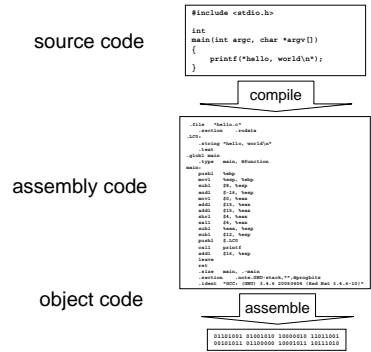


## Underneath the Hood

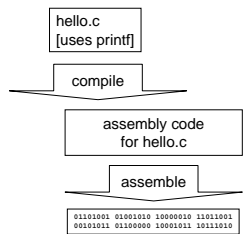
Software

- :: Pre-Processing
- :: Compiling
- :: Assembling
- :: Linking
- :: Executing

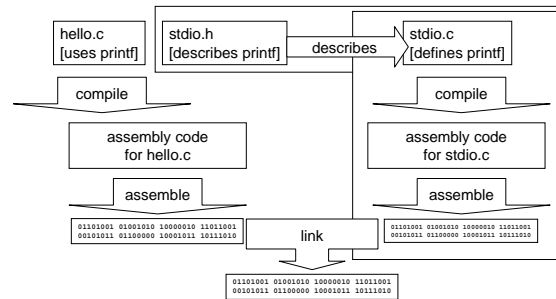
## From Source Code to Object Code



## Linking against Libraries

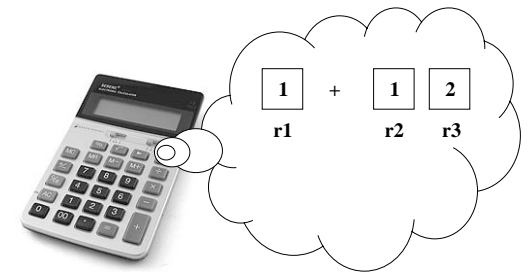


## Linking against Libraries



## Underneath the Hood

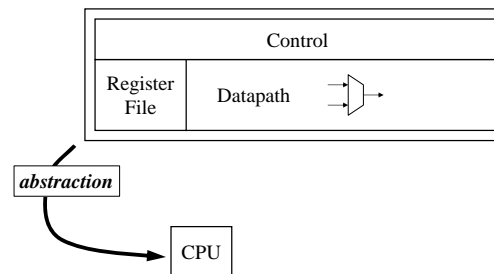
Hardware



## What's in the Box?

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>:: <b>Registers</b> <ul style="list-style-type: none"> <li>:: very fast temporary memory</li> <li>:: few of them (16 or 32)</li> </ul> </li> <li>:: <b>Program counter</b> <ul style="list-style-type: none"> <li>:: special register for tracking the next instruction to execute</li> </ul> </li> <li>:: <b>Memory</b> <ul style="list-style-type: none"> <li>:: storage for program code and data</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>:: <b>Control unit</b> <ul style="list-style-type: none"> <li>:: translates instructions into commands for registers and datapath</li> </ul> </li> <li>:: <b>Datapath</b> <ul style="list-style-type: none"> <li>:: carries out basic operations (arithmetic, logical)</li> </ul> </li> <li>:: <b>I/O devices</b> <ul style="list-style-type: none"> <li>:: supports flow of data into and out of the machine</li> </ul> </li> </ul> |
|--|---|

## What's in the CPU?



## What can a CPU do?

x86 Instruction Set

- :: `addl`
- :: `call`
- :: `leave`
- :: `movl`
- :: `pushl`
- :: `ret`
- :: `sall`
- :: `shrl`
- :: `subl`
- :: ...

# What can a CPU do?

## x86 Instruction Set

### ADD - Arithmetic Addition

Usage: ADD destination

Modifies Flags: AF CF OF PF SF ZF

Adds "src" to "dest" and replacing the original contents of "dest". Both operands are binary

operands	Checks			Size Bytes
	286	386	486	
reg,reg	2	2	1	2
mem,reg	7	7	3	2-4
reg,mem	7	6	2	2-4
reg,imm8	3	2	1	3-4
mem,imm8	7	7	3	3-6
accum,imm8	3	2	1	2-3

Example from <http://www.penguin.cz/~litrak/inst/a.html#ADD>.

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# Computer Science 50

## Introduction to Computer Science I

Harvard College

Week 10

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