Course: Computer Programming

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The LNMIIT Jaipur

August 2, 2016

Encounters

Lectures

- L10
- Monday 09:00-10:00
- Tuesday 08:00-09:00
- Thursday 11:00-12:00

I can be reached via email at

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Please join the following google group for regular updates

https://groups.google.com/forum/#!forum/cp-a2-lnmiit-2016

Still not happy??

Office room number 1062.

References

Prescribed textbook

Computer Science: A Structured Programming Approach Using C

- Forouzan, B.A & Gilberg R. F.

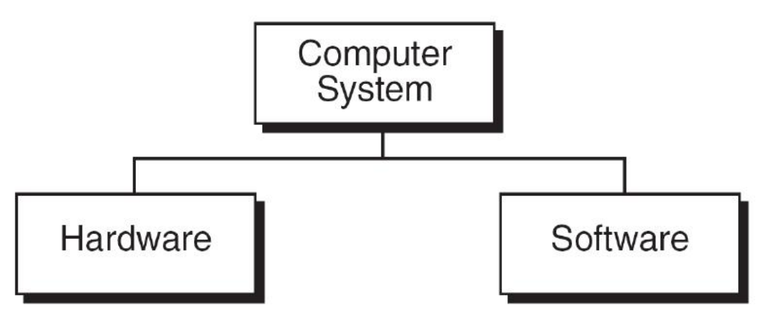
My strong recommendation

The C Programming Language

- Brian W. Kernighan & Dennis M. Ritchie

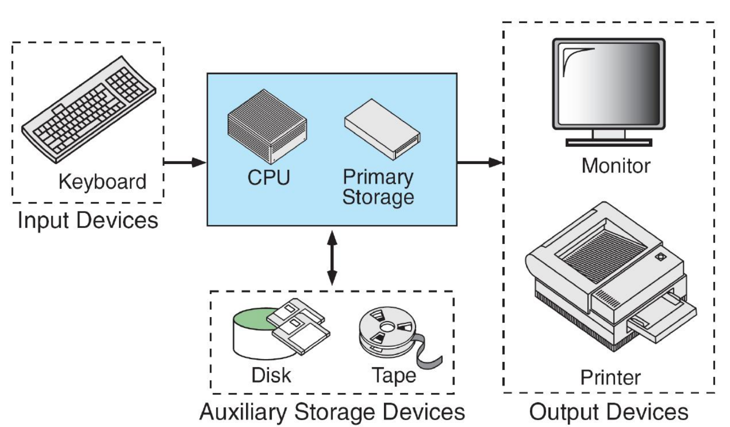
A Computer System

Divided into two major components



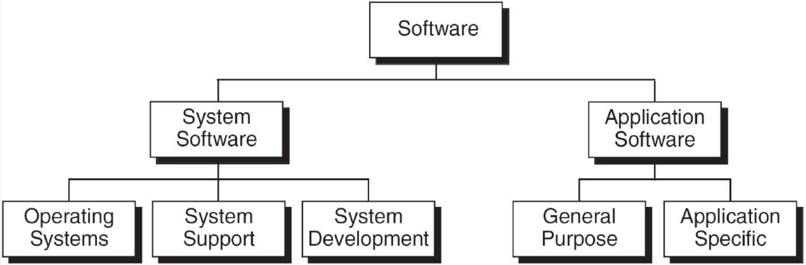
Computer Hardware

Basic Hardware Components

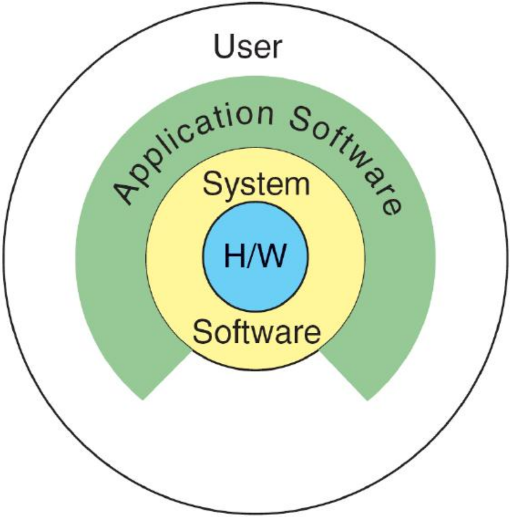


Computer Software

Types of Software

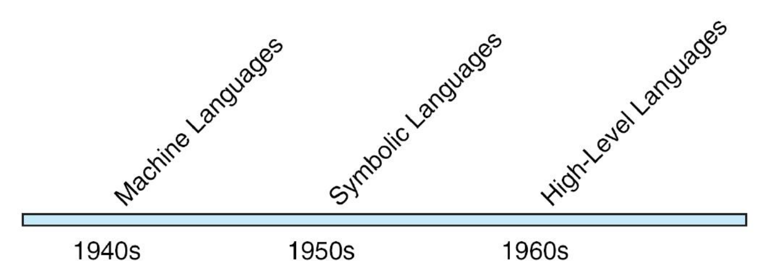


Relationship between System and Application Software



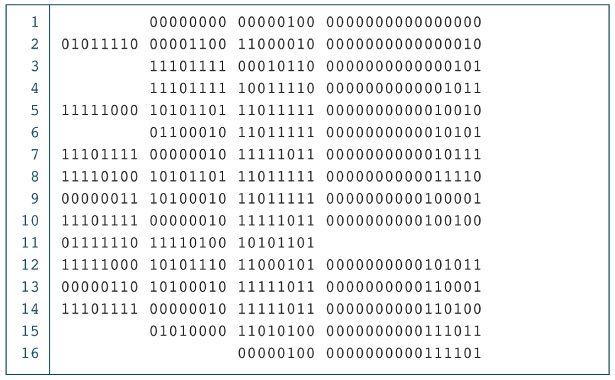
Major classification of Programming languages

We are mainly interested in High level languages



Machine language: The only one understood by Hardware

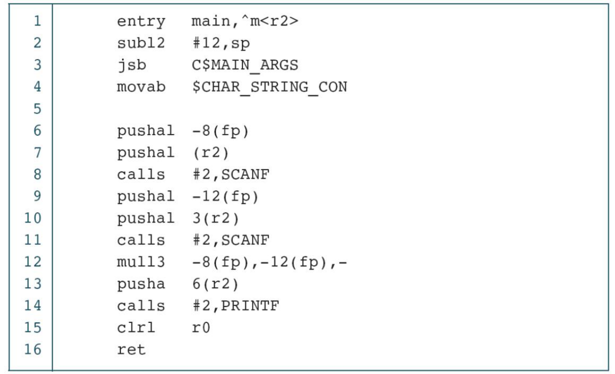
For multiplying two numbers



```
         00000000 00000100 0000000000000000
01011110 00001100 11000010 0000000000000010
         11101111 00010110 0000000000000101
         11101111 10011110 0000000000001011
11111000 10101101 11011111 0000000000010010
