CS6.201: Introduction to Software Systems

About the Course

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Biometrics and Secure ID Lab

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About the Course

- Introduction of Software Systems: CS6.201
  - Lectures on Tuesdays: 8:30 – 10 / 11:30 – 1:00
  - Labs on Fridays: @ Regular class time
  - Tutorials: Friday 4 -5pm (Gr 1-5), Saturday 12:40-1:40 (Gr 9,10)
  - Lectures will end soon after Mid-Term
- Course webpage: https://courses.iiit.ac.in/
  - All details, resources, assignments are posted there
- Pre-requisites: C-Programming, Basics of Linux
- Textbooks: None
  - Lots of resources online.
  - Python documentation

Grading

- Tentative Weightage:
- Attendance
- Tutorials
- Project
- Academic Honesty

Head	% of Grade
Quiz 1	10
Lab Exam	10
Mid-Term/Final	15
Hackathon (Final Lab Exam)	15
Project	25
Assignments	10
Labs	15

Class Etiquettes

- Before the Lecture
  - This is a short course and we have lots to learn
  - Watch any videos / read any material given for preparation
  - We will start sharp at 8:30pm; Do not be late
- During the Class
  - Please pay attention in the class
    - Keep your cell phones and laptops away (no screen during class)
  - If you have a doubt, ask. Others are likely to have the same doubt.
  - Pay Attention: Not every topic discussed in the class comes from a textbook; Not everything is on the slides.

A Different Course

- Lectures are just introductions; most of the learning happens outside the class
  - Tutorials
  - Labs
  - Self Study; Learning by doing
  - Projects/Assignments
- Technology Course
  - Large amount of details
  - Pick-up fundamentals
  - Technologies change over time

Questions?

Software System: An Overview

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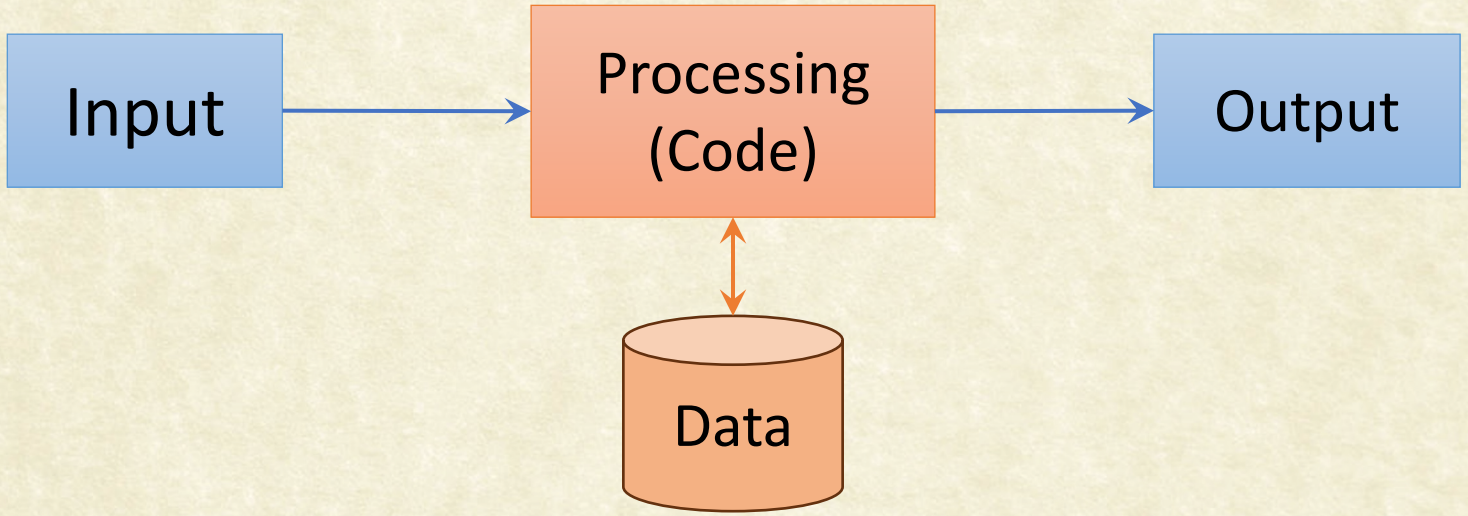
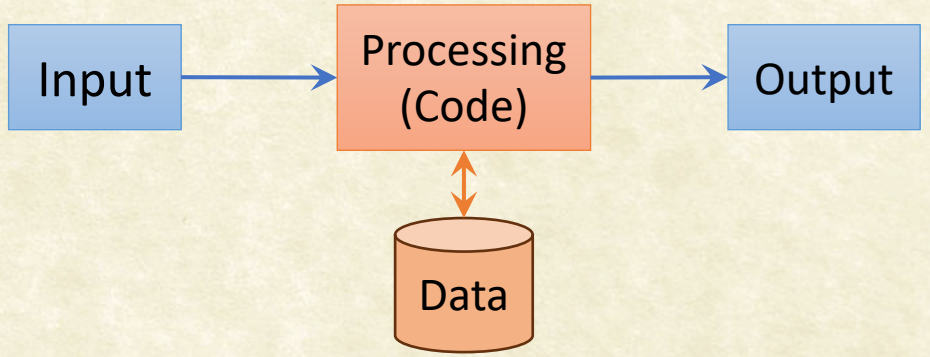
Components of a Simple Program

