

Programming, Problem Solving, and Abstraction

Chapter One

Computers and Programs

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Concepts

1.1 Computers and Computation

1.2 Programs and programming

1.3 A first C program

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1.5 Be careful

Summary

Concepts

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Summary

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Summary

- ▶ **Computer Science** is the study of information – how it is represented, manipulated, and transformed.
- ▶ **Software Engineers** design and implement large-scale software systems, and do so in a manner that is both socially responsible, and maximizes the likelihood of a successful outcome.
- ▶ Other technology disciplines require a level of knowledge of both of these areas.
- ▶ **Programming is fun!**

1.1 Computers and computation

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Concepts

1.1 Computers

1.2 Programs

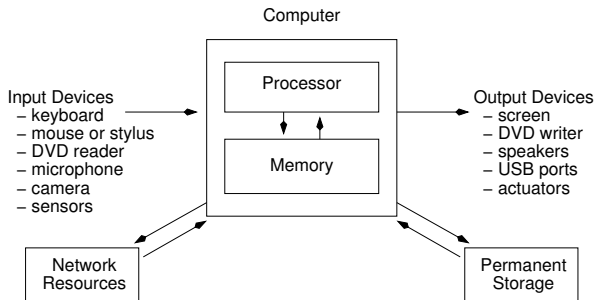
1.3 C programs

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Summary

Computers manipulate information symbolically.



1.1 Computers and computation

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Summary

Computers have a limited repertoire of operations, but carry them out extremely quickly and with astounding reliability.

As a rule of thumb, a standard laptop computer can perform more than a hundred million operations per second; and a desktop computer today has more power than a million-dollar computer of twenty-five years ago.

1.1 Computers and computation

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Summary

Working in pairs, swap information about the first computer you ever used. Can you remember when it was, what speed it was rated at, how much memory it had, and how much it cost?

1.2 Programs and programming

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Summary

The computer **hardware** is controlled and directed by the computer **software**, with each program written in one or more **programming languages**.

Natural language cannot be used for programming because it is too imprecise.

1.2 Programs and programming

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Summary

There are many different programming languages, loosely categorized into four broad classes.

C is a procedural programming language, developed in the 1970s at Bell Laboratories in the United States by Brian Kernighan and Dennis Ritchie.

It is a robust, standardized, portable, and widely available language suitable for a broad range of computing, engineering, and scientific calculations.

1.3 A first C program

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Summary

► `helloworld.c`

To actually run a program, it needs to be converted to simple machine instructions using a [compiler](#):

```
mac: ls
helloworld.c
mac: gcc -Wall -ansi -o helloworld helloworld.c
mac: ls
helloworld helloworld.c
mac: ./helloworld
Hello world!
mac:
```

1.3 A first C program

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Summary

The command `gcc` is a C compiler, and the options `-Wall` and `-ansi` request warnings for non-standard features.

You might use different shell commands in your computing environment for compiling and executing C programs.

The C program itself is portable from one machine to another. But it needs to be compiled for each such system.

1.3 A second C program

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► `addnumbers.c`

The principal features in most programs are comments, declarations, assignment statements, control structures, and I/O statements.

Working with a neighbor, decide what changes would be necessary so that `addnumbers.c` reports the number of input values and their mean, as well as their sum.

1.4 The task of programming

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Summary

Programming is a construction exercise.

- ▶ Think about the problem
- ▶ Write down a proposed solution
- ▶ Break each step into smaller steps
- ▶ Convert the basic steps into instructions in the program
- ▶ Use an [editor](#) to create a [file](#) that contains the program
- ▶ Use the [compiler](#) to check the [syntax](#) of the program
- ▶ [Test](#) the program on a range of data.

Remember an important message: [keep it simple, stupid.](#)

1.5 Be careful

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Summary

Computers **always eventually fail**. Be prepared for that day.

If you have used your computer for work or a business, the value of the data might easily be 10 or 100 times greater than the value of the hardware.

Maintain a regular routine for backing up your work.

Keep some of your backups in a different location.

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Summary

Tell the person sitting next to you about the dumbest way that you have ever lost data off a computer or phone.

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Summary

- ▶ Computers manipulate information according to the instructions specified by programs; programs are written in a programming language.
- ▶ C is a standardized and portable language in widespread use.
- ▶ A compiler translates the program statements into the detailed machine instructions executed by a particular computer.
- ▶ Data is more valuable than hardware, and needs to be carefully safeguarded.