#1 Introduction to C Language

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Why C language is so important?

C language is very popular among programmers for its unique features and capabilities. Let's first have a look to its fame.

- Oracle was written in C
- Core libraries of android are written in C
- MySQL is written in C
- Almost all device drivers are written in C
- Major part of web browser is written in C
- UNIX operating system was developed in C
- C language is ranked 1 on the basis of usage of language in the programming (present time)

These are some of the points to make you understand that C is not an outdated language. Many students have this myth, they believe that C is out of industry, but it is not. C is more popular in system level programming, hardware interaction, embedded systems and building core libraries of android.

For a student C language is even more important, specially to build his career. Some of the reasons are:

- C is important to build programming skills
  - o If you are a beginner, C is ideal language to start with, and you can easily focus in developing your programming skills rather than getting confused in too many bookish concepts.
  - o Language is just a medium of expressing your thoughts, so learning a language makes you capable to express your thoughts. Language is for thoughts but thoughts are not depended on language. Thinking about a solution to a particular problem is more important. Language is required to express that solution only. Programming is all about learning an art of developing solution to a problem
- C covers elementary language features of all programming language
  - o Language constructs are common in all programming languages like variables, data type, control statements, functions, arrays, strings, etc. Once you have learnt all these concepts in C, it becomes easier to learn these concepts in another language.
- Campus recruitment process
  - o Companies take exams (written + interview) which may contain questions based on C language. Especially more important for fresher.
- C is the most popular language for hardware dependent programming

- o Students belongs to non-computer science branch should learn C language, because it has its part in integration with your core field.

History of C Language

- BCPL (Basic Combined Programming Language) was developed by Martin Richards in 1966
- Taking inspiration from BCPL, Ken Thompson has developed B language in 1969. Objective was to create UNIX operating system.
- Dennis Ritchie developed C language by making improvements in B language in 1972 at AT & T's Bell Laboratory, New Jersy, USA.
- UNIX was rewritten in C language. Ritchie and Thompson are co-developers of UNIX.

Computer

Computer is an electronic device which takes input, process it and gives output.

- Desktop computers, personal computers, laptops are general purpose computers.
- Home appliances, electronic gadgets are also computers if a circuit containing program is embedded into them. For example, digital camera, washing machine, digital watch, etc.
- Ceiling fan is not a computer as it is not an electronic device but it is an electrical device
- Mobile phone is a computer

What is 0 and 1?

There is nothing like 0 and 1 in computer. There is no physical significance of 0 and 1.

We can encode any information in the form of 0s and 1s. Whether it is an audio, text, video or images, we can convert them into series of 0s and 1s.

Computer hardware constitutes of many kind of memory devices to store information. Such memory devices are Hard Drive, flash memory, RAM, CPU registers, etc. Memory devices differ in technologies, but all have this common capability to store information.

Hard drive can store magnetic information in two states (North Pole upside or downside), RAM has capacitors to store information in two states (charge in the capacitor is present or absent), CPU registers or processor registers can also store information in two states (low volt and high volt).

We can encode any information in the form of 0s and 1s. Whether it is an audio, text, video or images, we can convert them into series of 0s and 1s.

Any real world information in encoded form (0s and 1s) can be stored in computer memory devices. As all memory devices can maintain two state of information, we can easily map one state with 0 and another state with 1.

Hardware

Hardware is a comprehensive term for all of the physical parts of a computer, as distinguished from the data it contains or operates on, and the software that provides instructions for the hardware to accomplish tasks.

Hardware is anything which is tangible in the computer system.

File

Data is stored in your computer, generally in hard drive. It is stored in files. You must have seen files in your computer. They are audio files, video files, text files, image files, etc.

Every file has a name and extension. For example, Track01.mp3 is a file, where Track01 is name of the file and mp3 is extension of the file.

File is a data bundle. Kind of data stored in the file can be interpreted by looking at file extension. Like mp3 is for audio, jpg is for image, txt is for text, etc.

All file contains 0s and 1s, but there decoding depends on the file extension. So the same sequence of 0s and 1s can be interpreted in multiple ways. If it is stored in some text file then it is decoded as some character.

