CSC231-Assembly

Week #2
Fall 2019

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Logistics

• Lab report due Wednesday 11:55 p.m.

• Windows users, install **Putty** on your computer ([putty.org](http://putty.org)). Mac users, all set.

• Wednesday, emacs/nasm lab

• This **Thursday, 5:15 p.m.**, Special lab on **emacs** and login in to Linux class accounts with **David Marshall**, FH241
Today...

- Review of demolition lab
- The main players (CPU, RAM, hard drive)
- Game
- Simplified Simulator
• Review of demolition lab
• The main players (CPU, RAM, hard drive)
• Game
• Simplified Simulator
Last Week Review
Main Players

Pentium
Main Players

Pentium

RAM
Main Players

- Pentium
- RAM
- Disk Drive
Main Players

Pentium

RAM

Disk Drive

hello.asm
https://youtu.be/p-JJp-oLx58?t=303
Main Players

- Pentium
- RAM
- Disk Drive

hello.asm
;;; hello.asm
;;; D. Thiebaut
;;; Display "Hello World!" on the screen
;;; To assemble, link, and run:
;;;     nasm -f elf  hello.asm
;;;     ld -melf_i386 -o hello hello.o
;;;     ./hello

section .data
Hello           db      "Hello World!", 10, 10
HelloLen        equ     $-Hello

section .text
global  _start
_start:

;;; print message
    mov     eax, 4          ; write
    mov     ebx, 1          ; stdout
    mov     ecx, Hello      ; address of message to print
    mov     edx, HelloLen   ; # of chars to print
    int     0x80

;;; exit
    mov     ebx, 0
    mov     eax, 1
    int     0x80
Main Players

Pentium

RAM

Disk Drive

hello.asm

nasm

hello.o
Main Players

Pentium

RAM

Disk Drive

hello.asm

hello.o

hello

`nasm`

`ld`
Main Players

- Pentium
- RAM
- Disk Drive

Process:
1. `nasm` hello.asm
2. `ld` hello.o
3. `./hello`
Main Players

Pentium

RAM

Disk Drive

hello.asm

nasm

ld

./hello

hello.o

hello
Main Players

- Pentium
- RAM
- Disk Drive

- hello.asm
- hello.o
- hello

Tools:
- nasm
- ld
Linux Accounts

- cs231a-xx

- **Keep** top part, **sign** the bottom part and **return it**

- We will use them on **Wednesday** (in-class lab)

- Windows Users, please install **Putty** on your computer:
  - **https://www.putty.org**
A Microprocessor Simulator
The Processor

Atmega16U2 (USB interface)

USB interface

Power LED

Voltage regulator

Power in

Atmega328P

https://i.stack.imgur.com/uxIPv.jpg

http://www.scind.org/content_images/full/1445359752New_Processor.jpg

00 Really?
01 Hello
02 How are you?
03 Did you enjoy breakfast?
04 Was it good?
05 Have you stared on the homework?
06 Do you like apples?
07 Do you like bananas?
08 Goodbye!

00 No
01 Yes
02 Good
03 Bad
04 A tiny bit
05 A lot
06 Sometimes
07 Hello!
08 Sad
09 Goodbye!
00 Really?
01 Hello
02 How are you?
10 Did you enjoy …
04 Was it good?
05 Have you stared on the homework?
11 Do you like …
08 Goodbye!
12 Apples
13 Bananas
14 Breakfast

00 No
01 Yes
02 Good
03 Bad
04 A tiny bit
05 A lot
06 Sometimes
07 Hello!
08 Sad
09 Goodbye!
How could we setup a conversation with the whole class?
00 Really?
01 Hello
02 How are you?
10 Did you enjoy …?
04 Was it good?
05 Have you stared on the homework?
11 Do you like …
08 Goodbye!
12 Apples
13 Bananas
14 Breakfast

00 No
01 Yes
02 Good
03 Bad
04 A tiny bit
05 A lot
06 Sometimes
07 Hello!
08 Sad
09 Goodbye!
Exercise

Recreate the original conversations
On Infinite Verbal Loops...
Important Concepts

