

# Lehigh CSE007

A Java Introduction Into Computer Science

# Instructors

Dr Chen Lunde (principal)

Dr Pfaender Fabien

# Computer Science Context

**Store & interact** – set and print

**Act** – choose things

**Regroup** – functions

**Object I** – basic class, CRUD

**Object II** – access methods, constructors

**Object III** – heritage and polymorphism, internal class

**Object IV** – abstract class, anonymous class, interface

**Array I** – fixed 1D 2D matrix CRUD

**Array II** – list, dict, stream, lambda CRUD

**Array III** – searching, sorting (complexity)

**Exceptions & testing** – with Junit & logging

**Android program** – wrap up

In class:

Assignment from github

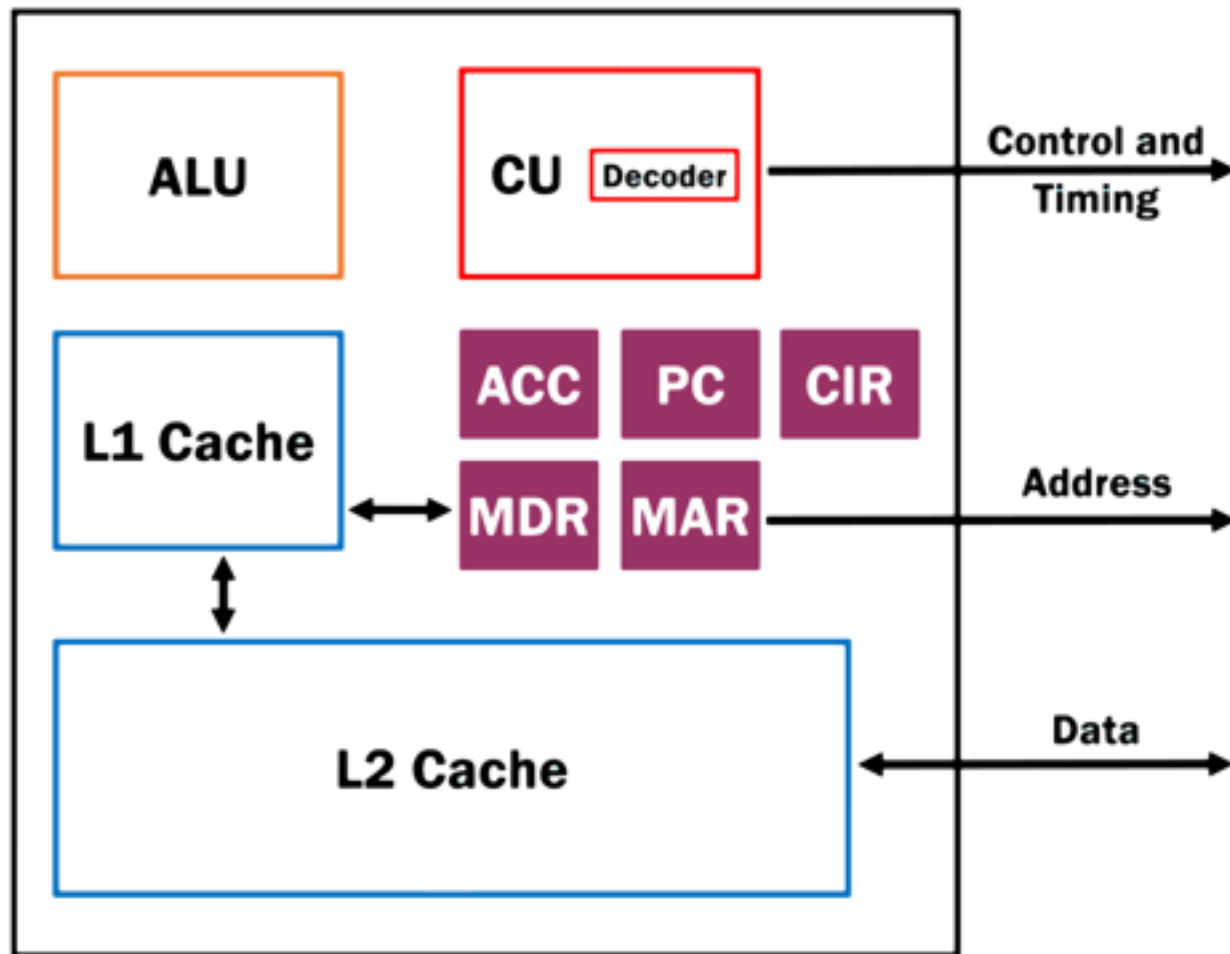
At home

Each week, the same project: The  
coffee Machine

# Computer Science Context

- 1– Architecture Von Neumann
- 2– Binary language
- 3– Algorithm as a process
- 4– High level vs Low level programming language
- 5– Compiler vs Interpreter
- 6– Java is Just Another Programming Language

