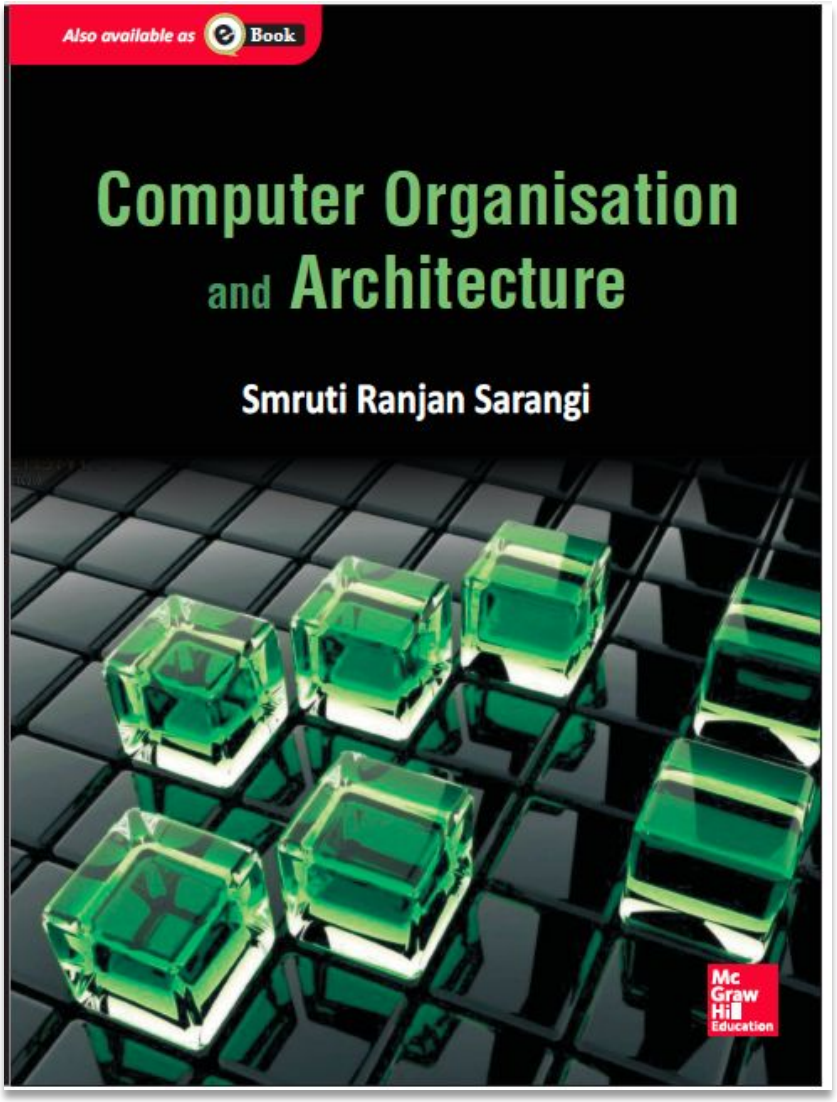
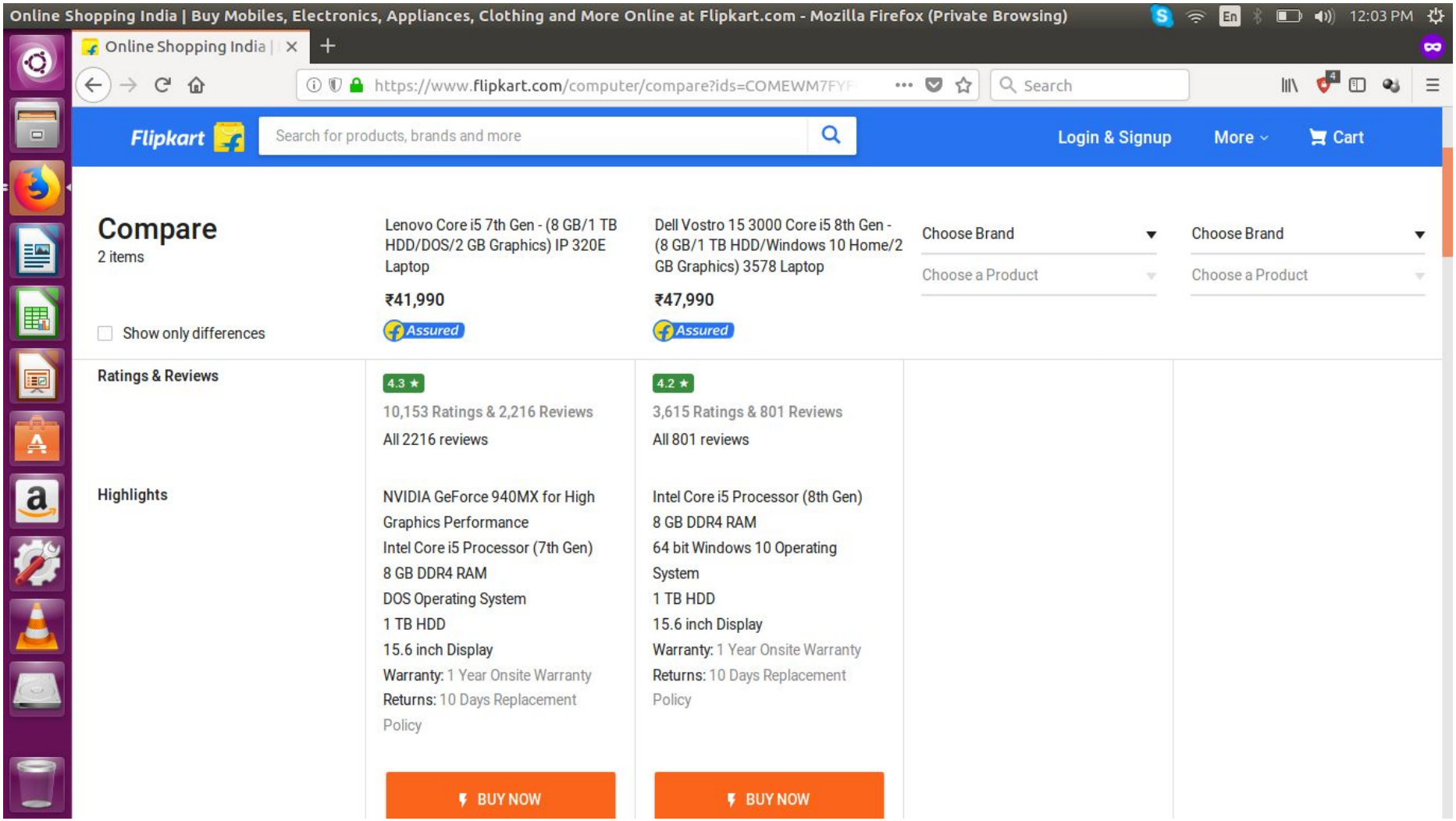
# CS301: Computer Architecture