         01100010 11011111 0000000000010101
11101111 00000010 11111011 0000000000010111
11110100 10101101 11011111 0000000000011110
00000011 10100010 11011111 0000000000100001
11101111 00000010 11111011 0000000000100100
01111110 11110100 10101101
11111000 10101110 11000101 0000000000101011
00000110 10100010 11111011 0000000000110001
11101111 00000010 11111011 0000000000110100
         01010000 11010100 0000000000111011
                  00000100 0000000000111101
```

Symbolic Language program

For multiplying two numbers

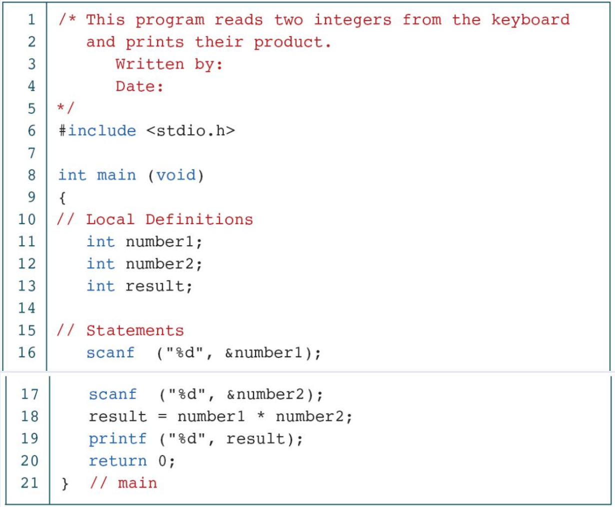


```
        entry   main,^m<r2>
        subl2   #12,sp
        jsb     C$MAIN_ARGS
        movab   $CHAR_STRING_CON

        pushal  -8(fp)
        pushal  (r2)
        calls   #2,SCANF
        pushal  -12(fp)
        pushal  3(r2)
        calls   #2,SCANF
        mull3   -8(fp),-12(fp),-
        pusha   6(r2)
        calls   #2,PRINTF
        clrl    r0
        ret
```

High-level Language program

For multiplying two numbers



```c
/* This program reads two integers from the keyboard
   and prints their product.
      Written by:
      Date:
*/
#include <stdio.h>

int main (void)
{
// Local Definitions
   int number1;
   int number2;
   int result;

// Statements
   scanf  ("%d", &number1);
   scanf  ("%d", &number2);
   result = number1 * number2;
   printf ("%d", result);
   return 0;
}  // main
```

Number system

Brief introduction to binary numbers

- Why use binary numbers?
- Other bases exist (nothing special with binary/decimal)
    - Octal, Hexadecimal
- Counting is the same!!