Now you can observe files with the extensions exe. These are special files. Data in exe file, are instructions for the computer to perform a task. Exe file or executable file is software.

Software

Software is an executable file (Extension exe is windows operating system specific, for other OS extension may differ).

Software are of two types, System software and Application software.

System software is for computer system, they might be software responsible to control hardware or any background task. Like software responsible for graphics is system software.

Application software is for the users. It is developed to solve human problems. Like MS word is application software.

Program

Set of instructions is called a program.

Active state of a program is called process.

Operating system

OS is system software. Windows 8, Windows XP, Windows 10, Ubuntu, RedHat, Solaris, Macintosh, etc are all examples of operating system.

Operating system is essential software in your computer responsible to manage all resources (hardware and software), running programs, memory management, file management, security and interaction with user.

It provides an interface between user and machine.

**Execution of a program**
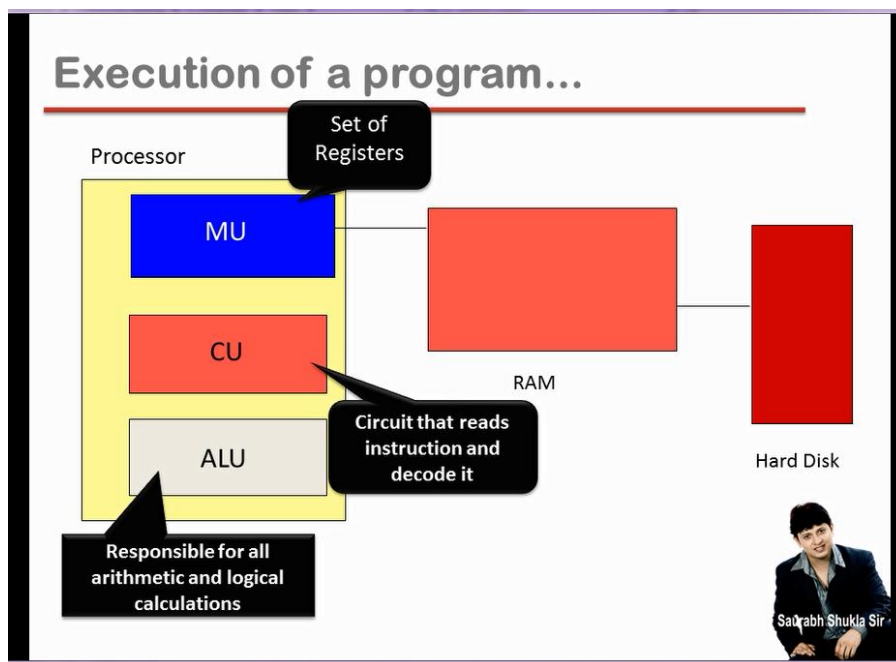
Your program or software is an exe file stored somewhere in your hard drive. You double click on it to execute program.

- The very first step, it loads into the RAM.
- Operating System allocates memory for your program in the RAM.
- First instruction (sequence of 0s and 1s of fixed length) is read and taken to processor.
- Instruction is stored in instruction register in processor's memory unit
- Control unit decode instruction and give a signal accordingly to the ALU to perform task
- ALU is Arithmetic and Logical Unit
- ALU is a circuit responsible to perform all kind of arithmetic and logical operations.
- ALU performs the instruction.
- Again second instruction from program file (in RAM) is taken to the instruction register and same procedure is repeated.
- Once all the instructions are executed, process completes.