These slides are meant to be used along with the book: Computer Organisation and Architecture, Smruti Ranjan Sarangi, McGrawHill 2015
Visit: http://www.cse.iitd.ernet.in/~srsarangi/archbooksoft.html




What do all these mean?

# i3 v/s i5 v/s i7

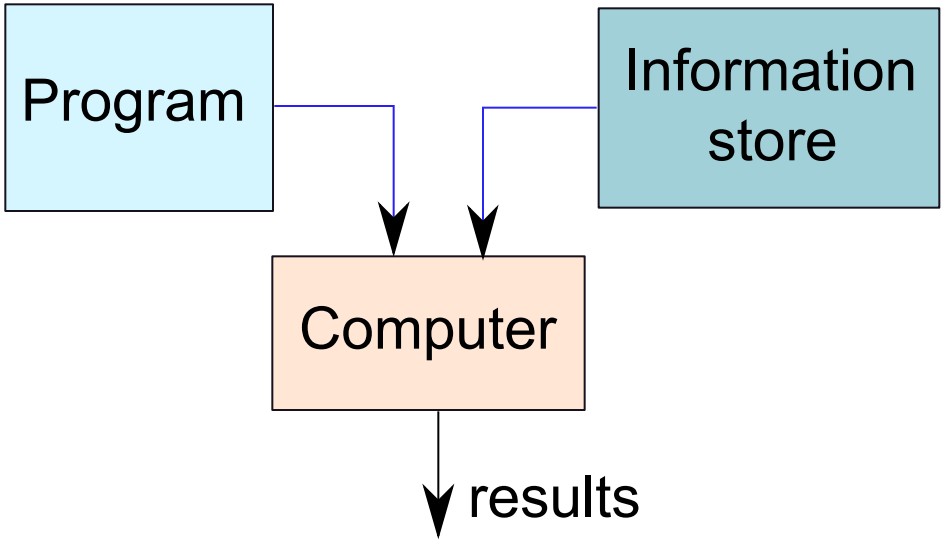
- Classification of manufactured chips based on maximum safe operating frequency

