The Processor

Atmega16U2 (USB interface)

USB interface

Voltage regulator

Power in

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

Let's Play a Game
00  Really?
01  Hello
02  How are you?
03  Did you enjoy...
04  Was it good?
05  Have you finished...
06  Do you like...

00  No
01  Yes
02  Good
03  Bad
04  A tiny bit
05  A lot
06  Homework
07  Wiki
08  Apples
09  Cereals
10  Bugs
11  Breakfast
12  PC Lab
13  Hello!
00 Really?
01 Hello
02 How are you?
03 Did you enjoy...
04 Was it good?
05 Have you finished...
06 Do you like...

20 Go back to...

00 No
01 Yes
02 Good
03 Bad
04 A tiny bit
05 A lot
06 Homework
07 Wiki
08 Apples
09 Cereals
10 Bugs
11 Breakfast
12 PC Lab
13 Hello!
00 Really?
01 Hello
02 How are you?
03 Did you enjoy...
04 Was it good?
05 Have you finished...
06 Do you like...

20 Go back to...

30 Start with Person...
31 Move to next person

00 No
01 Yes
02 Good
03 Bad
04 A tiny bit
05 A lot
06 Homework
07 Wiki
08 Apples
09 Cereals
10 Bugs
11 Breakfast
12 PC Lab
13 Hello!
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 numbers (1, 2, 10, 3.14159…)

D. Thiebaut, Computer Science, Smith College
## The ASCII Table

**American Standard Code for Information Interchange**

<table>
<thead>
<tr>
<th>ASCII value</th>
<th>Character</th>
<th>Control character</th>
<th>ASCII value</th>
<th>Character</th>
<th>ASCII value</th>
<th>Character</th>
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<th>Character</th>
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<td>(space)</td>
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<td>@</td>
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<td>SOH</td>
<td>033</td>
<td>!</td>
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<td>073</td>
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<td>063</td>
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Assembly Language
Assembly Language
The Key Players

Processor

AC

PC

+

Memory
The Key Players

Processor
- AC
- PC

Memory
We stopped here last time...
Announcement

Types of Operation Supported

Processor

AC
PC
+

Memory

LOAD
STORE
ADD

LOAD
STORE
ADD

LOAD
STORE
ADD

LOAD
STORE
ADD

LOAD
STORE
ADD

LOAD
STORE
ADD
LOAD instruction

Example

Processor

AC

PC

+

??

??

103

??

??

??

??

Load [9]

??

??

??

??

??

??
STORE instruction

Example

Processor

AC

PC

+  

11

10

...  

103

9

??  

8

??  

7

??  

6

??  

5

??  

4

??  

3

??  

2

??  

1

??  

0

??  

Store [10]
ADD instruction
Write an assembly language program that takes the number stored at Address 9, adds 1 to it, and stores the result back at Address 9.
JUMP instruction

Example

Processor

AC
PC
+

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

3
Jump 0
Store [9]
Add 1
Load [9]
HALT instruction

Example

Processor

AC

PC

+
Computer Simulator


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

- Link to the simulator
- Link to the documentation
- Link to the lab (to be done on Friday)
Exercise

Write an assembly language program that uses 4 variables in memory, containing, 3, 4, 10, and 0, respectively. The program will compute the sum of the first 3 and store the result in the 4th variable. Run your program on the simulator.