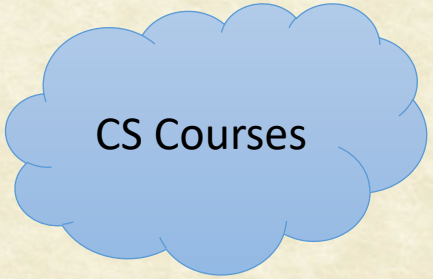


A Software System

- Input
  - Processes: Transactions, Services
  - Sensors: Cameras, Mic, Weather
  - Other Software/HW Systems
- Processing
  - Servers, Distributed
  - Mobiles, Small Devices
  - Real-Time, Batch, Offline
- Data
  - Files, Memory, Distributed
- Output
  - Screen, Speaker, Other Systems

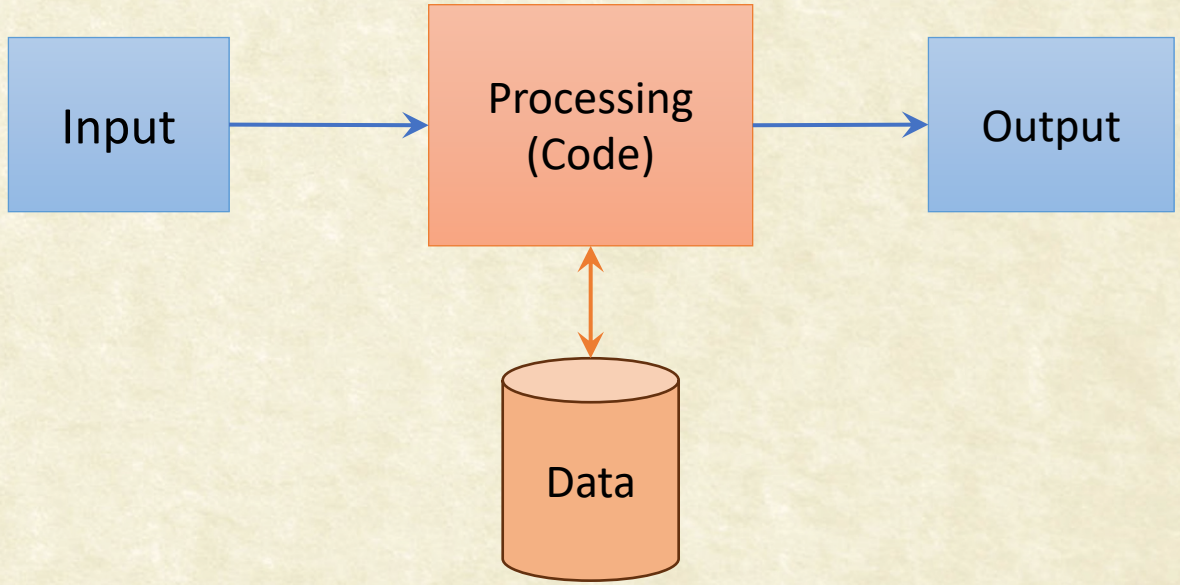


- Challenges
  - Correctness
  - Efficiency
  - Scalability
  - Portability
  - Development, Maintenance
  - Utility, Usability
  - Security
  - Communication
- Self Improvement



This Course

- Input/Output
  - HTML, CSS, Javascript
- Coding
  - Python
- Data
  - Databases, MySQL
- Software Development
  - Shell, Git, SDLC
- Project-based Learning
  - Develop a end-to-end system
  - Front-end, Back-end, Database