# Generations

- Reducing feature size
  - Transistors are smaller, switch faster, consume less energy
- Improved Computer Architecture

Based on the same principles

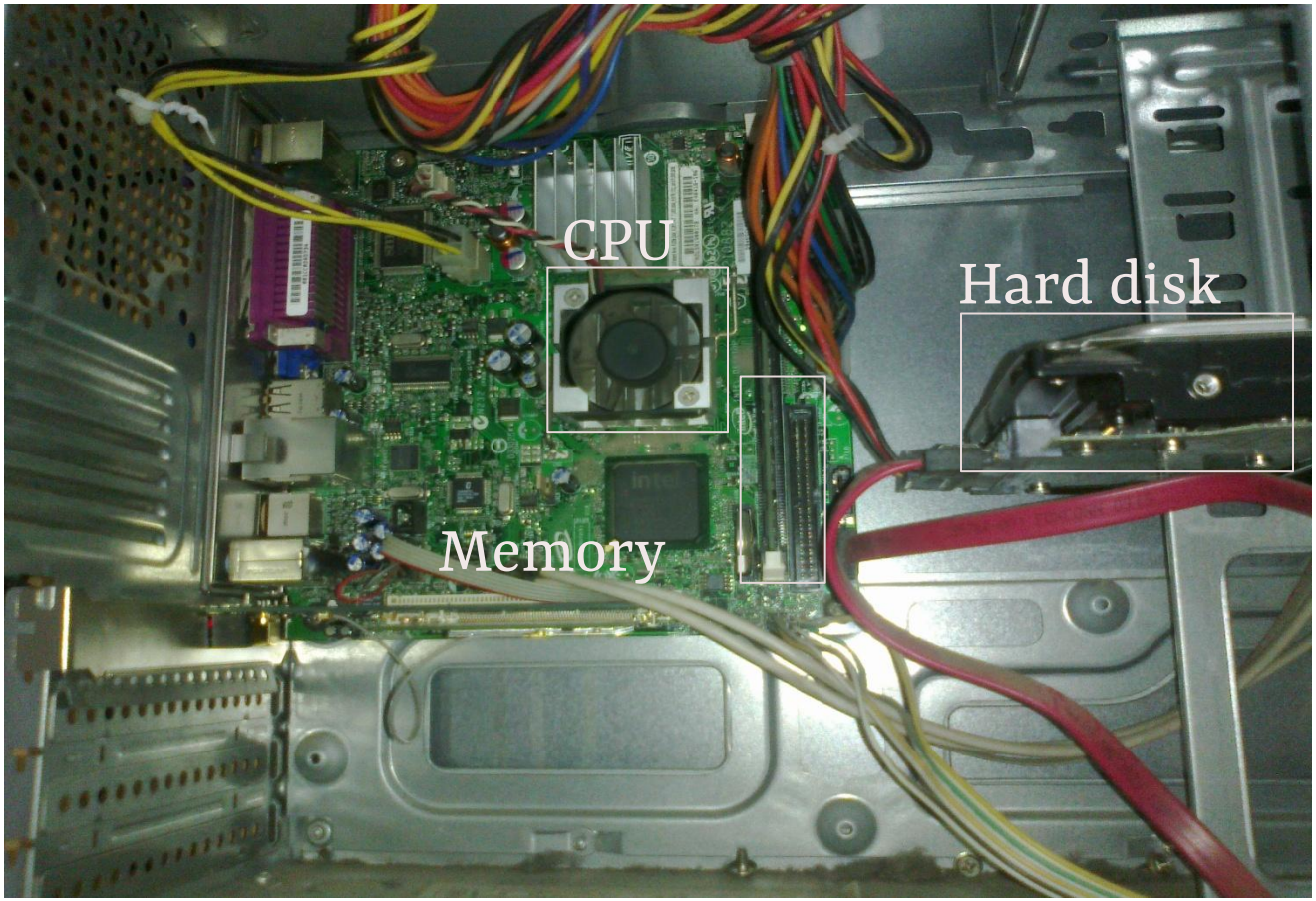
# How does it work ?

