

Exercises Part 1

Ex1.

Do not use an array to hold numbers that user enters in this exercise!

Write a program that calculates average of positive numbers that user enters. Program asks user to enter numbers and calculates the average of entered numbers when user enters 0 as the number. The zero is not included in the average. If user enters a negative number the program must print a message telling that only positive numbers are accepted and ignore the negative number.

Ex2.

Write a program that defines a floating-point array of 12 elements. Ask user to enter yearly gross income. Then the program assigns values to the array so that elements 0-5 and 7-11 are assigned value that you get by dividing gross income with 12.5.

Element 6 is assigned value that you get from $\text{gross}/12.5 * 1.5$

Then print the array in the following format:

```
element[ 0] =    993.0098
element[ 1] =    993.0098
...
element[ 6] =   1489.5147
...
element[11] =    993.0098
total      =  12475.1225
```

You need to get familiar with printf field width specifiers to complete this!

Note that equal signs and decimal points must be aligned as shown above!

Ex. 3

Write a function that takes an array of integers and array size as a parameter and returns a float. The function calculates average value of the array and returns it.

Write a program that uses an array to hold course grades. The array is initialized to zero in the beginning. The program asks user how many students are to be graded. Program must not allow values that are greater than the array size.

Then the program asks user to enter a grade for each student. Only values in the range 0-5 are accepted. Student number that is displayed to the user is array index + 45000.

(For example if array index is 2 user is asked to enter grade for student nr: 45002)

Program must check that array bounds are not violated!

In the end program calculates the average of course grades using the average function and prints the average with two decimal accuracy.

Remember to write both function declaration and definition!

Ex. 4

Write a program that asks user to enter current time in 24 hour format and asks how long you want to sleep. Program then calculates your wake up time and prints it. The program must check that values are entered in correct format and must print an error message if invalid input is entered. Program must also check that the entered numbers are in valid range (0 - 23 / 0 - 59).

Example:

```
Enter current time (hh:mm): 21:56
How long do you want to sleep (h:mm): 8:30
If you go to bed now you must wake up at 6:26.
```

Ex 5.

Write a program which multiplies a 3 element vector (3 by 1 matrix) with 3 by 3 matrix.

Program asks user to enter initial values for vector and matrix.

Write a function to do matrix multiplication. Function takes three parameters: Result vector, source vector, source matrix. Function returns no value but modifies result vector. Function may not modify source values.

Program must print the initial values before multiplication and result after multiplication.

The matrix multiplication function must do only the multiplication and may not print anything.

Ex 6.

Write a function that performs Caesar cipher on the given string.

See https://en.wikipedia.org/wiki/Caesar_cipher

The function takes two parameters: the string to be encrypted and an integer indicating the amount of shift. Assume that only letters A-Z and whitespace characters are used. White space characters must not be affected by the encryption.

Write a program that uses the function above to create encrypt and decrypt a given text. The program must ask user to enter the amount of shift and the text to encrypt. The program converts the string to uppercase before using the encryption function. When user has entered the values the program prints the original text, the encrypted text and the decrypted text. If the program works correctly the original text and decrypted text are identical.

Note: You can encrypt and decrypt with the same function by giving a different shift value as a parameter. For example if you encrypted text with shift 7 you decrypt by using shift -7 or $(26 - 7) = 19$.

Ex 7.

Write a function that converts all white space in a string to underscores.

Write a program that asks user to enter a string and then calls the function above. The program keeps asking for strings until user enters "stop" or "STOP". When user enters stop the program terminates.

Note. To avoid platform dependent problems with string use `strncmp` and compare only the first four characters to detect stop.

Ex 8.

Write a function that converts the first letter of every word in a string to uppercase.

Write a program that asks user to enter a string and then calls the function above. The program keeps asking for strings until user enters "stop" or "STOP". When user enters stop the program terminates.

Ex 9.

In this exercise the function interfaces aren't fully specified so you need to design the interface yourself. **Note that all the information that the functions need must be passed as parameters.**

Define a structure to store rental car information. The structure must contain the following information: Make of the car, model of the car, rental category, registration plate, current mileage, availability (available/currently rented).

<https://www.zestcarrental.com/blog/2015/06/09/car-hire-classes-explained/>

Write a function that prints a list of available cars in the given category (passed as a parameter). The list must contain all information about the cars in formatted columns where text is aligned to the left and numbers are aligned to the right. If an '*' is given as parameter the program prints all cars.

Write a function that sets the state of a car (available/not available). The registration plate of the car to change is given as a parameter. Function must return a status that indicated if the car was found or not.

The program must define a 15-element array of car information and initialize the array with an initializer that initializes all elements of the array. The program allows user to do four things:

1. print all cars
2. print free cars of given category
3. change state of a car
4. quit the program.