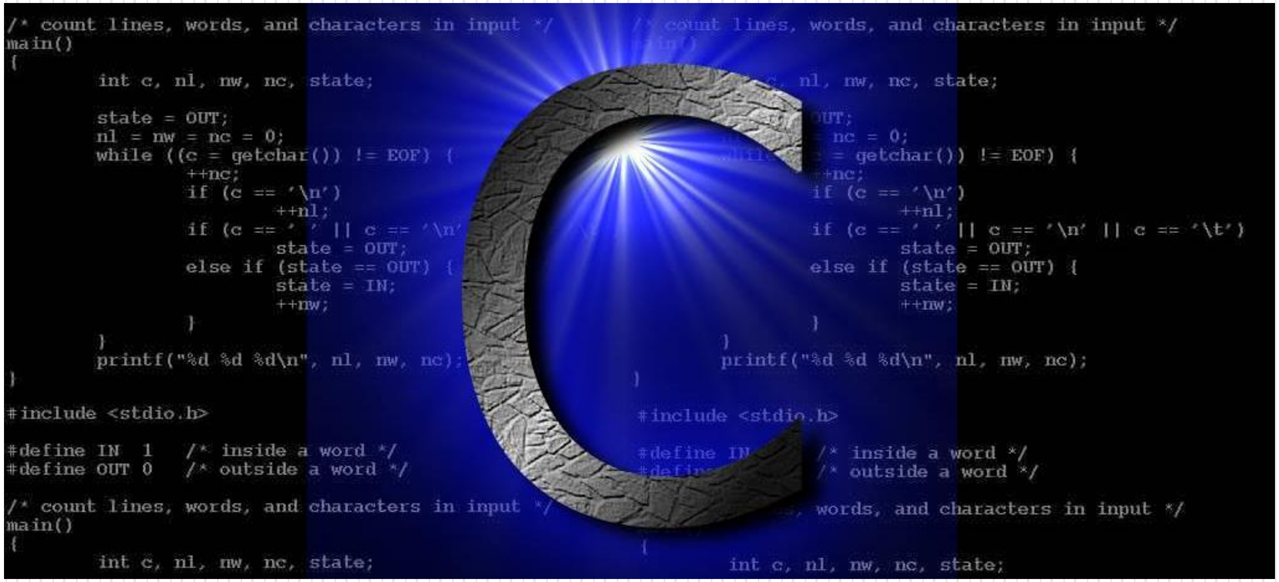
Programming in C

Chapter 1

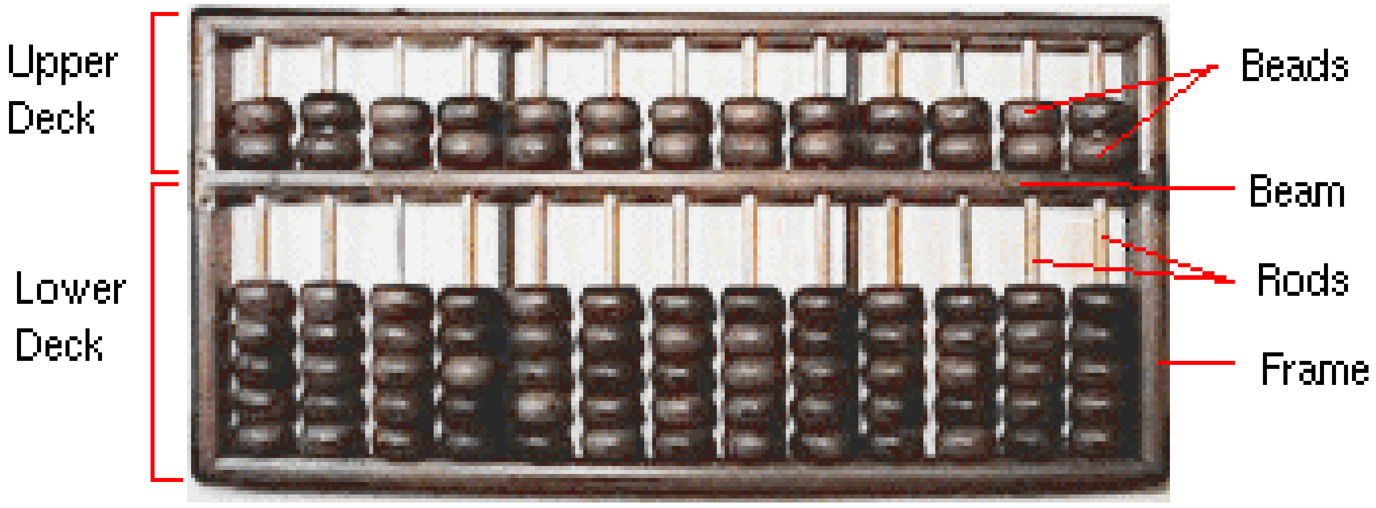
Introduction to C



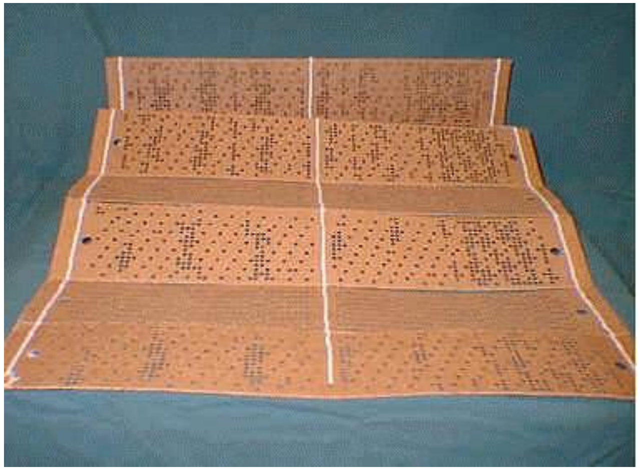
```
/* count lines, words, and characters in input */
main()
{
        int c, nl, nw, nc, state;

        state = OUT;
        nl = nw = nc = 0;
        while ((c = getchar()) != EOF) {
                ++nc;
                if (c == '\n')
                        ++nl;
                if (c == ' ' || c == '\n'
                        state = OUT;
                else if (state == OUT) {
                        state = IN;
                        ++nw;
                }
        }
        printf("%d %d %d\n", nl, nw, nc);
}
#include <stdio.h>

#define IN  1   /* inside a word */
#define OUT 0   /* outside a word */

/* count lines, words, and characters in input */
main()
{
        int c, nl, nw, nc, state;
```

