Computer Programming 143 – Lecture 2
Introduction to module

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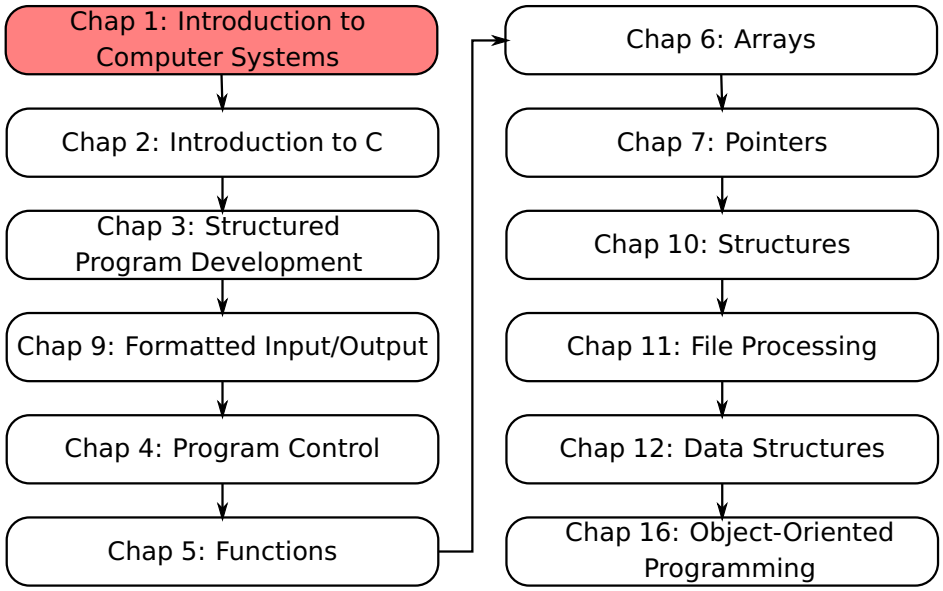
Module Overview



Lecture Overview

1.1 Introduction

We will learn

- The C programming language
- Structured programming and proper programming techniques

This book also covers

- C++: Chapter 15 – 24 introduce the C++ programming language

This course is appropriate for

- Technically oriented people with little or no programming experience
- Experienced programmers who want a deep and rigorous treatment of the language

1.2 Computers: Hardware and Software

Computer

- Device capable of performing computations and making logical decisions
- Computers process data under the control of sets of instructions called computer programs

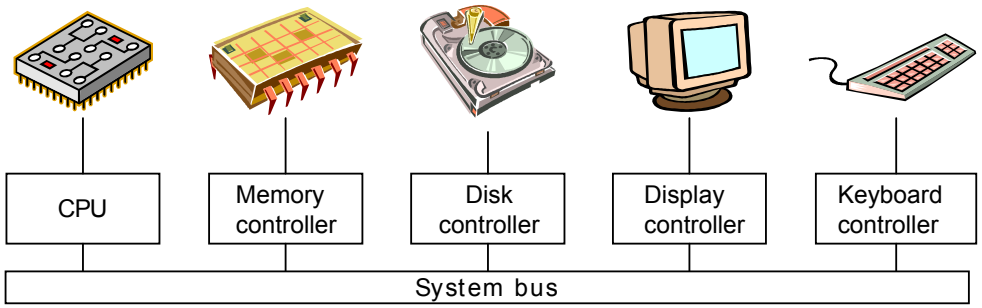
Hardware

- A computer consists of various devices
- Keyboard, screen, mouse, disks, memory, CD-ROM, and processing units

Software

- Programs that run on a computer

1.2.2 Computer Organization I



1.2.2 Computer Organization II

Six logical units in every computer:

1. Input unit (Keyboard, mouse)
   - Obtains user input information from input devices
2. Output unit (Screen, printer)
   - Outputs user or processed information and results
3. Arithmetic Logic Unit (ALU)
   - Performs arithmetic calculations and logic decisions
4. Central processing unit (CPU)
   - Supervises and coordinates the other sections of the computer
5. Memory unit (RAM)
   - Volatile, rapid access, low capacity, and expensive
   - Stores program and input information temporarily
6. Secondary storage unit (Disks)
   - Cheap, long-term, high-capacity storage
   - Stores inactive programs and data

1.4 Machine Languages, Assembly Languages, and High-level Languages I

Three types of programming languages:

1. Machine languages
   - Strings of numbers giving machine specific instructions
   - Example:

```
+1300042774
+1400593419
+1200274027
```

2. Assembly languages
   - English-like abbreviations representing elementary computer operations (translated via assemblers)
   - Example:

```
LOAD   BASEPAY
ADD    OVERPAY
STORE  GROSSPAY
```

1.4 Machine Languages, Assembly Languages, and High-level Languages II

3. High-level languages
   - Codes similar to everyday English
   - Use mathematical notations
   - Translated via compilers
   - Example:

```
grossPay = basePay + overTimePay
```


1.5 History of C

C

- Evolved by Ritchie from two previous programming languages, BCPL and B
- Used to develop UNIX
- Used to write modern operating systems
- Hardware independent (portable)
- By late 1970's C had evolved to "Traditional C"

Standardization

- Many slight variations of C existed, and were incompatible
- Committee formed to create a "unambiguous, machine-independent" definition
- Standard created in 1989, updated in 1999

1.6 The C Standard Library

C programs consist of pieces/modules called functions

- A programmer can create his own functions
  - Advantage: the programmer knows exactly how it works
  - Disadvantage: time consuming
- Programmers will often use the C library functions
  - Use these as building blocks
  - Advantages: saves time
  - Disadvantages: must know exactly how the library work
- Avoid re-inventing the wheel
  - If a pre-made function exists, generally best to use it rather than write your own
  - Library functions carefully written, efficient, and portable

Fortran, COBOL, Pascal en Ada (Structured Programming)

In the 1960's most software development companies were experiencing major problems during development

- Projects were never completed on time
- Projects always went over budget
- Final products were never reliable

- Research lead to the development of structured programming

What is structured programming?

- It is a disciplined approach to programming where programs can be:
  - more reliable
  - more understandable
  - provable as correct
  - reused

- Pascal (1971) is a language that was developed directly from the research into structured programming

1.8 Key software trend: Object technology I

Writing Code as Objects

- started in the 1990's
- simplified the development of code "objects"
- closely resembles real world objects
- improved code re-usability
- eliminates the process of having to "start from scratch"
- produces code that is easier to understand and maintain

1.9 Typical C program development environment I

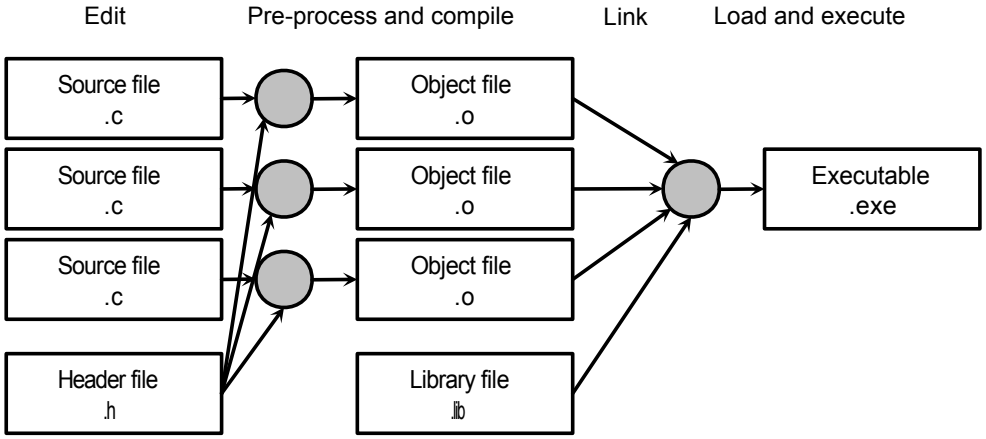
Typical C systems consists of many parts, they include:

- a program development environment
- the language
- the C Standard Library

C programs typically go through six phases to be executed:

- edit
- pre-process
- compile
- link
- load
- execute

1.9 Typical C program development environment II



Why C?

Why do we use C in this module?

- Programming principles are easy to learn in C
- Provides a good base from which to learn higher level languages (C++/Java)
- Essential for embedded applications
- Many libraries for mathematical and scientific applications available

Perspective

Today

Introduction to Computer Systems and Programming

- Introduction (1.1)
- Computer Systems (1.3-1.4)
- Programming Languages (1.5-1.10)
- Why C?

Next lecture

Introduction to C

- First program

Homework

1. Read Chapter 1
2. Do Self-Review Exercises 1.1, 1.2
3. Do Exercises 1.4, 1.5