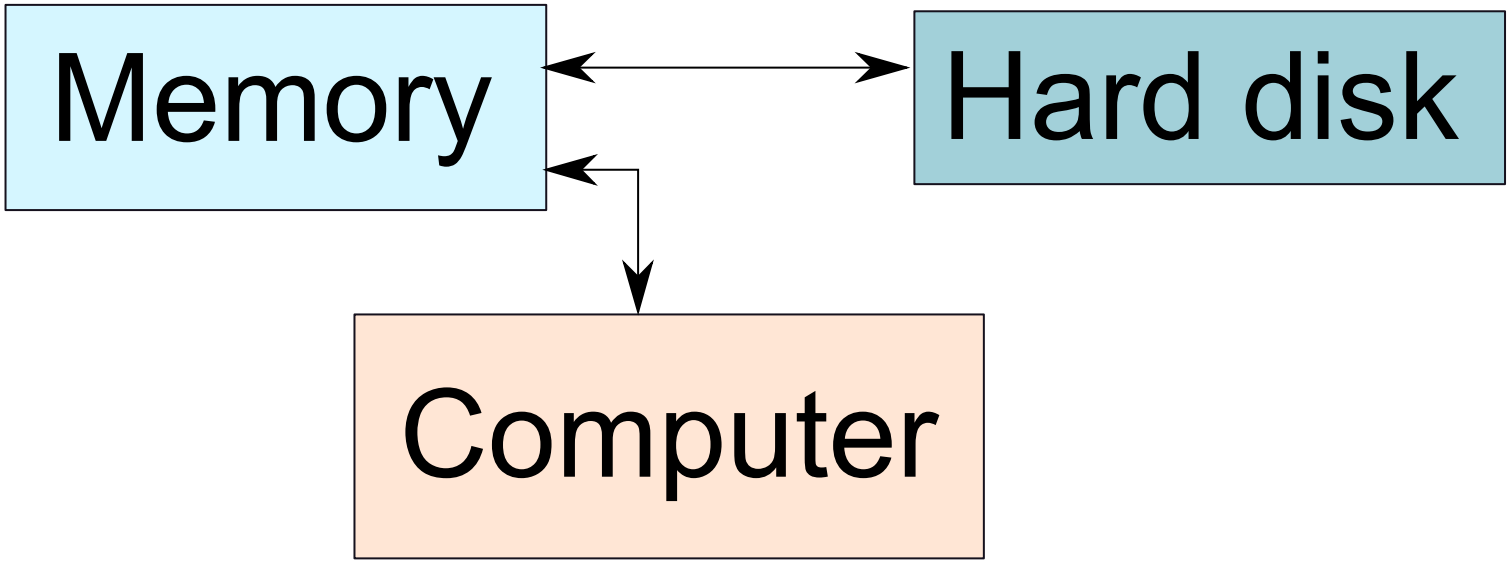



* Program – List of instructions given to the computer
* Information store – data, images, files, videos
* Computer – Process the information store according to the instructions in the program

# What does a computer look like ?

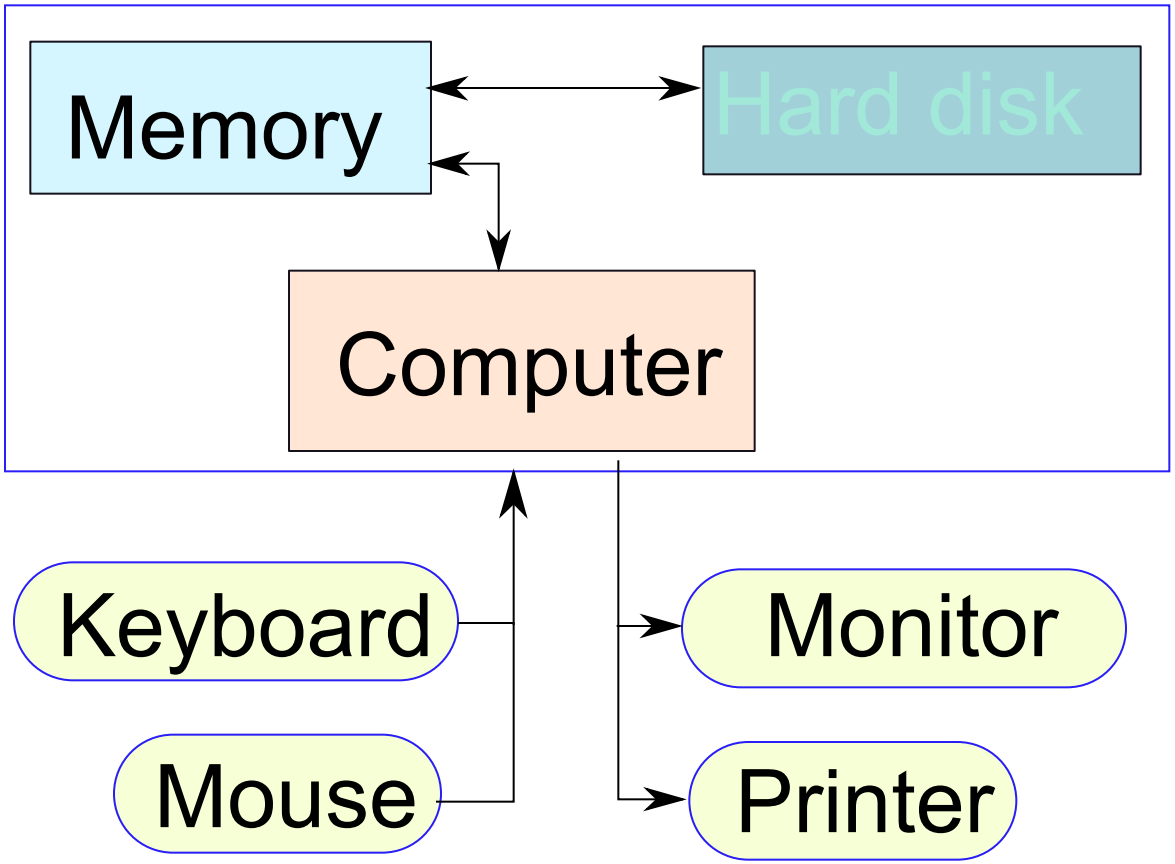
* Let us take the lid off a desktop computer