Conversion from decimal to binary

1. Divide the number by 2
2. Store quotient and remainder
3. Use quotient as new number
4. Go to step 1 till quotient is 0
5. Read remainders from bottom to top to get binary representation

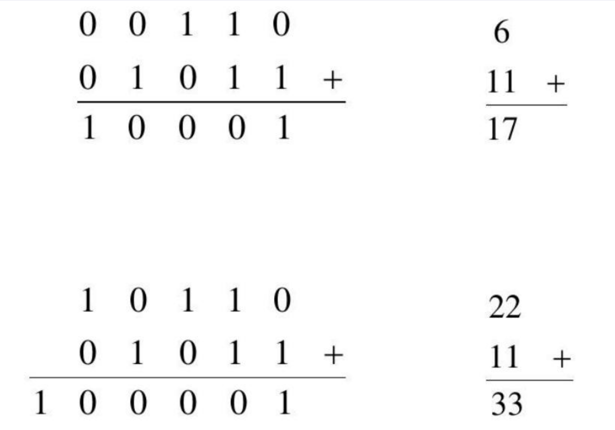
We are accustomed to decimal representation

Conversion from binary to decimal

1. Start with the least significant (right most) digit
2. Multiply it by 2^0
3. Multiply the next digit by 2^1
4. Continue like this until the most significant (left most) digit
5. Add all these numbers to get decimal representation

Computers process binary numbers

Addition operation on binary



$$
\begin{array}{cccccc}
 & 0 & 0 & 1 & 1 & 0 \\
 & 0 & 1 & 0 & 1 & 1 \quad + \\
\hline
 & 1 & 0 & 0 & 0 & 1
\end{array}
\qquad
\begin{array}{r}
6 \\
11 \quad + \\
\hline
17
\end{array}
$$

$$
\begin{array}{cccccc}
 & 1 & 0 & 1 & 1 & 0 \\
 & 0 & 1 & 0 & 1 & 1 \quad + \\
\hline
1 & 0 & 0 & 0 & 0 & 1
\end{array}
\qquad
\begin{array}{r}
22 \\
11 \quad + \\
\hline
33
\end{array}
$$

Binary representation will be useful to better understand some concepts.

High level languages

To make task easier

- Programming in binary is tedious
  - But computers understand only this
- This gap is bridged by high level languages like C
- Programming has to be made easier for human beings to write meaningful/error free programs
- Such program has to be somehow changed to machine language
- This course will revolve around these concepts

How to write a program

Common steps for any Programming language

- A precise set of instructions need to be given
- The set of instructions has to be finite
- Such a set of instructions is called an algorithm

Language specific

- Languages (artificial or natural) follow a syntax
- There are grammar rules that govern the language
- Unless the text follows all the rules of a particular language, it is invalid
- The same is true for programming

Goals of the course

Learn to write algorithms

- Think algorithmically
- Writing neat algorithms with proper division as steps

Learn syntax of C

- Mug up the rules of the language
- Given an algorithm, write a C program

Platform used to achieve the goal: Linux

- If you have your own computer. Install Linux on it.
  - http://www.ubuntu.com/download/alternative-downloads
- Make it dual boot alongside windows.
- Make sure to do it by this weekend.
  - Take help of your seniors.

An algorithm: A stepwise solution to a problem

Properties of an algorithm

- Has input/output
- Precise
- Finite number of steps
- Steps must be ordered
- Must terminate
- Must work for all possible inputs within a specified domain

Can you think of an example?

An alternative to algorithms: Flow charts

Pictorial representation of an algorithm

- Sometimes, easier to understand
- Different steps are shown in boxes
- Arrows determine the flow of algorithm or the order in which steps have to be executed

In my sections, we will be using algorithms for almost all the purposes.
Read https://en.wikipedia.org/wiki/Flowchart

Octal and Hexadecimal Representations

Octal

- Symbols used are 0, 1, 2, 3, 4, 5, 6, 7
- Can be converted from binary by grouping 3 digits from right
- Writing the representation of three digits in decimal

Hexadecimal

- Symbols used are 0, 1, 2, 3 ,4 ,5, 6, 7, 8, 9, a, b, c, d, e, f
- Can be converted from binary by grouping 4 digits from right
- Writing the representation of four digits as above.