 , 3), the output should be [7,8,9,1,2,3,4,5,6]. The function should return a pointer to the new array.

	Array Size	Array	N	Output
Test Case 1	7	2 2 6 3 5 1 4	2	1 4 2 2 6 3 5
Test Case 2	6	20 14 18 23 30 25	4	18 23 30 25 20 14
Test Case 2	6	20 14 18 23 30 25	-2	NULL
Test Case 3	8	99 0 11 11 100 58 70 99	5	11 100 58 70 99 99 0 11
Test Case 3	8	99 0 11 11 100 58 70 99	10	NULL