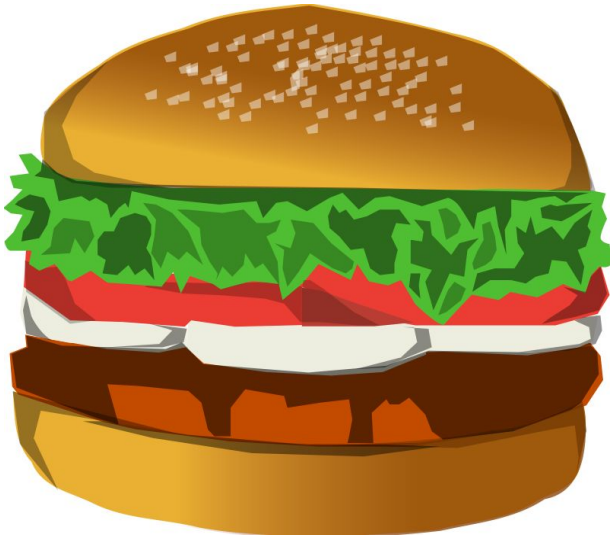



* Memory – Stores programs and data. Gets destroyed when the computer is powered off
* Hard disk – stores programs/data permanently

# Let us make it a full system ...

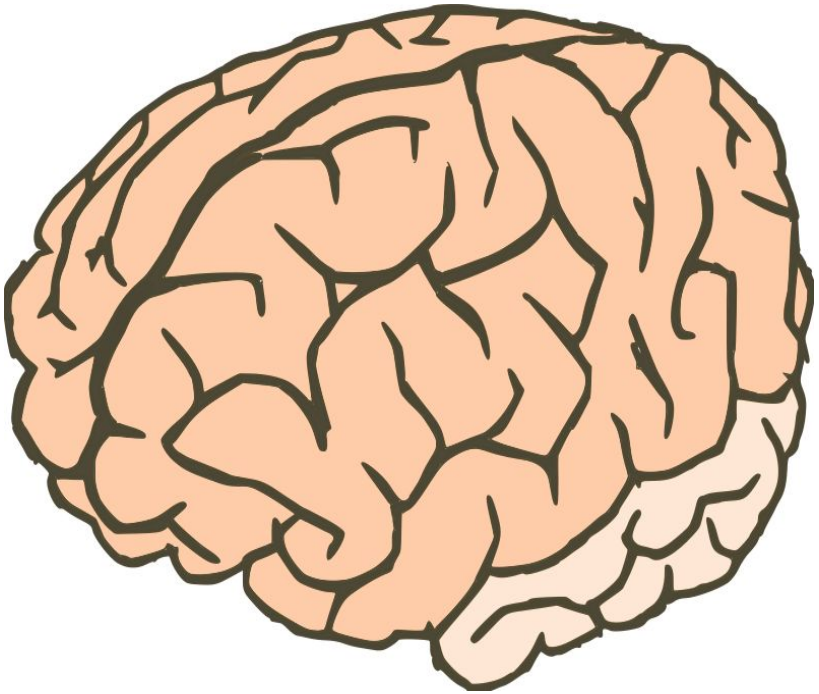


# Food for Thought...



* What is the most intelligent computer ?

