

January 10, 2001

Important announcements

[Class home page](#)

[Class syllabus](#)

[Class schedule](#)

[Homework assignment 1](#)

Two important points from Chapter 1

- 1) Given enough (tape) storage and enough time, all computers can compute the same set of problems.
- 2) “Problems” are solving by transformations between abstractions.

Turing machine

A simple “computer” and an infinite “tape”.

Read and then write a tape symbol at each computer step.

Universal Turing machine

A Turing machine that can simulate any Turing machine.

Turing’s thesis

Every computation can be computed by a Turing machine.

[Who was Alan Turing?](#)

Layers of Abstraction

Problem	A natural-language description of the task to be solved
Algorithm	An abstract specification of the computational methods needed to solve the task
Program	What you wrote in CSCI 201
Instruction set architecture	The 1's and 0's used by the computer to execute your program. For example, the x86 machine code.
Microarchitecture	The processor that execute your code. For example, a Pentium II or an AMD Athlon.
Circuits	Hardware "modules", such as adders and multiplexers.
Devices	Transistors, such CMOS or bipolar.

Example of a transformation

From the C program:

```
int Add2Big(int A, int B, int C)
{
    int R ;
    if (A < B)
        R = A ;
    else
        R = B ;
    if (C < R)
        R = C ;
    return(A+B+C-R) ;
} ;
```

The GCC compiler generates the assembly code:

```
Add2Big:
    pushl %ebp
    movl %esp,%ebp
    subl $4,%esp
    movl 8(%ebp),%eax
    cmpl 12(%ebp),%eax
    jge .L2
    movl 8(%ebp),%eax
    movl %eax,-4(%ebp)
    jmp .L3
.L2:
    movl 12(%ebp),%eax
    movl %eax,-4(%ebp)
.L3:
    movl 16(%ebp),%eax
    cmpl -4(%ebp),%eax
    jge .L4
    movl 16(%ebp),%eax
    movl %eax,-4(%ebp)
.L4:
    movl 8(%ebp),%eax
    movl 12(%ebp),%ecx
    leal (%ecx,%eax),%edx
    addl 16(%ebp),%edx
    subl -4(%ebp),%edx
    movl %edx,%eax
    jmp .L1
.L1:
    leave
    ret
```

16(%ebp)	C
12(%ebp)	B
8(%ebp)	A
4(%ebp)	
0(%ebp)	
-4(%ebp)	R