The Shell: The Most Powerful GUI

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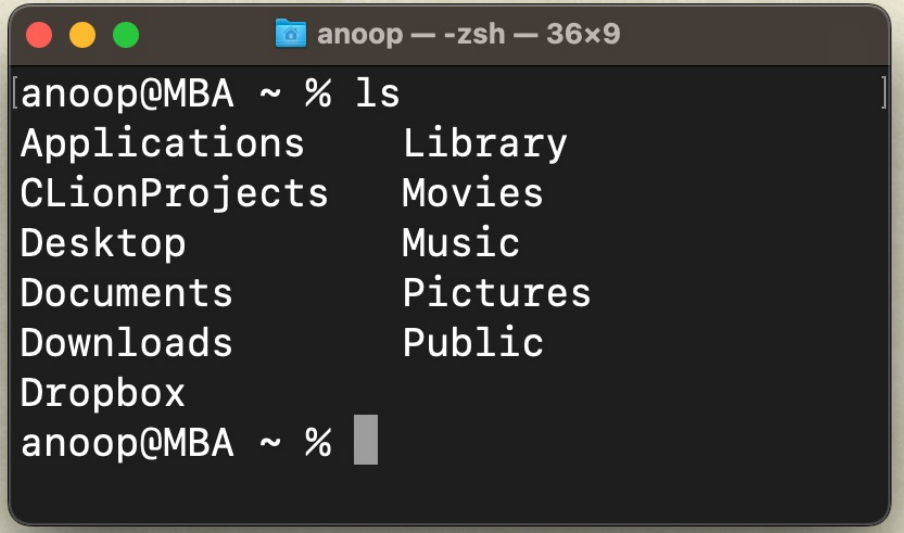
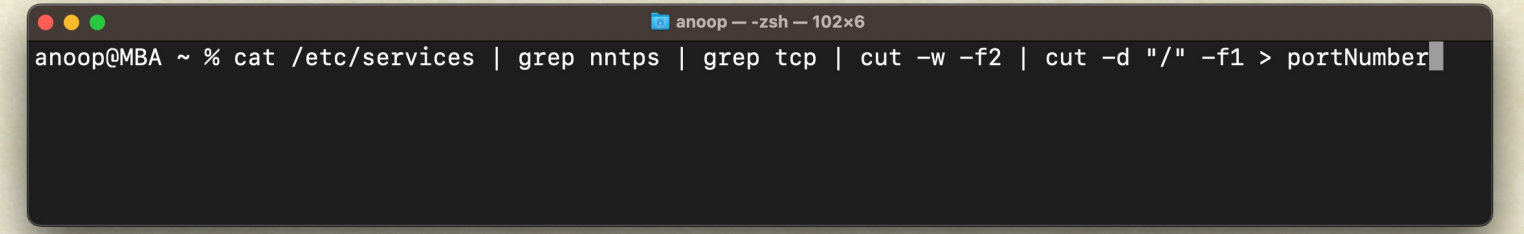
The Shell