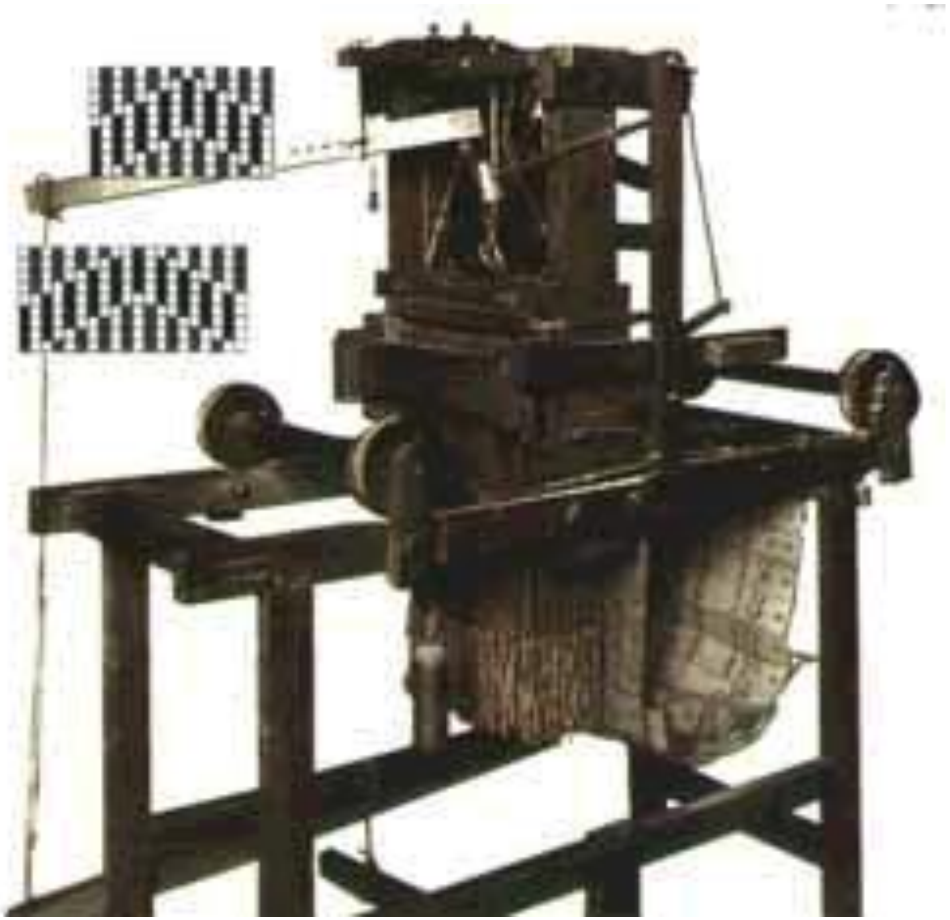
The Abacus

- **T**he abacus, a simple counting aid, may have been invented in Babylonia (now Iraq) in the fourth century B.C.

