A bright yellow sticky note is partially visible on the left side of the slide, overlapping the white title card.

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 vs. Machine Code

Assembly Code

.loop:

INC A

CMP A, 22

JNZ .loop

HLT

Assembly Code vs. Machine Code

Assembly Code

Machine Code

.loop:

INC A

CMP A, 22

JNZ .loop

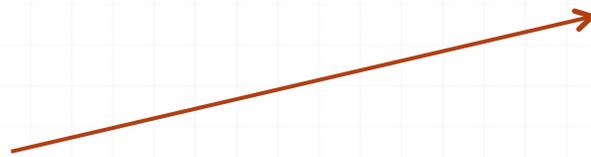
HLT

18 0

23 0 22

39 0

0



Assembly Code vs. Machine Code

Assembly Code

Machine Code

.loop:

INC A

CMP A, 22

JNZ .loop

HLT

18 0

; 0 for reg A

23 0 22

39 0

; loop at address 0

0

; stop the program

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)

Grace Hopper

- Joined the Navy during WWII in 1943



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(1906-1992)
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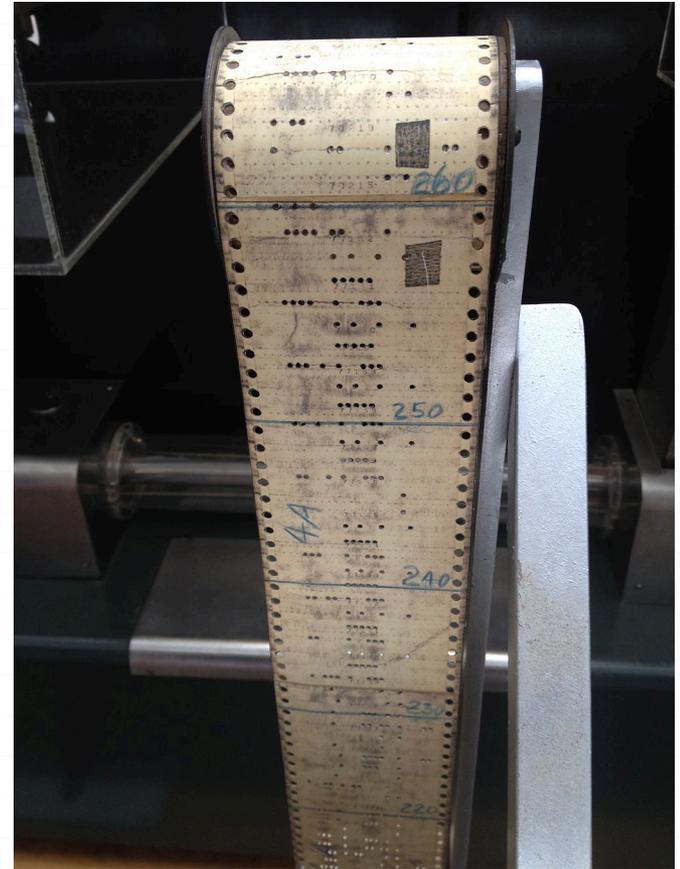
- Joined the Navy during WWII in 1943
- Trained at Smith College (!)
- Worked on the Harvard Mark 1
- Inventor of the first compiler (1952)
- Helped develop COBOL
- Believed that computers should be programmed using a language close to natural language



Grace Hopper
(1906-1992)
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Harvard Mark 1

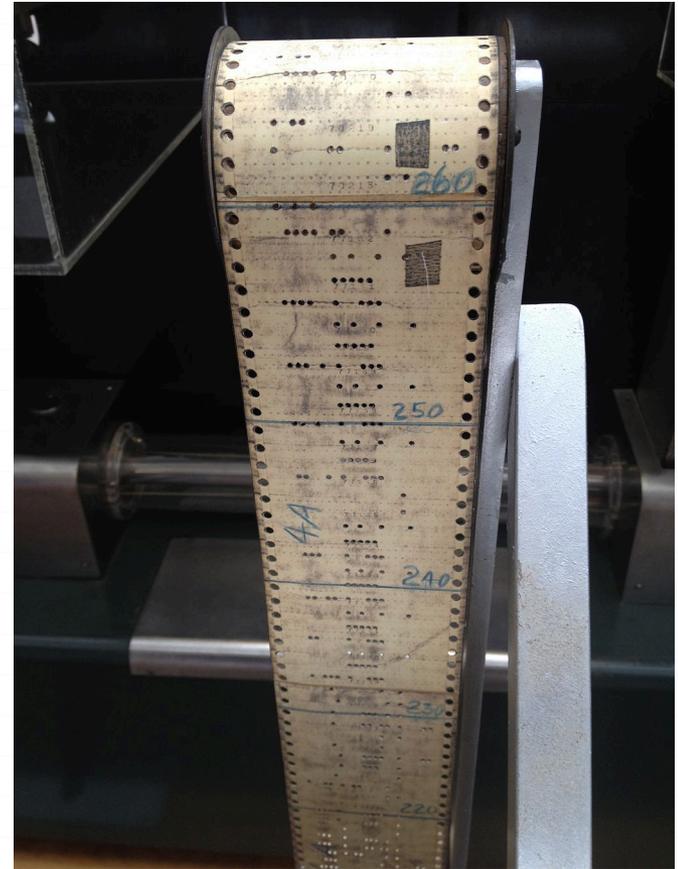
- Computer used in WWII



<https://www.youtube.com/watch?v=qundvme1Tik> (start: 35:55)