# Answer …



* Our brilliant brains

# How does an Electronic Computer Differ from our Brain ?

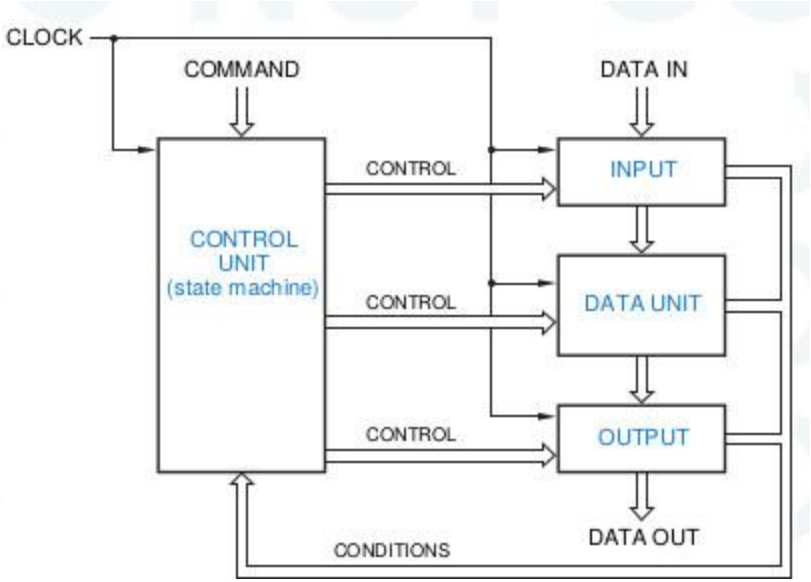
| Feature | Computer | Our Brilliant Brain |
|---|---|---|
| Intelligence | Dumb | Intelligent |
| Speed of basic calculations | Ultra-fast | Slow |
| Can get tired | Never | After sometime |
| Can get bored | Never | Almost always |

* Computers are ultra-fast and ultra-dumb

# Foundations -- Theory of Computation

- A modern computer is a practical Turing Machine
  - The memory refers to the tape
    - Both program instructions and data reside in memory
  - Program counter refers to the state
    - Program counter indicates which instruction is to be executed next
  - The processor itself refers to the transition table
    - Based on the instruction, it performs some modifications on data

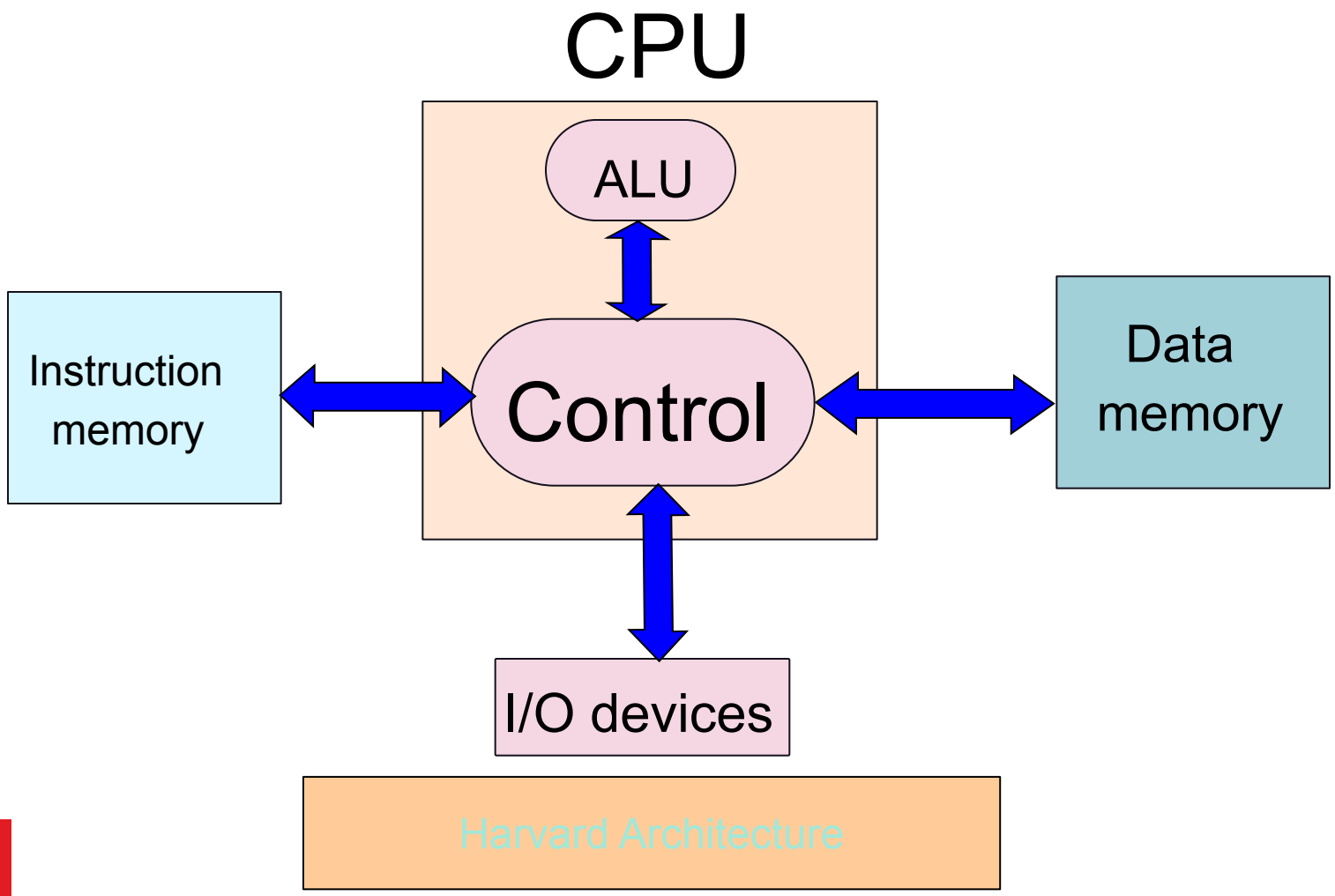
# Foundations -- Synchronous Digital Systems