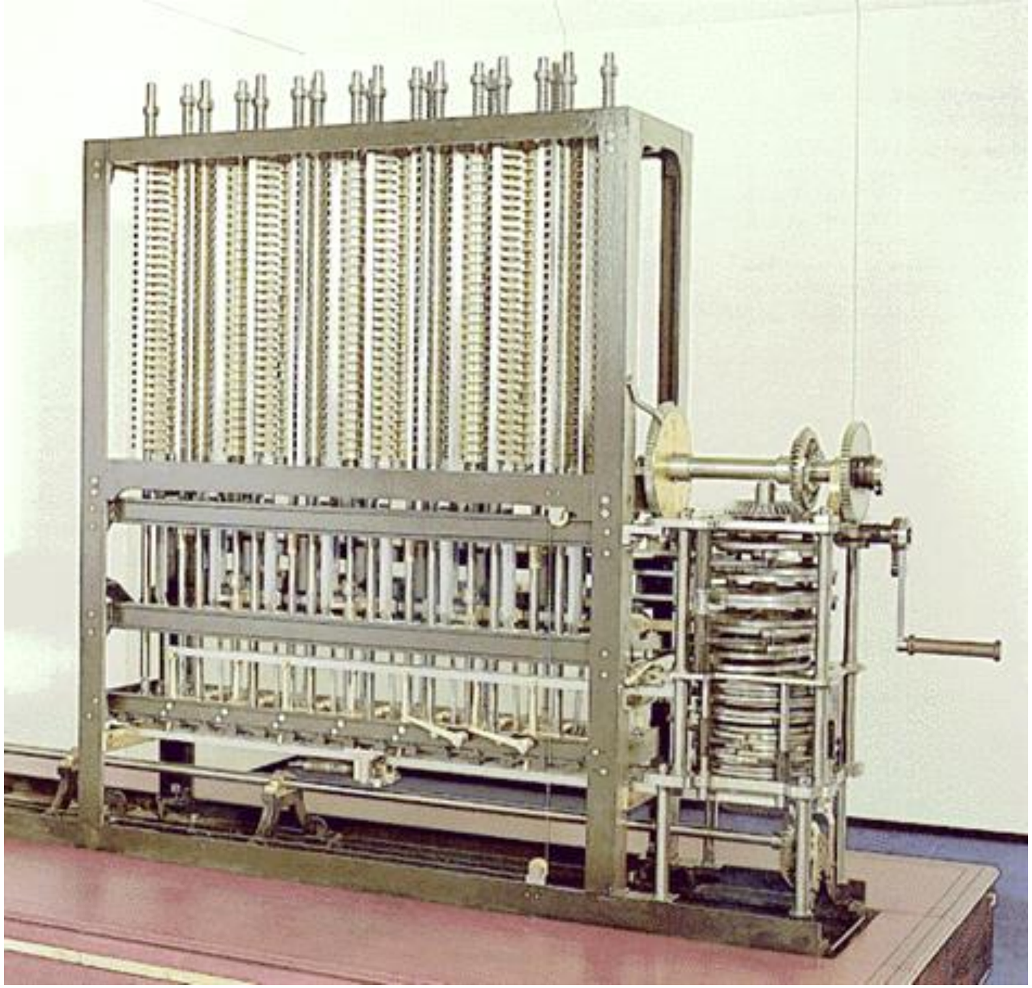


Jacquard Loom

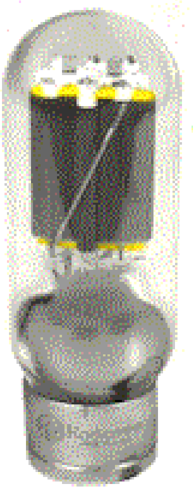




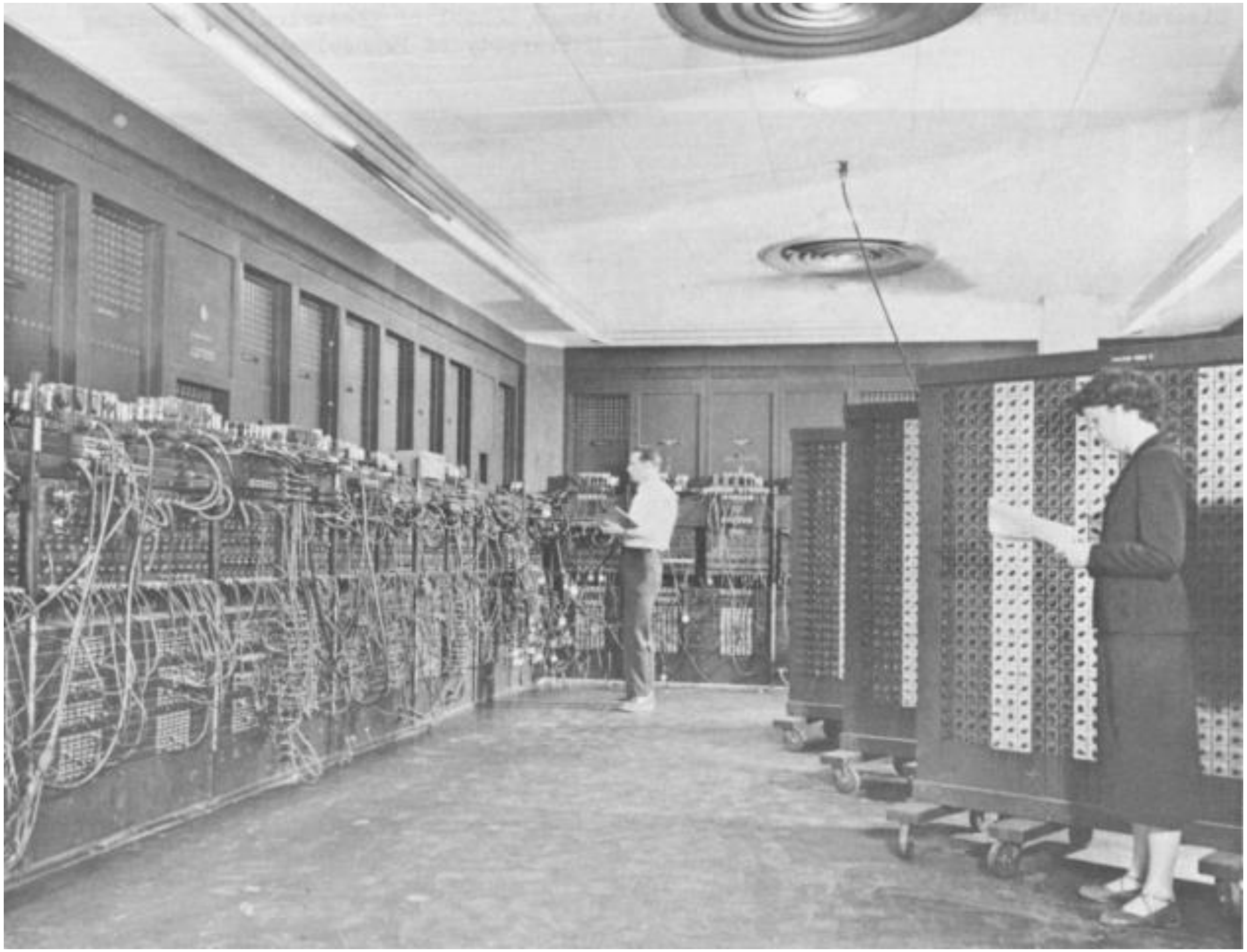
Babbage Difference Engine, reconstructed by the British Government in 1991.