Software Development in C

We want to make software that is an exe file. Executable file is machine dependent coding. It is hard to remember machine codes. Thus creating exe file by typing machine code is hell lot of task. So we prefer to write code in comparatively simple language called C language and then convert C language code into machine code using some software (translator).
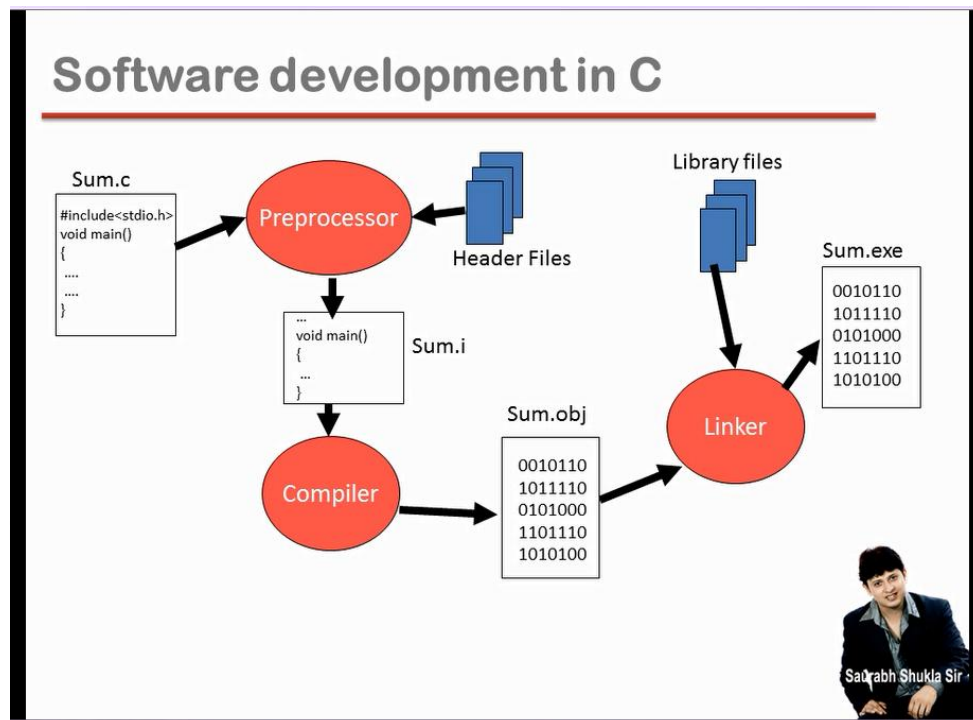
- Create a file with name of your choice but extension must be .c, this file is known as source file.
- Sometimes you added statements in your program which are required to preprocess (You will learn about them later). Such statements are handled by a program called Preprocessor. Preprocessor generate a file for the compiler
- Compiler then translates your code into machine code. Compiler may generate error if your code is not written according to the rules. A code with no error is successfully compiled and saved with extension .o or .obj, this file is known as object file.
- Linker software then links your object file with the library code (library code resides in library files), and as a result yield an executable file (extension .exe) , which you call your developed software

References:

YouTube video links

- Lecture 1 Introduction to C language part 1
  - https://www.youtube.com/watch?v=Bjzfag1zZPg&feature=youtu.be&list=PL7ersPsTyYt2Q-SqZxTA1D-melSfqBRMW
- Lecture 1 Introduction to C language part 2

- o https://www.youtube.com/watch?v=__JKmT5EFb8&feature=youtu.be&list=PL7ersPsTyYt2Q-SqZxTA1D-melSfqBRMW
  - Lecture 1 Introduction to C language part 3
    - o https://www.youtube.com/watch?v=92HLfZHH814&feature=youtu.be&list=PL7ersPsTyYt2Q-SqZxTA1D-melSfqBRMW

Exercise

1. Download and install code::blocks IDE
   a. Here you can download and install https://www.mysirg.com/installation-of-codeblocks/
2. Test your installed environment by developing sample code
   a. Here are steps to test sample code https://www.mysirg.com/test-code/
   b. Troubleshooting (if required) https://www.mysirg.com/troubleshooting/
3. Learn number system, conversion from decimal to binary and from binary to decimal
   a. Convert Decimal to Binary
   https://www.youtube.com/watch?v=h81WPA3y2Fw&feature=youtu.be&list=PL7ersPsTyYt2sohwBWF03kSpW1Ymt0Q9R
4. Describe Compiler and interpreter
   a. Watch this
   https://www.youtube.com/watch?v=iQNOY2wWWew&feature=youtu.be&list=PL7ersPsTyYt2sohwBWF03kSpW1Ymt0Q9R