- Codes, codes, codes
- Numbers can represent questions, as well as answers
- The same number can have different meanings, depending on context
- With the right choice of questions and answers, coded as numbers, one could have a rich conversation!
Important Concepts Relating to Computers

• Only numbers can be stored in memory

• The memory is made of bits

• Bits represent binary digits

• The memory contains only binary numbers

• Using codes, the numbers can be used to represent characters (a, b, A, B, 0, 1, #, &…)

• Using codes, the numbers can be used to represent actions to be executed by the processor

• Using codes, the binary numbers can be used to represent decimal numbers, integer, or real (1, -2, 10, 3.14159…)
### The ASCII Table

**American Standard Code for Information Interchange**

<table>
<thead>
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<th>ASCII value</th>
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</table>

Hand Calculator Example
Assembly Language
With a Simulator
The Key Players

Processor

AC
PC
+

Memory
Types of Operation Supported

- LOAD
- STORE
- ADD
- HALT
LOAD instruction (memory)

Example

Processor

AC

PC

+
LOAD instruction (immediate)

Example

Processor

AC

PC

+

Load 3
Example

STORE instruction (memory)
Program #1

Processor

AC
PC
+

11
10
9
8
7
6
5
4
3
2
1
0

LOAD 1
STORE [9]
HALT
103
Program #2

Processor

AC  PC  +

11  10  9  8  7  6  5  4  3  2  1  0

103  HALT  STORE [9]  ADD 1  LOAD [9]
ADD instruction (memory)

Example

Processor

AC

PC

+

5

ADD [10]

LOAD 3

D. Thiebaut, Computer Science, Smith College
ADD instruction (immediate)
Write an assembly language program that takes the numbers stored at Addresses 9, and 10 adds them together, and stores the sum back at Address 11.
JUMP instruction

Example

Processor

AC

PC

+
HALT instruction

Example

Processor

AC

PC +

11 10 9 8 7 6 5 4 3 2 1 0

Halt
Store [9]
Add 1
Load [9]
We stopped here last time...

Outline for Today
9/18/19

• Play with the simplified computer simulator

• Learn how to use the software platform for CSC231:
  • Linux account
  • emacs
  • write, assemble, link and run pentium assembly programs
Logistics

- **Faculty meeting** tonight, **no office hours**

- Will be checking **Piazza** regularly this evening!

- Please **resubmit** pdf for **Homework 1** if submitted before 11:00 a.m. this morning (9/18)
Computer Simulator


http://www.science.smith.edu/dftwiki/media/simulator/
Resources

- **Link to the simulator**
- **Link to the documentation** (also at bottom of simulator page)
Exercise

Write an assembly language program that uses 3 variables in memory, containing 30, 40, and 0, respectively. The program will compute the sum of the first 2 and store the result in the 3th variable. Run your program on the simulator.
Assembly Under Linux
Windows

marax.smith.edu
ssh -Y cs231a-xx@marax.smith.edu
<table>
<thead>
<tr>
<th>Topics:</th>
<th>Lab/Hw</th>
<th>Reading</th>
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</thead>
<tbody>
<tr>
<td>Monday</td>
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<tr>
<td>- Review demolition lab</td>
<td>- Simplified Computer Simulator Lab</td>
<td>- Reading</td>
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<tr>
<td>- Coding game</td>
<td>- &quot;Hello World!&quot; lab</td>
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<tr>
<td>- Simplified Computer Simulator</td>
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<tr>
<td>- Link to the simulator</td>
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<td>- Link to the documentation on the simulator</td>
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<td>- slides (pdf)</td>
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<td>Wednesday</td>
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<tr>
<td>- Simplified Computer Simulator, Part 2</td>
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<td>- Simplified Computer Simulator in-class lab</td>
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<td>- Assembly</td>
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<td>- &quot;Hello World!&quot; in-class lab</td>
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<tr>
<td>Thursday: Special TA session at 5:15 p.m. with Dave Marshall in FH241.</td>
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<tr>
<td>- Emacs lab, for those new to emacs</td>
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</table>