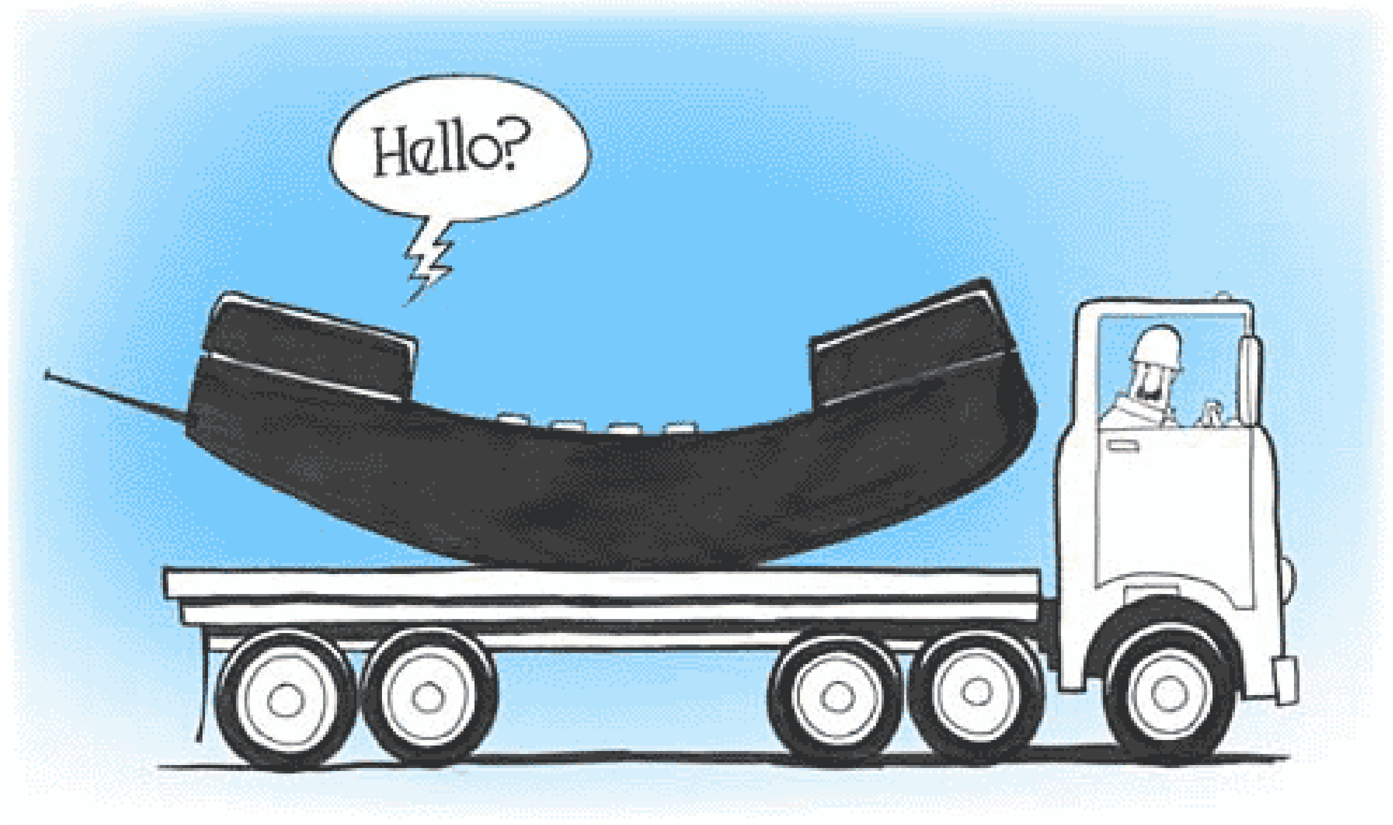
The ENIAC



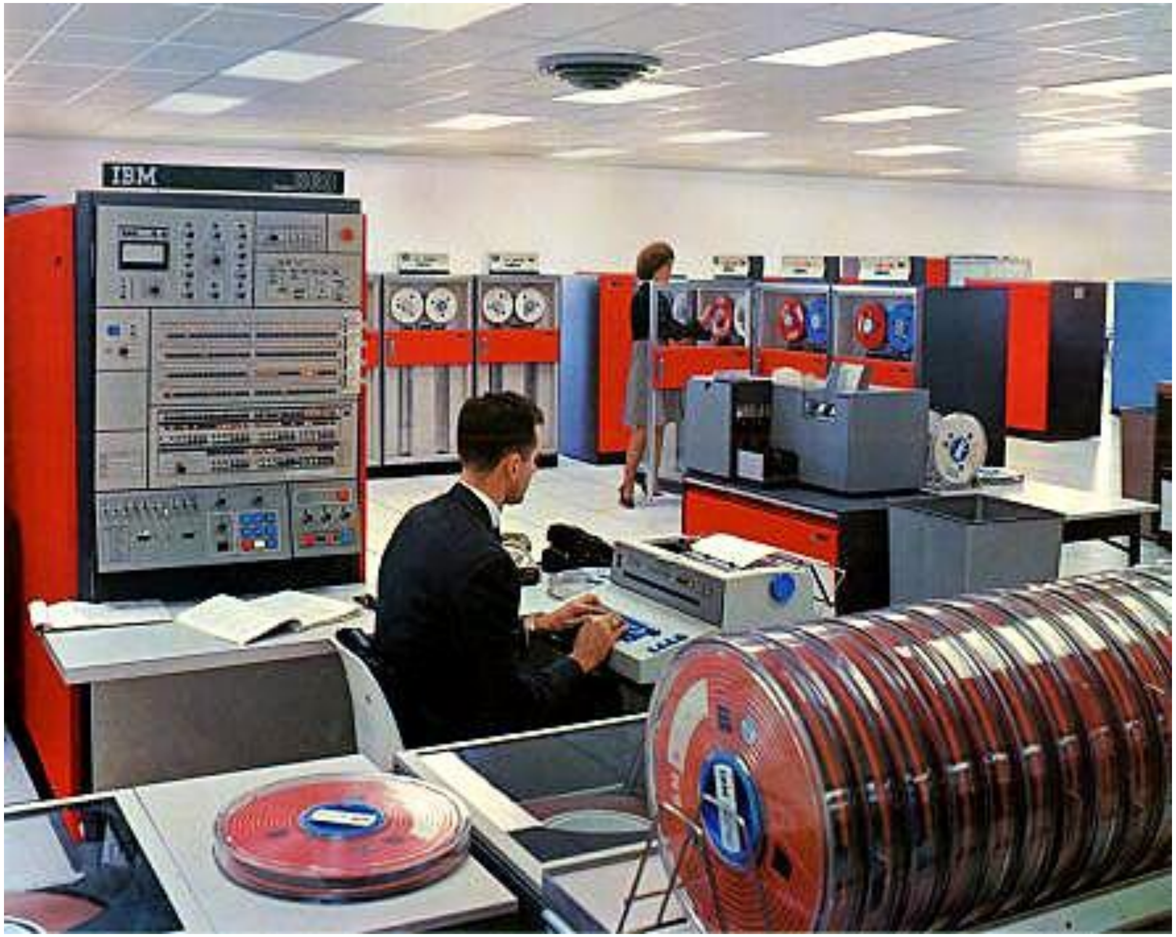
Vacuum Tube



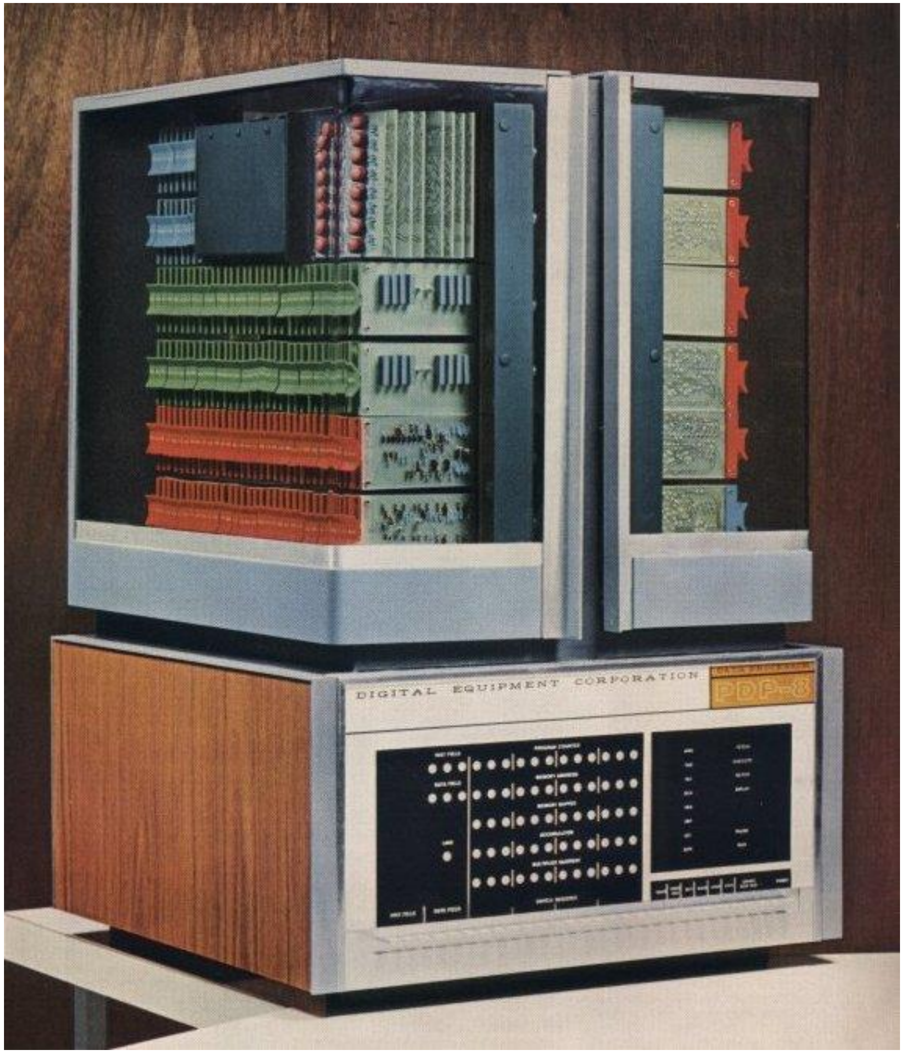
The size of a cell phone built with Vacuum Tubes



The IBM 360

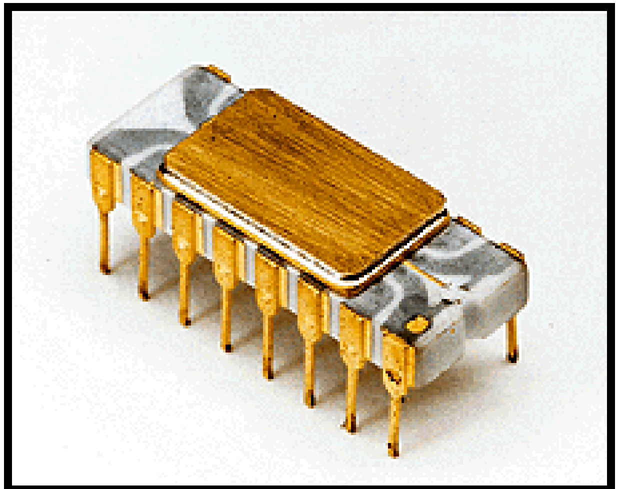


The PDP-8



The Microprocessor

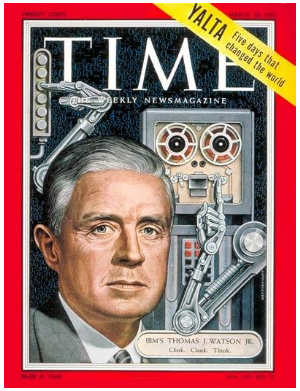
- A computer chip that contains on it the entire CPU
  - Mass produced at a very low price
  - Computers become smaller and cheaper
- Intel 4004 – the first computer on a chip, more powerful than the original ENIAC.
- Intel 8088 – used in IBM PC

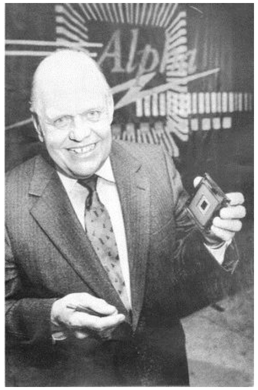


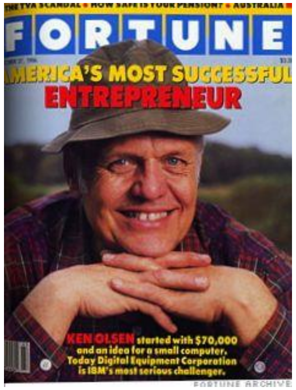
The Intel 4004, it was supposed to be the brains of a calculator. Instead, it turned into a general-purpose microprocessor as powerful as ENIAC.

