**SOLENT UNIVERSITY**   
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Individual Degree Related Project COM305

**memory allocation in C**

**Report AE1 (50%)**

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# Introduction

In this work of Individual Degree Related Project, Is going to be aborded the topic of memory allocation in the programming language C.

“*C is a practical and still-current software tool; it remains one of the most popular programming languages in existence, particularly in areas such as embedded systems.”* (Bailey 2005)

C It is used in developing an operating system such as Microsoft,  Apple's OS X and also to develop databases such as MySQL. This is because C language is a verry simple and efficient language and is the base of most of the existing programming languages.

“It provides “high-level” structured programming constructs such as statement grouping, decision making, and looping, as well as “lowlevel” capabilities such as the ability to manipulate bytes and addresses” (Bailey 2005)

Now a days the programs, and even the operating systems consumes more and more memory. And one of the peculiarities of C language is the fact that it allow us to organise every amount of memory that we use.

For a true understanding of the language and to be able do due even simple programs in C, is practically mandatory to know how the language store, change and use de memory available. If is not done a proper research about the topic to now the minimum, even the storage of a variable can go wrong.

The research that I made about this topic tacked a long time, but I found it funny. I am going to show in this work what I learned and what was the conclusions made of it.

# Aim and objective:

## The aim of this project:

The aim of this project is to enrich the knowledge and to be more comfortable with the use of the programing language C and for a better comprehension of how it works in terms of the memory

## Objectives:

* Presenting the way that the compiler works and the differences with the Interpreter
* How variables works in C and do some experiments whit them to have some conclusions.
* Understand what are pointers and how they can help us to better understand how C works with memory
* Explore the malloc and calloc commands and do some experiments with them

# Requirements/Specification:

For this project due to the difficulty of getting GCC (GNU Compiler Collection) compiler for windows, it was used the online site called replit (<https://replit.com/>).

Replit is a online site that do the both jobs (compiler and Interpreter), that allow to program in Python, Java ,C ,C++,node.js and a lot of other programming languages.

# Methods:

The methods used in this project are those:

* Fundamental:

I used Fundamental research to get some bases in the subject and be able to write and talk about this subject comfortably.

* Empirical:

In this project was used books, videos and webpages as reliable soureces to structure the work. Was a suitable way to interconnect the fundamental and empirical research.

# Project Management:

I chose the waterfall diagram because:

* Transfer information well.
* It uses a clear structure.
* Determinate every gool earlier.
* It is more suitable for a Fundamental research.
* Is more open for possible disasters

# Evaluation:

## Compiler:

The peculiarity of C language is that, unlike the other programing languages such as Python , JavaScript and Ruby ,C uses a Compiler instead of a Interpreter.

The main differences between a Compiler and a Interpreter are that :

* A compiler scans the program and translate it as a whole in to machine lenguage, and a Interpreter read statement by statement and that is completely difrent.
* Compilers usually take a mutch more time to analyse the source code. In the other hand , the overall execution time is more faster than interpreters.

The most used compiler for C is the gcc compiler (GNU Compiler Collection).

Is an open source compiler but is not verry used in windows but is verry common in Linux and Unix.

## How memory is used in C

The use of memory in c is commonly referred as “minacious” and “with no waste”.

This is do to the high capability of the programmer to now what amount of memory is allocated in their program or even in their vairiables, and exactly where in memory is it located.

### Types of variables and their use of memory

In this programming language there are four types of variables:

* Int: The int is used to store a integer and use a space of 4 bytes
* Char: Is used to store characters , 1 character per variable to be more precise. The length of a char is 1 byte (8 bits)
* Float: the float is used to store Real numbers. The size is 4 bytes (32 bits)
* Double: The double is used to store bigger real numbers. The size of a double is 8 bytes (64 bits)

There are other functions to allocate more memory to each variable :

* The long function allows the variable to duplicate the bits allocated to store the value assigned. The Short function do the same thing but in the reverse way.
* The unsigned function allow to store the double of the bites but with no negatives.

### Pointers:

The pointers are usually associated with a verry difficult and confusing part in C, because is verry low-level information.

Basically a pointer just show the address in memory where is stored a variable.

“The Pointer in C, is a variable that stores address of another variable. A pointer can also be used to refer to another pointer function. A pointer can be incremented/decremented, i.e., to point to the next/ previous memory location. The purpose of pointer is to save memory space and achieve faster execution time.” (Anon. c)

The pointers can be also used to set a array but this subject has nothing to do with memory allocation so I am not going to explore this subject.

# Conclusion

In conclusion this work allows to have basic knowledge about the way that we look and understand the programming language C.

Now a days is more and more important to now how to manage the memory of programs.

“ Memory management requires that the programmer provides ways to dynamically allocate portions of memory to programs, when requested, and free it for reuse when it is no longer needed. In any advanced computer system, where more than a single process might be running at any given point in time, this is critical.” (Anon. b)

# Reference list

*The Importance of Memory Management* b. Available from: <https://www.opensourceforu.com/2015/12/the-importance-of-memory-management/>

*Pointers in C Programming: What is Pointer, Types & Examples* c. Available from: <https://www.guru99.com/c-pointers.html>

BAILEY, T., 2005. *An Introduction to the C Programming Language  
and Software Design.*

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# Bibliography

GOOKIN, D., 2015. *Advanced C Programming.* Carpenteria, CA: linkedin.com

HANSEN, A., 1989. *C programming : a complete guide to mastering the C language.* Wokingham: Addison Wesley

OUALLINE, S., 1997. *Practical C programming.* 3rd ed. Beijing ;: O'Reilly Media, Inc

PERRY, G.M. and D. MILLER, 2014. *C programming.* 3rd ed. Indianapolis, Indiana: Que

Synthesis of hardware models in C with pointers and complex data structures. d.

*Beginning C Programming - Tutorials for the Beginner.* a.

CORPEÑO, E., 2018. *C Programming for Embedded Applications.* Carpenteria, CA: linkedin.com

GOOKIN, D., 2014. *Beginning programming with C for dummies.* Hoboken, N.J: John Wiley & Sons

# Appendices