Harvard Mark 1

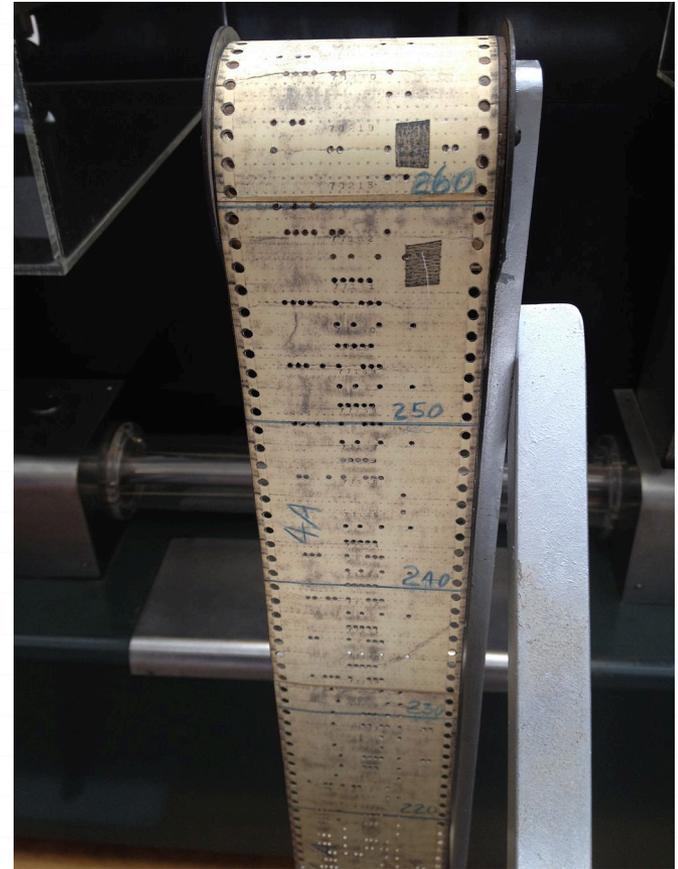
- Computer used in WWII
- Speed
 - Add/subtract: 1/3 second
 - Multiply: 6 seconds
 - Divide: 15 seconds
 - Log/Trig: over a minute



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Harvard Mark 1

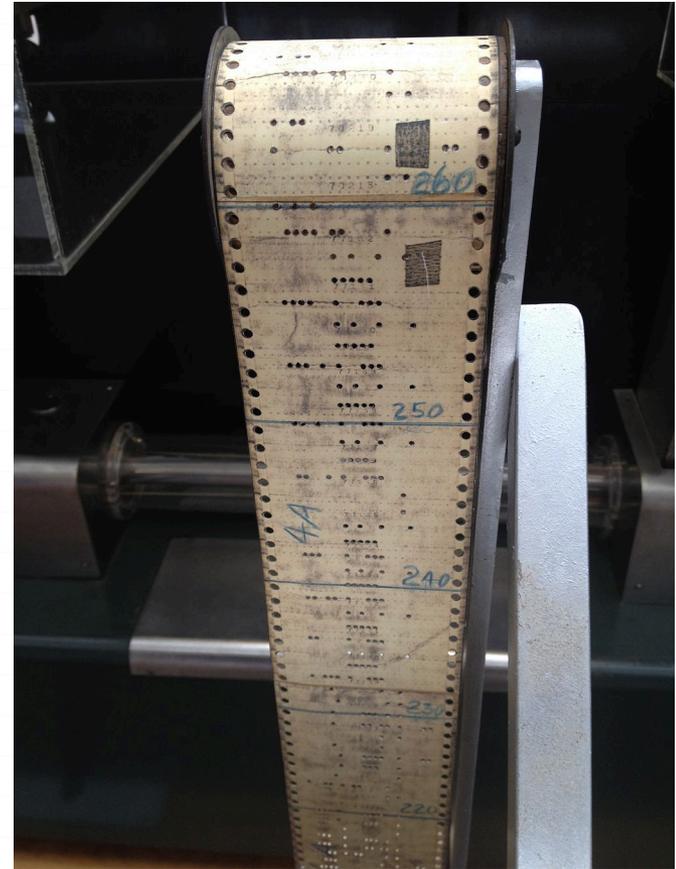
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- Instructions on punched control tape
 - 1) result
 - 2) source
 - 3) operation



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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

```
/* Hello world in C */  
#include<stdio.h>  
  
main()  
{  
    printf("Hello, World!");  
}
```

Java programming language

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

```
/** 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

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

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