Famous Quotes about Computers

- "I think there is a world market for maybe five computers." – Thomas Watson, chairman of IBM, 1943
- "There is no reason anyone in the right state of mind will want a computer in their home." – Ken Olson, President of Digital Equipment Corp, 1977.


TWENTY CENTS
TIME
THE WEEKLY NEWSMAGAZINE
YALTA Five days that changed the world
IBM'S THOMAS J. WATSON JR.
Clink. Clank. Think.

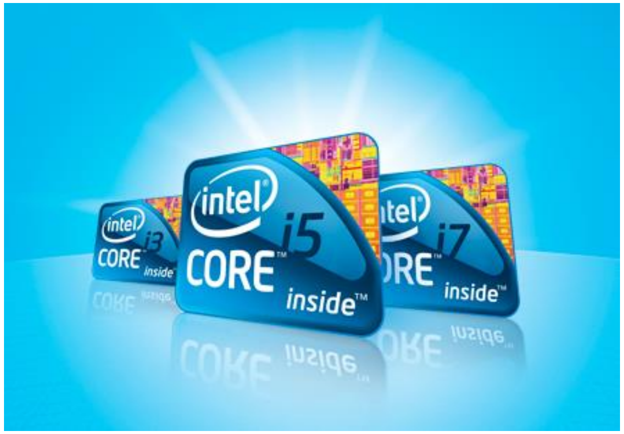



THE TVA SCANDAL • HOW SAFE IS YOUR PENSION? • AUSTRALIA
FORTUNE
AMERICA'S MOST SUCCESSFUL
ENTREPRENEUR
KEN OLSEN started with $70,000
and an idea for a small computer.
Today Digital Equipment Corporation
is IBM's most serious challenger.
FORTUNE ARCHIVE