## CPU



## RAM



**Secondary  
Storage  
e.g. HDD**

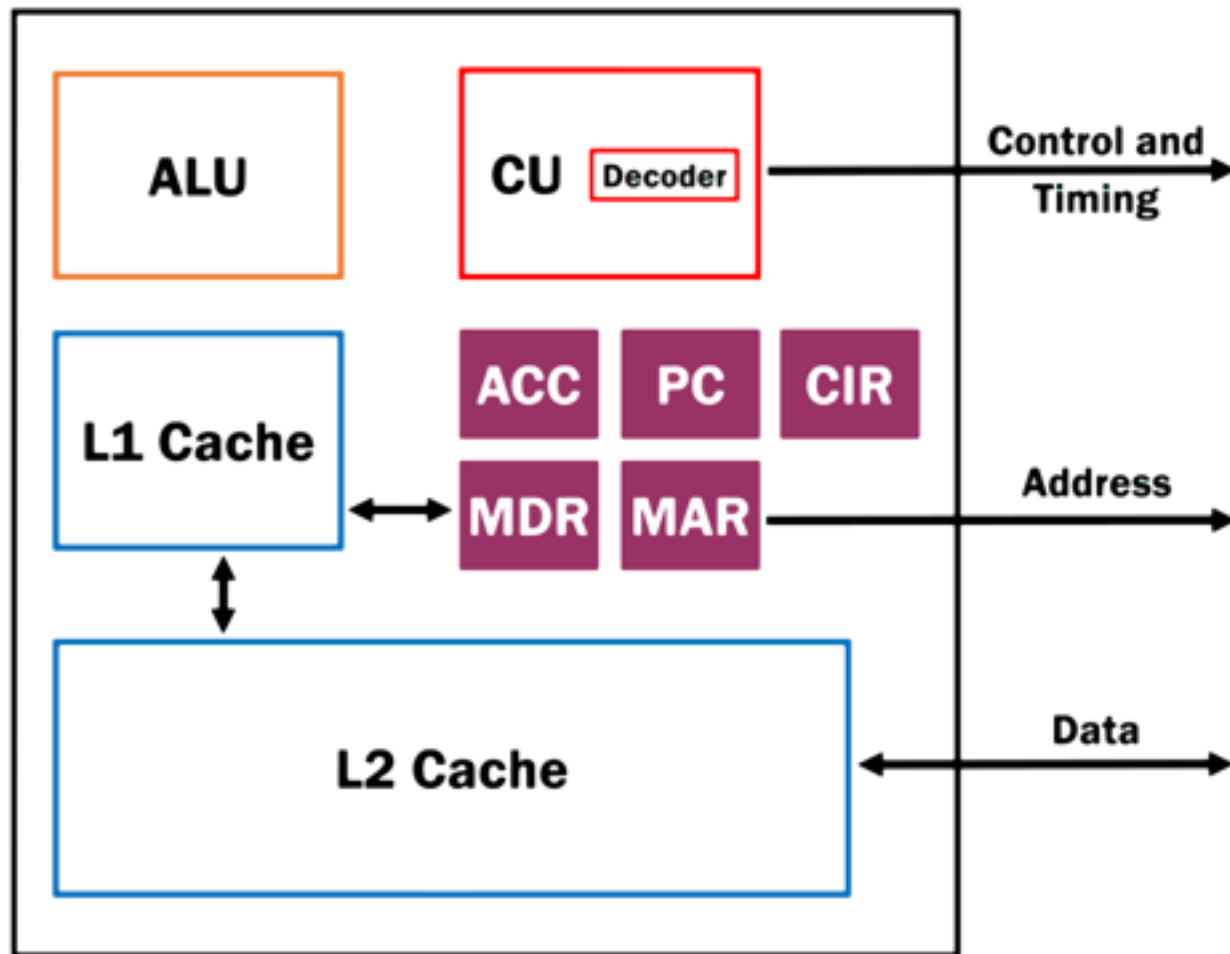
**Virtual Memory**



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# Von Neumann Architecture

## CPU



## RAM



**Secondary  
Storage  
e.g. HDD**

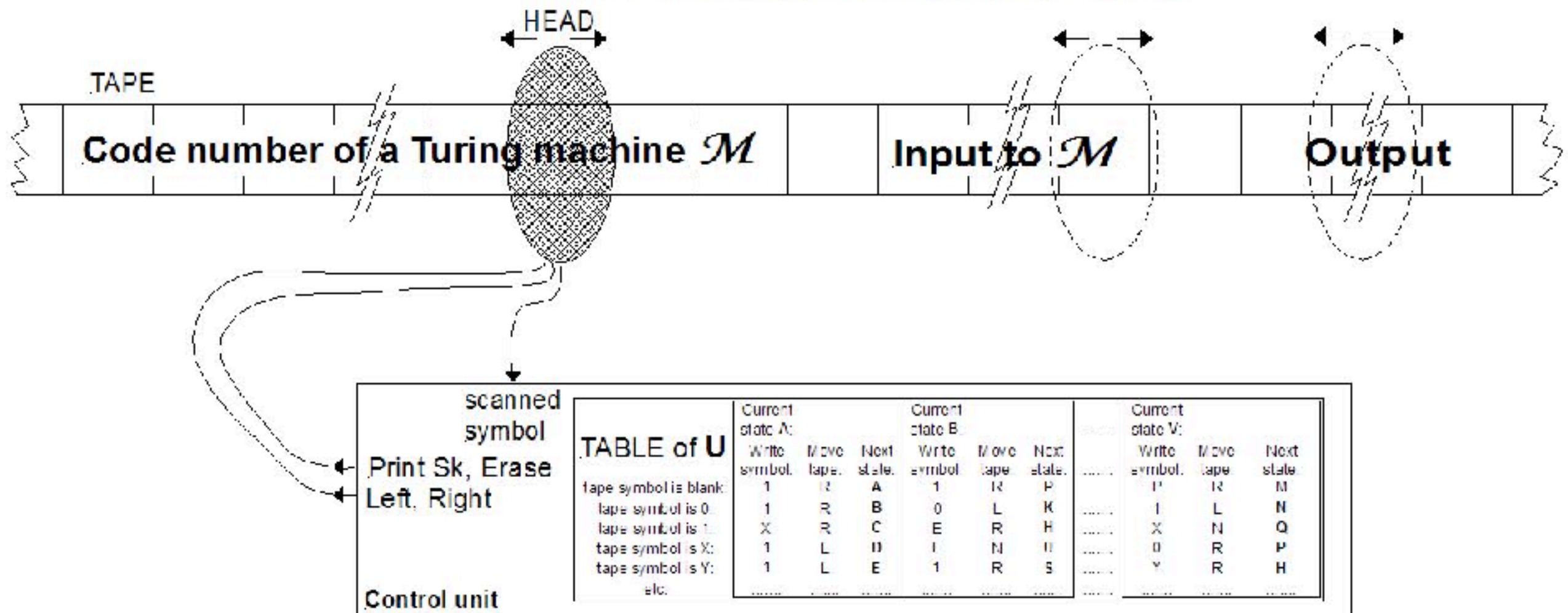
**Virtual Memory**



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# Von Neumann Architecture

In some models the HEAD shuttles back and forth between various regions on the TAPE, in other models the HEAD shuttles the TAPE back and forth



The **Universal machine U** consists of a set of instructions in the TABLE that can "execute" the correctly-formulated "code number" of any arbitrary Turing machine  $\mathcal{M}$  on its TAPE.

(Entries in the TABLE are fictitious: drawing partially after Davis (2000), p. 164.



SO I'M STUCK IN THIS  
DESERT FOR ETERNITY.