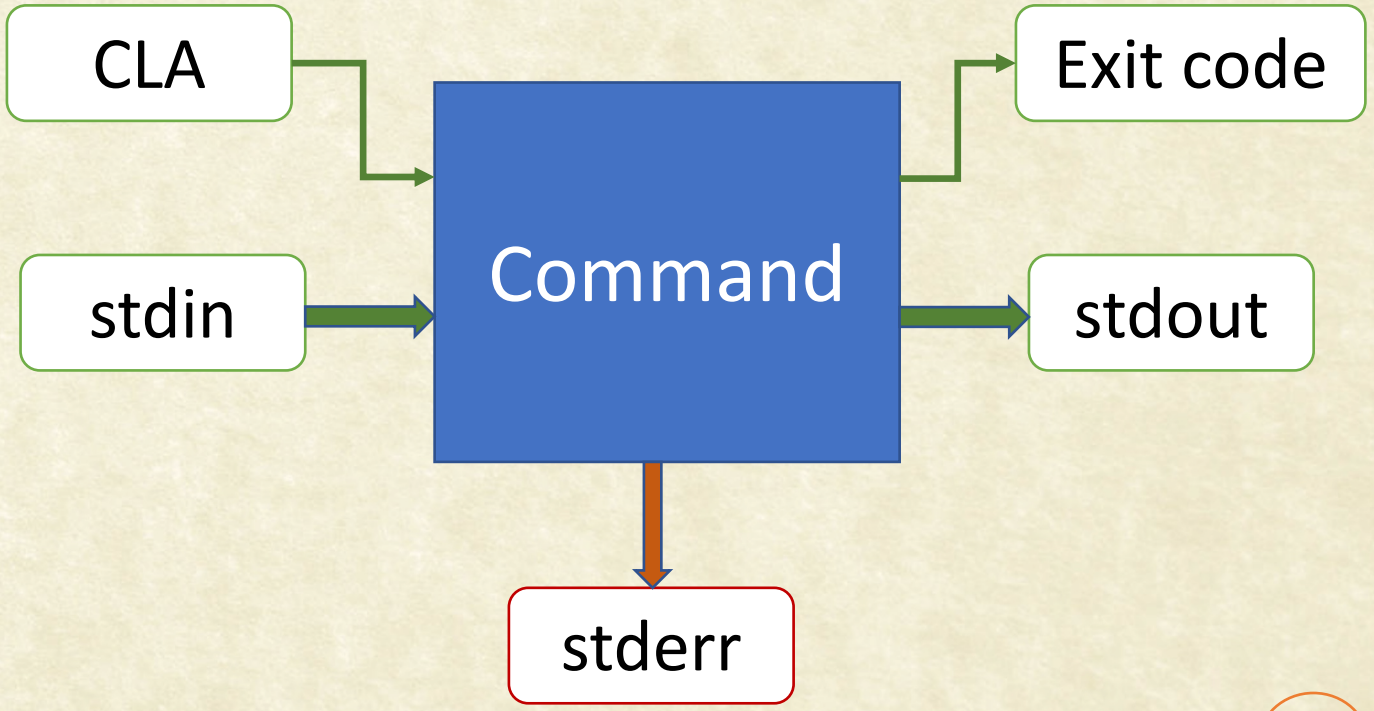
- Your interface to the OS
  - Command Line Interface
- Different Shells:
  - sh, ksh, bash, zsh
- Far more powerful that GUI to control the computer
  - Doing a set of commands repeatedly; and more.
- Commands, Permission and Path
- Complex commands:
  - Pipes, Redirection
- Commands and Processes