Hardware

- ***Hardware*** – the physical devices that make up a computer (often referred to as the computer system)

Hardware Core



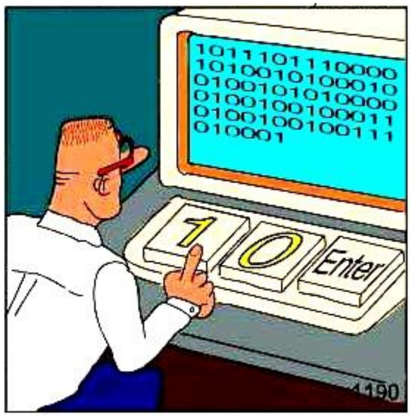
- CPU (Central Processing Unit)
  - ***CPU (machine) cycle*** – retrieve, decode, and execute instruction, then return result to RAM if necessary
  - CPU speed measured in gigahertz (GHz)
    - ***GHz*** – number of billions of CPU cycles per second
- RAM (Random Access Memory)
  - Also called Memory, Main Memory, or Primary Storage
  - Measured in gigabytes (GB, billions of bytes) today
    - Byte → Character
  - RAM is volatile
    - Temporary storage for instructions and data

Capacity of Secondary Storage Devices

- ***Kilobyte (KB or K)*** – about 1 thousand bytes
- ***Megabyte (MB or M or Meg)*** – about 1 million bytes
- ***Gigabyte (GB or Gig)*** – about 1 billion bytes
- ***Terabyte (TB)*** – about 1 trillion bytes

Software

- Programs – instructions that tell the computer what to do
- Categories
  - **Application software** - enables you to solve specific problems or perform specific tasks.
  - **System software** - handles tasks specific to technology management and coordinates the interaction of all technology devices
  - **Utility software** - provides additional functionality to your operating system software



REAL Programmers code in BINARY.

System Software

- Operating System
  - UNIX / Linux
  - Windows
  - MAC OS
  - Palm OS
  - Android
- Language Translators
  - C, C++, Basic, Java, …
- Device Drivers

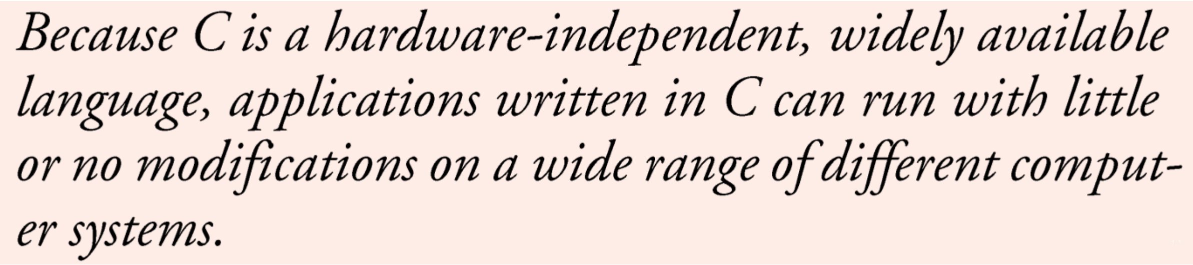
C Programming Language

Bell Laboratories

- Developed at AT&T Bell Labs in early 1970s
- Unix also developed at Bell Labs
  - All but core of Unix is in C
- Standardized by
  American National Standards Institute (ANSI)

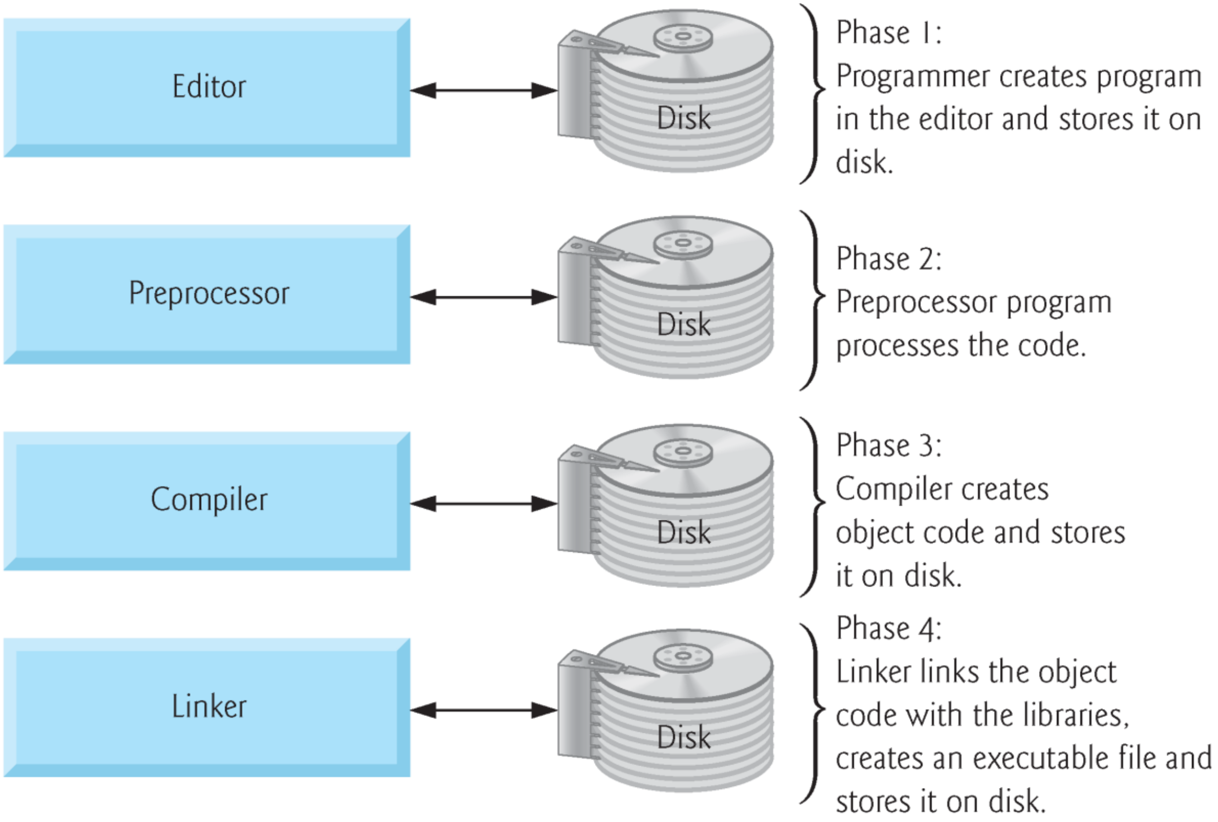
ANSI American National Standards Institute

GCC



Because C is a hardware-independent, widely available language, applications written in C can run with little or no modifications on a wide range of different computer systems.