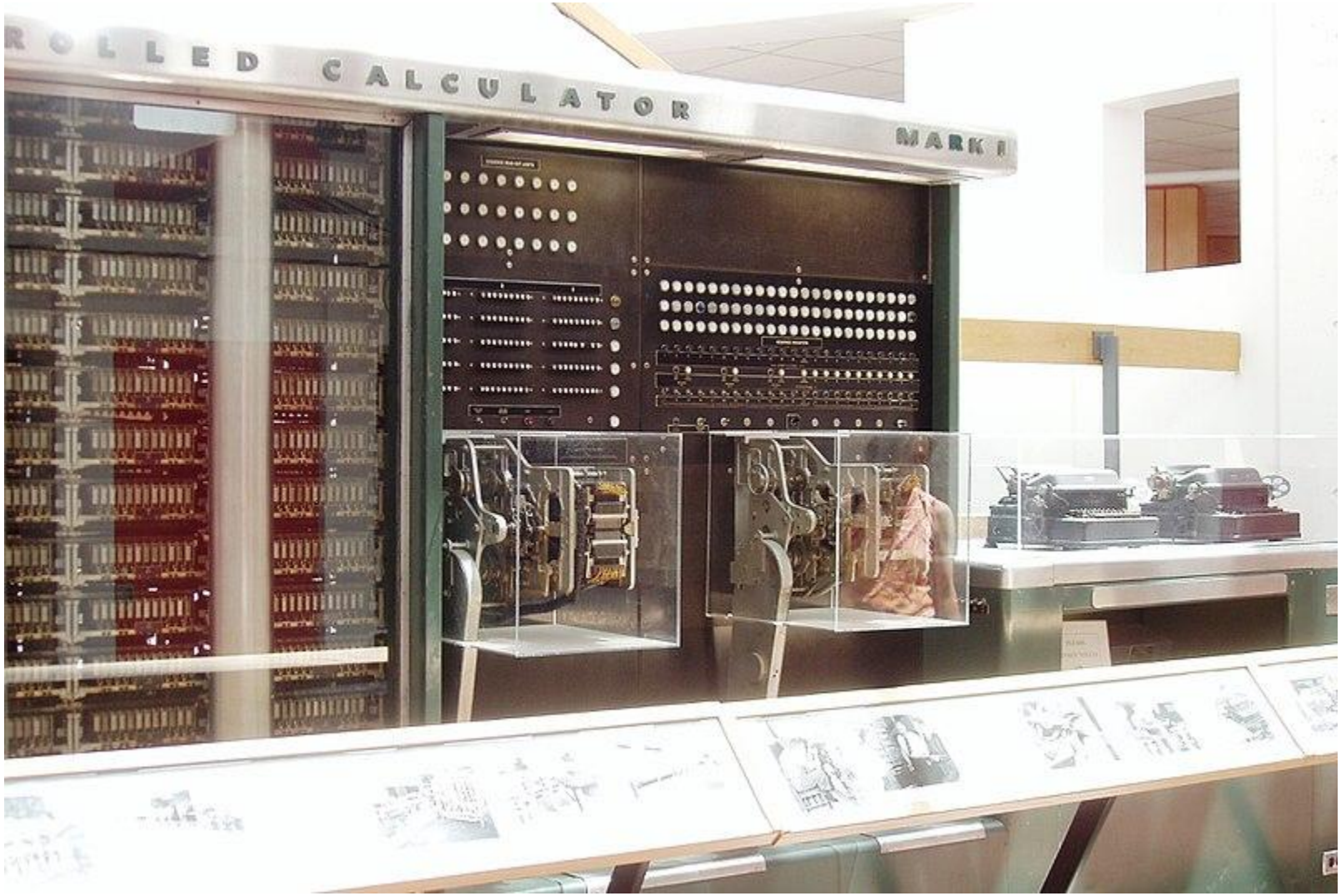



- "Control" can be a hardwired circuit. This makes it "application specific".
- Alternatively, "control" can be "programmable". This allows it to do a lot more.