I DON'T KNOW WHY.  
I JUST WOKE UP  
HERE ONE DAY.



I NEVER FEEL  
HUNGRY OR  
THIRSTY.



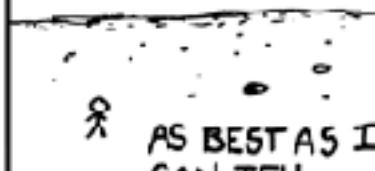
I JUST WALK.



SAND AND ROCKS



STRETCH TO INFINITY.



THERE'S PLENTY OF TIME  
FOR THINKING OUT HERE.



AN ETERNITY, REALLY.

I'VE REDERIVED  
MODERN MATH  
IN THE SAND



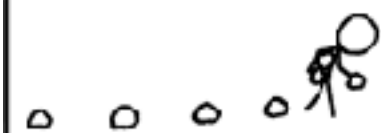
AND THEN SOME.

PHYSICS, TOO I WORKED OUT THE  
KINKS IN QUANTUM MECHANICS  
AND RELATIVITY.



TOOK A LOT OF THINKING, BUT THIS  
PLACE HAS FEWER DISTRACTIONS THAN  
A SWISS PATENT OFFICE.

ONE DAY I STARTED  
LAYING DOWN ROWS OF  
ROCKS.



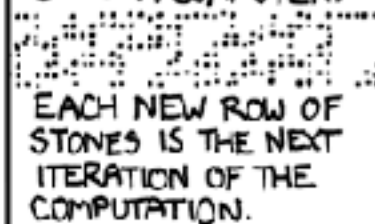
EACH NEW ROW  
FOLLOWED FROM  
THE LAST IN A  
SIMPLE PATTERN.



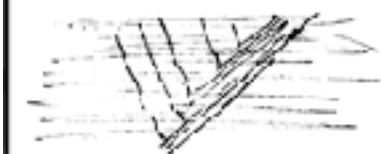
WITH THE RIGHT  
SET OF RULES AND  
ENOUGH SPACE,



I WAS ABLE TO  
BUILD A COMPUTER.



SURE, IT'S ROCKS  
INSTEAD OF ELECTRICITY,  
BUT IT'S THE SAME  
THING. JUST SLOWER.



• TURING-COMPLETE

AFTER A WHILE, I  
PROGRAMMED IT TO  
BE A PHYSICS SIMU-  
LATOR.



EVERY PIECE OF  
INFORMATION ABOUT  
A PARTICLE WAS  
ENCODED AS A STRING  
OF BITS WRITTEN  
IN THE STONES.



WITH ENOUGH TIME AND  
SPACE, I COULD FULLY  
SIMULATE TWO  
PARTICLES INTERACTING.



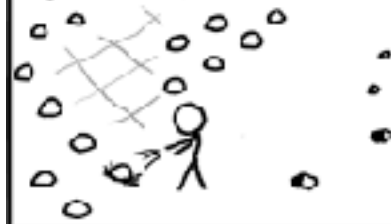
BUT I HAVE INFINITE  
TIME AND SPACE.



SO I DECIDED TO SIMULATE A UNIVERSE.



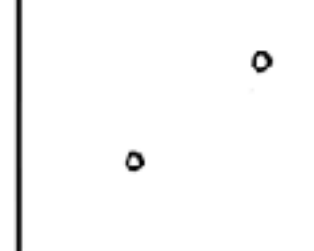
THE EONS BLUR  
PAST AS I WALK  
DOWN A SINGLE ROW.



THE ROWS BLUR PAST TO  
COMPUTE A SINGLE STEP.



AND IN THE  
SIMULATION



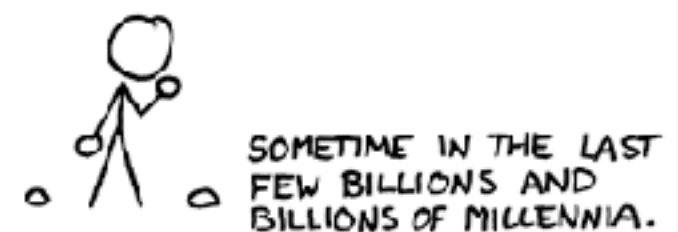
ANOTHER INSTANT  
TICKS BY.