C Development Environment



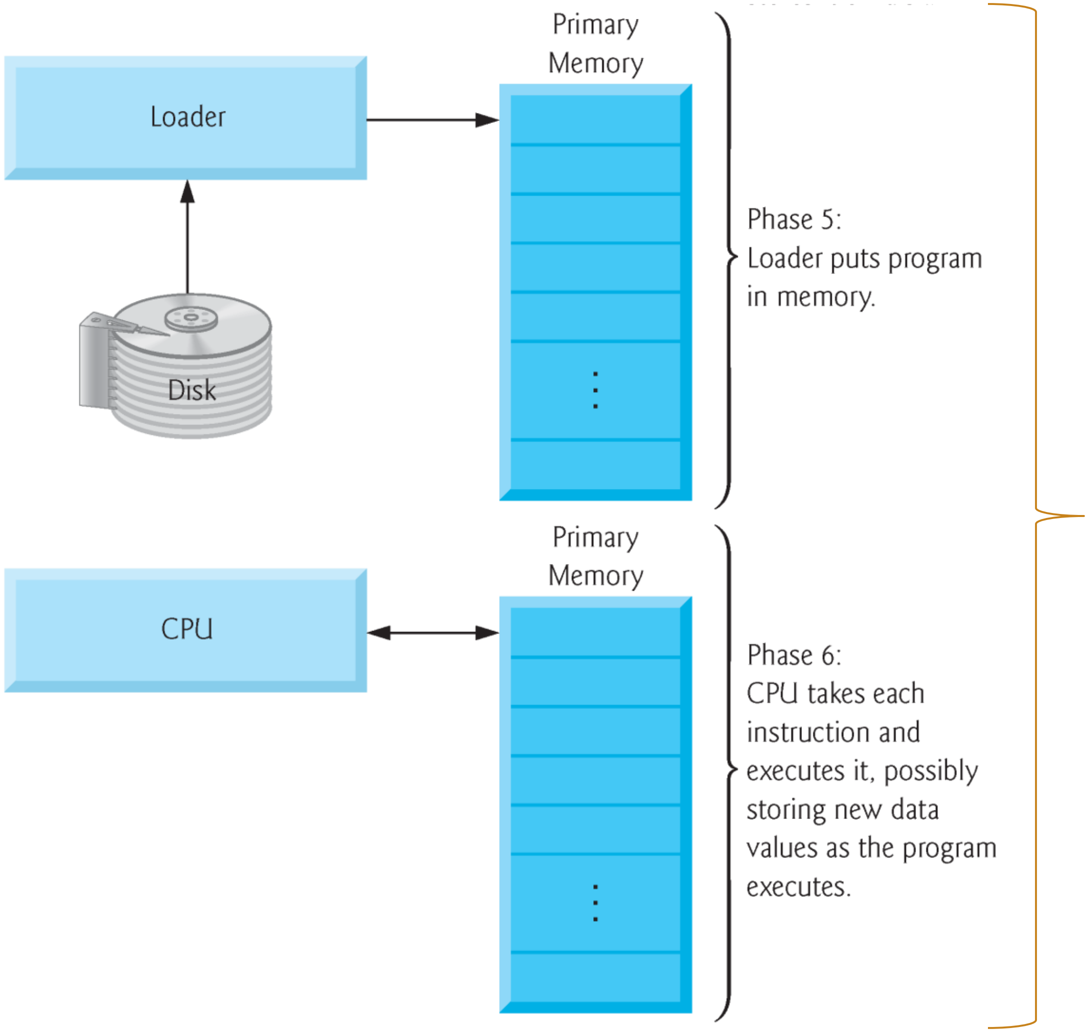
Phase 1:
Programmer creates program in the editor and stores it on disk.

Phase 2:
Preprocessor program processes the code.

Phase 3:
Compiler creates object code and stores it on disk.

Phase 4:
Linker links the object code with the libraries, creates an executable file and stores it on disk.

Execution Environment



Primary Memory

Loader

Disk

Phase 5:
Loader puts program in memory.

