CSC 103: How Computers Work

Spring 2016
Smith College
Prof. Sheehan
Class 7: April 11
Outline

- Compilers and some history
- “High-level” programming languages
- Introduction to Processing
- Mini-lab in Processing
Assembly Follow-up

• Needed to add “HLT” (halt), so that our variables are not executed as code!

MOV A, [myNumber]
HLT

myNumber: DB 7
Assembly Code

.loop:

INC A
CMP A, 22
JNZ .loop
HLT
Assembly Code vs. Machine Code

Assembly Code

```
.loop:
INC A
CMP A, 22
JNZ .loop
HLT
```

Machine Code

```
18 0
23 0 22
39 0
0
```
Assembly Code vs. Machine Code

Assembly Code

```
.loop:
INC A
CMP A, 22
JNZ .loop
HLT
```

Machine Code

```
18 0 ; 0 for reg A
23 0 22 ; loop at address 0
39 0 ; stop the program
0
```
Compiler

- Assembly code is a human-readable form of machine code
- Motivation: still challenging to do simple tasks
- Converts source code into machine code (that can be read by the computer)
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- Helped develop COBOL
- Believed that computers should be programmed using a language close to natural language

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Harvard Mark 1

- Computer used in WWII

https://www.youtube.com/watch?v=qundvme1Tik (start: 35:55)
Harvard Mark 1

- Computer used in WWII
- Speed
  - Add/subtract: 1/3 second
  - Multiply: 6 seconds
  - Divide: 15 seconds
  - Log/Trig: over a minute

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- Instructions on punched control tape
  - 1) result
  - 2) source
  - 3) operation

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  - 1) result
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- Loop: join two ends of tape

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Higher-level Programming Languages
C programming language

- Since 1972
- Fairly easy to compile C to machine language

```c
/* Hello world in C */
#include<stdio.h>

main()
{
    printf("Hello, World!");
}
```
Java programming language

- Designed to be portable
- “WORA” write once, run anywhere

```java
/**
 * Hello world in Java */
public class HelloWorld {

    public static void main(String[] args) {
        System.out.println("Hello, World!");
    }
}
```
Python programming language

- Designed with code readability in mind
- Very high-level
- Has become a common choice for a first programming language

```python
# Hello world in Python
print("Hello, World!")

# For loop in Python
for student in my_class:
    print(student.name)
```