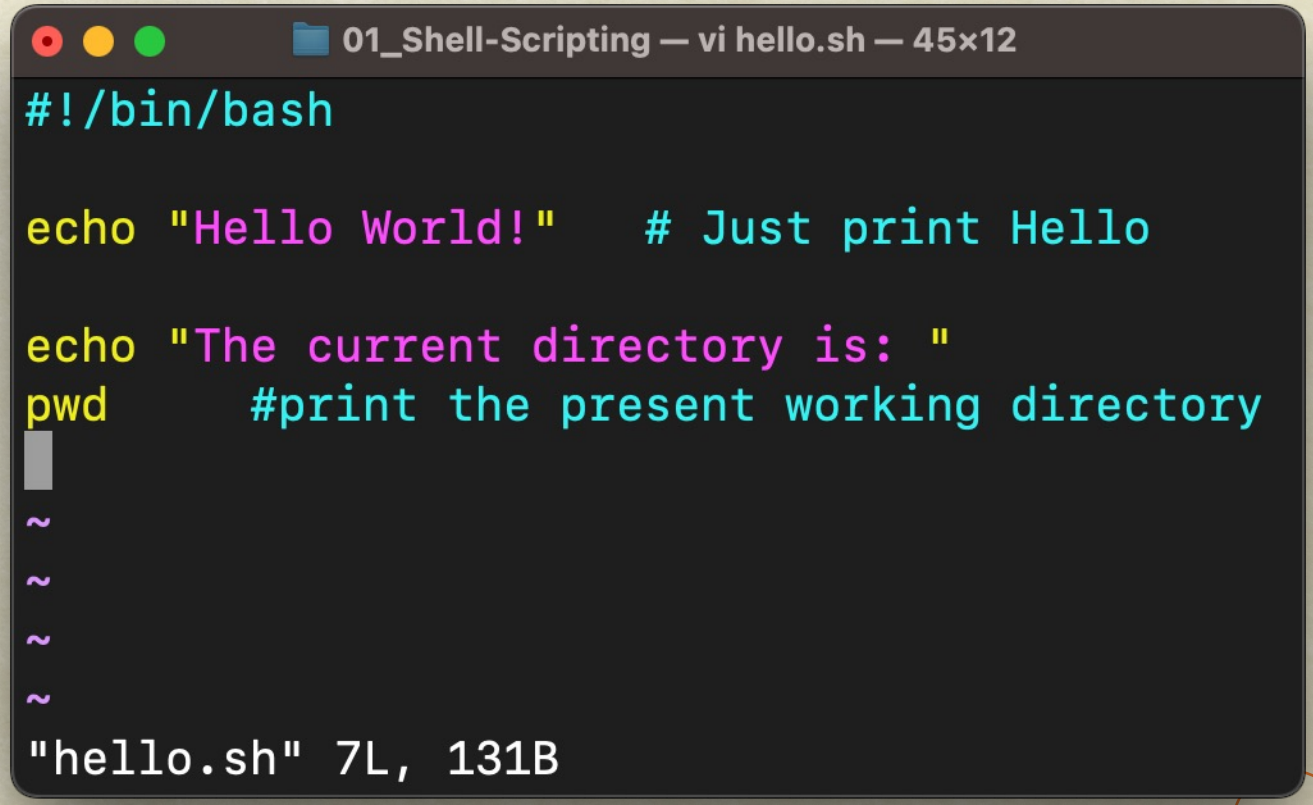
Extending Your Command Tools

- Any C-program can be a command
- Unix Philosophy: [Eric Raymond's 17 Unix Rules]
  - Do one thing and do it well
  - Work well with others
  - Handle text streams
- Stick to conventions
  - Read only from stdin
  - Output only to stdout
  - Errors only to stderr
  - Use CLA to alter behavior
  - Use exit status properly



A Shell Script

- A sequence of commands in a file
- The ‘shell’ will read and execute them one-by-one
  - Compiler vs. Interpreter
- The script:
  - The shell specification
  - The script, comments
  - File permission
  - File name
- The scripting language
  - Programming constructs



Learning a Language

- Input-Output
- Variables, Data Structures
- Operators
- Conditional Statements
- Loops
- Functions
- Classes

Bash Scripting

- Simple, strict syntax
- Large number of functions

Additional Topics

- Command-line arguments

Printing

```
#!/bin/bash
echo "Hello World"
```

```
#!/bin/bash
echo "Hello World!"   # Just print Hello
echo "The current directory is: "
pwd    #print the present working directory
```

Variables, Input, Operators

```
#!/bin/bash
STRING="Hello World"
echo $STRING
```

```
#!/bin/bash
bkf=Backup_$(date +%Y%m%d).tar.gz
tar -czf $bkf ~/Documents
```

- declare
- let
- factor

```
#!/bin/bash
echo "Hi, What is your name? !"
read name
echo "Hello $name, Good to hear from you!!"
```

```
#!/bin/bash
read -p "Input two numbers: " num1 num2
res=$((num1+num2))  # arithmetic expansion
echo "The sum is: $res"
```

Operators [let, declare, $(( ))]

- ++x, x++, --x, x--
- +, -, *, /
- %, **, ^
- &&, ||, !
- &, |, ^, ~
- <=, <, >=, >, ==, !=
- =

Conditional Statements

```
#!/bin/bash
num=30
if [ $num -eq 30 ]
then
    echo "num is correct"
else
    echo "num is incorrect"
fi
```

- Conditional Operators

  -eq, -ne, -gt, -lt, -ge, le

  -f myFile: if myFile exists

  -d myDir: if myDir exists

  see `man test` for more.

Loops, Arrays

```
#!/bin/bash
#Declare an array with 5 elements
ARRAY=( Red Green Blue Yellow Orange )

ELEMENTS=${#ARRAY[@]} #number of elements in array

# loop over each element in array
for (( i=0;i<$ELEMENTS;i++)); do
    echo ${ARRAY[${i}]}
done
```

Other Loops

```
for var in list; do
    commands
done

while [ ]; do
    commands
done

Until [ ]; do
    commands
done
```

Command Line Arguments

```
#!/bin/bash
# passing values as command line arguments
echo '$1 $2 $3': $1 $2 $3

args=("$@")
echo 'Printing as Array: ' ${args[0]} ${args[1]} ${args[2]}

#Use $@ to print out all arguments at once
echo 'Printing $@: ‘ $@

# $# gives the number of arguments
echo Number of arguments passed: $#
```

Extending your Scripting Toolset

- Text/table processing
  - **cut**: split a string
  - **sed**: stream editor
  - **awk**: table processing
  - **grep/egrep**: pattern matching
  - **sort**: what it says
  - **wc**: word count
  - **tee**: fork the output
  - **xargs**: feed input as arguments
- **time**: time to execute a command
- **date**: current time, date, day, year

- File operations
  - **touch** : create/update a file
  - **diff**: changes between files
  - **head/tail**: lines from a file
  - **cat/tac**: concatenate files
  - **split**: split a file
  - **which/locate/find**: find a file
- **du**/**df**: Disk operations
- **bc**: command line calculator
- **trap**: capture interrupts
- **select, case, printf**

Questions?