Primary Memory

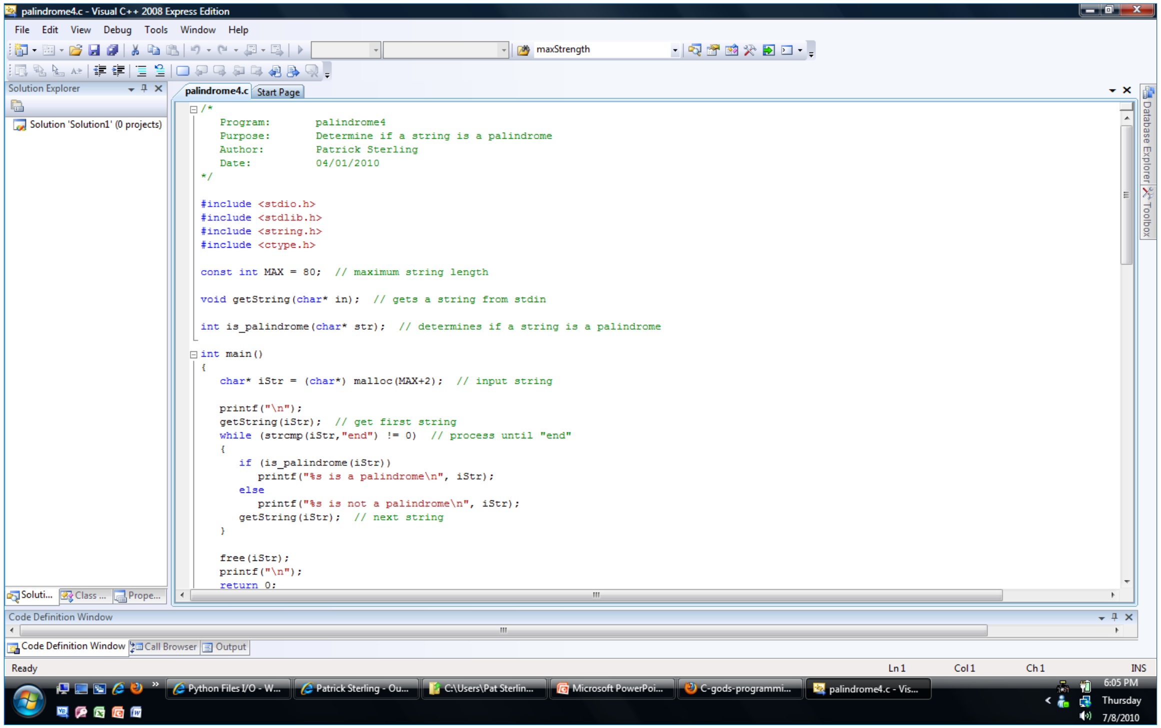
CPU

Phase 6:
CPU takes each instruction and executes it, possibly storing new data values as the program executes.

Optionally under control of a Debugger

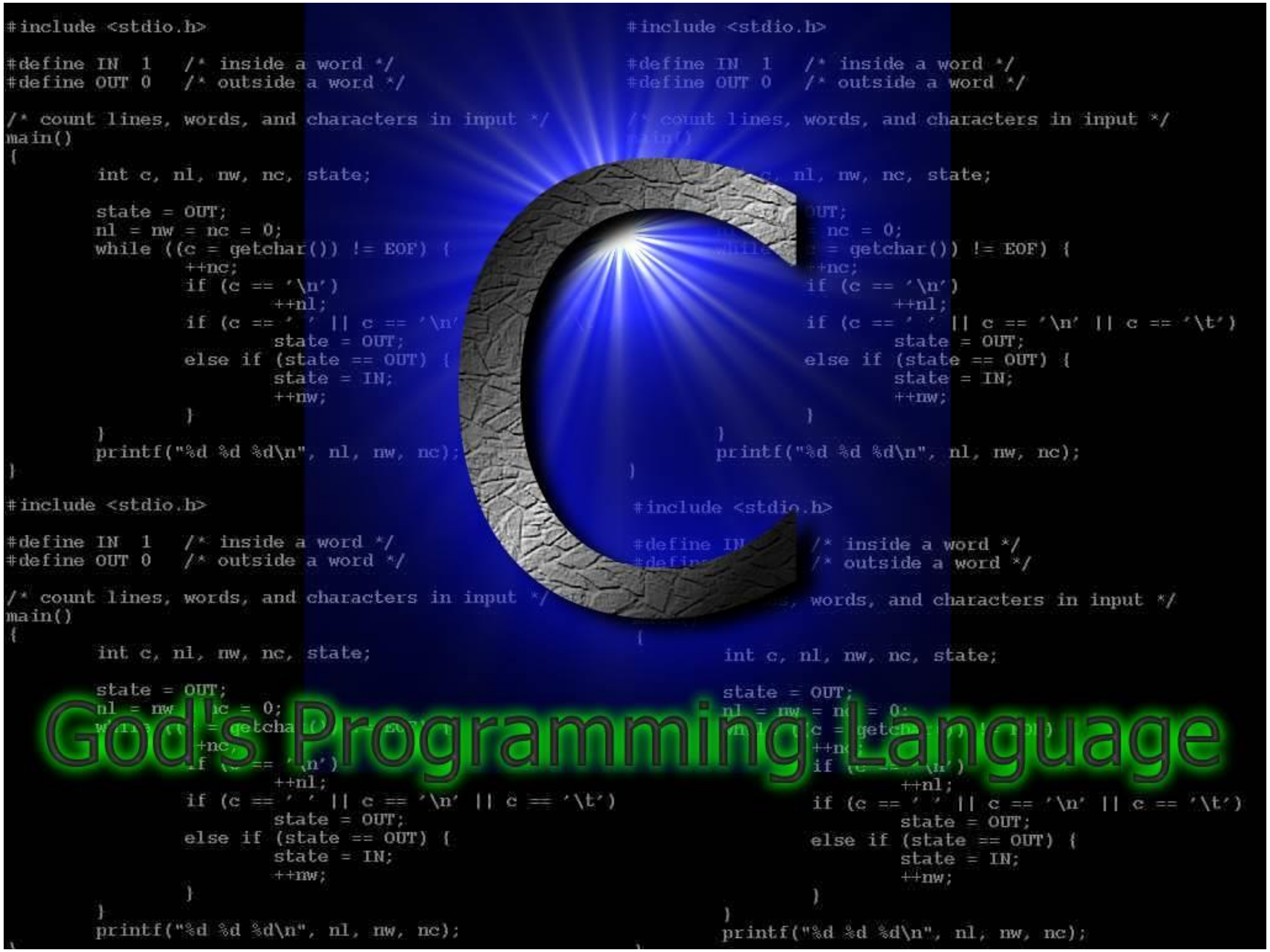
IDE

- Integrated Development Environment
  - Editor
  - Compiler
  - Debugger
- Ex:
  MS Visual C++
  Xcode



```c
/*
   Program:        palindrome4
   Purpose:        Determine if a string is a palindrome
   Author:         Patrick Sterling
   Date:           04/01/2010
*/

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <ctype.h>

const int MAX = 80;  // maximum string length

void getString(char* in);  // gets a string from stdin

int is_palindrome(char* str);  // determines if a string is a palindrome

int main()
{
   char* iStr = (char*) malloc(MAX+2);  // input string

   printf("\n");
   getString(iStr);  // get first string
   while (strcmp(iStr,"end") != 0)  // process until "end"
   {
      if (is_palindrome(iStr))
         printf("%s is a palindrome\n", iStr);
      else
         printf("%s is not a palindrome\n", iStr);
      getString(iStr);  // next string
   }

   free(iStr);
   printf("\n");
   return 0;
```

Best Programming Language?



```
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/* count lines, words, and characters in input */
main()
{
        int c, nl, nw, nc, state;

        state = OUT;
        nl = nw = nc = 0;
        while ((c = getchar()) != EOF) {
                ++nc;
                if (c == '\n')
                        ++nl;
                if (c == ' ' || c == '\n' || c == '\t')
                        state = OUT;
                else if (state == OUT) {
                        state = IN;
                        ++nw;
                }
        }
        printf("%d %d %d\n", nl, nw, nc);
}
```

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THE END