SO IF YOU SEE A MOTE OF DUST  
VANISH FROM YOUR VISION IN A  
LITTLE FLASH OR SOMETHING

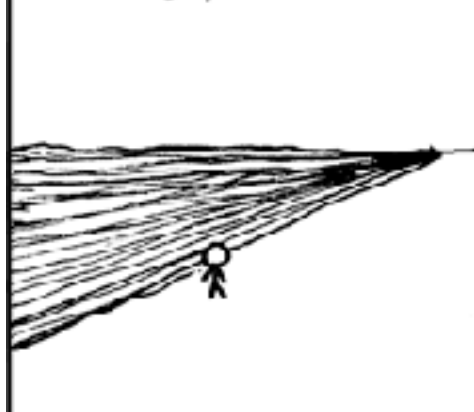


I'M SORRY. I MUST HAVE  
MISPLACED A ROCK



SOMETIME IN THE LAST  
FEW BILLIONS AND  
BILLIONS OF MILLENNIA.

OH, AND...



IF YOU THINK  
THE MINUTES IN  
YOUR MORNING LECTURE  
ARE TAKING A LONG TIME  
TO PASS FOR YOU...



Base 10 – let's decompose 1234

Base 2 – let's decompose 101010

Biggest number on 8 bits (a byte)

Today 64bits

A	B	D0	D1	D2	D3	D4
0	0	1	0	0	0	0
0	1	0	1	0	0	1
1	0	0	0	1	0	1
1	1	0	0	0	1	1

$$38457(10) = 1001011000111001(2)$$

00111001	10010110
----------	----------

MSB, msb      LSB, lsb

# Algorithm

Book « Transposition and Reduction » (Aljabr wa'lmuqābalah)

By Muhammad ibn Mūsā alKhuwārizmī

Persia, IX century



Algorithm: throw a dice until you get 6

The organigram method

Algorithm: throw a dice until you get 6

The text method

## **Algorithm secret**

Input: A list of numbers L.

Output: A number in the list L.

**if** L.size = 0 **return** null

number  $\leftarrow$  L[0]

**for each** item **in** L, **do**

**if** item > number, **then**

        number  $\leftarrow$  item

**end foreach**

**display** number

**end**

# Languages

### **in Assembly x86 under DOS**

```
Cseg segment
assume cs:cseg, ds:cseg
org 100h
main proc
jmp debut
mess db 'Hello world!$'
debut:
mov dx, offset mess
mov ah, 9
int 21h
ret
main endp
cseg ends
end main
```

### **in shell Unix**

```
echo "Hello world!"
```

### **in Basic originel**

```
10 PRINT "Hello world!" 20 END
```

### **in Python3**

```
print('hello world')
```

### **in C**

```
#include <stdio.h>
int main(int argc, char **argv) {
    printf("Hello world!\n"); return 0;
}
```

### **in C++**

```
#include <iostream>
int main() {
    std::cout < "Hello world!" < std::endl;
    return 0;
}
```

### **in Java**

```
public class HelloWorld {
    public static void main(String[] args) {
        System.out.println("Hello world!");
    }
}
```

### **In Visual Basic**

```
Sub Main()
    MsgBox("Hello world!")
End Sub
```

Compiled or  
Interpreted

# Java



# Surviving in the terminal

```
pwd
```

```
ls -l
```

```
mkdir <directory>
```

```
cd <path>
```

```
touch <file>
```

```
rm <file> # rm -r <directory>
```

```
mv <from> <to>
```

## Surviving with git

```
cd ~/code/<YOUR_GITHUB_NICKNAME>
git clone <ssh_url> # From GitHub, e.g. git@github.com:lehigh-cse007-shanghai/
class-material.git
cd <repo>
```

Working on master:

```
git status # Should be clean before you start working
stt # Working in Sublime Text on those files

git status # What files were added/removed/changed since last commit?
git diff # What lines were added/removed since last commit?

# Creating a new commit (2-step process)
git add <file1> <file2>
git commit -m "A MEANINGFUL MESSAGE"

# Pushing commit to GitHub
git push origin master
```

<https://classroom.github.com/a/D5hiJELx>