[image from "Digital Design Principles and Practices", John F. Wakerly, 3rd edition, Prentice Hall 1999]

# Designing Practical Machines

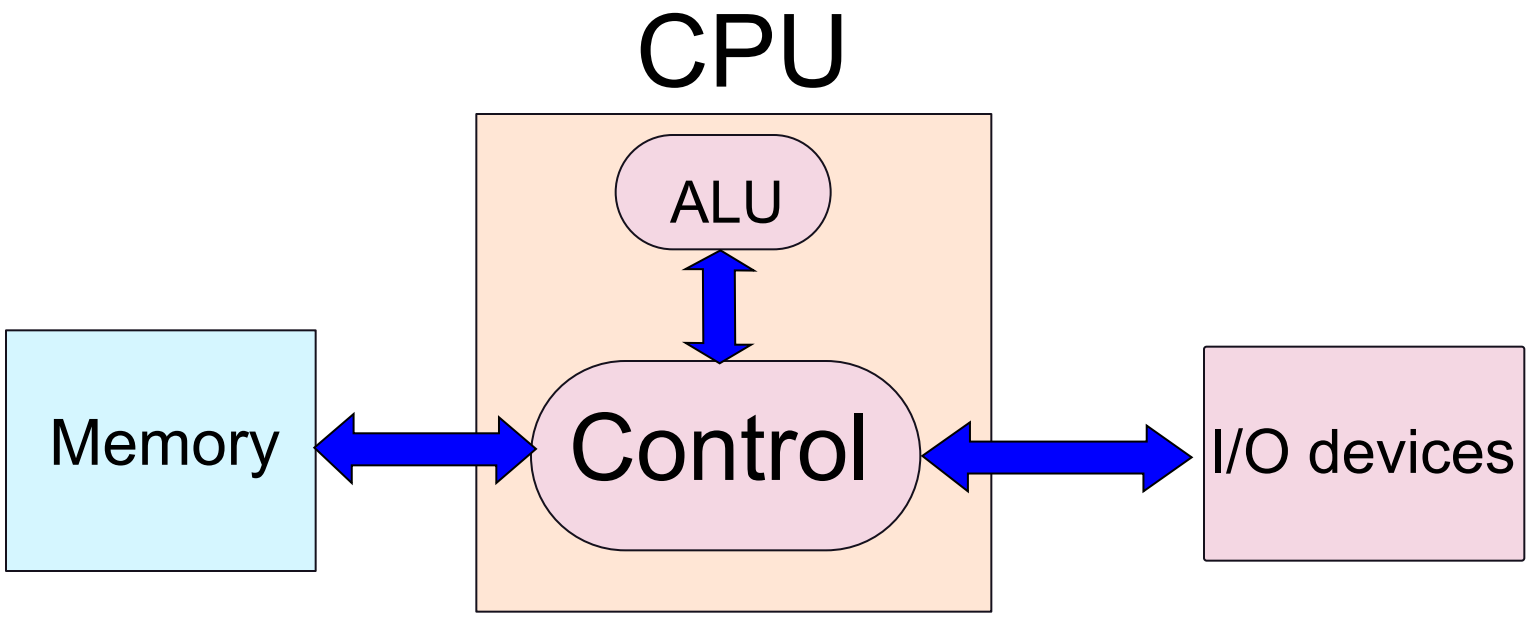


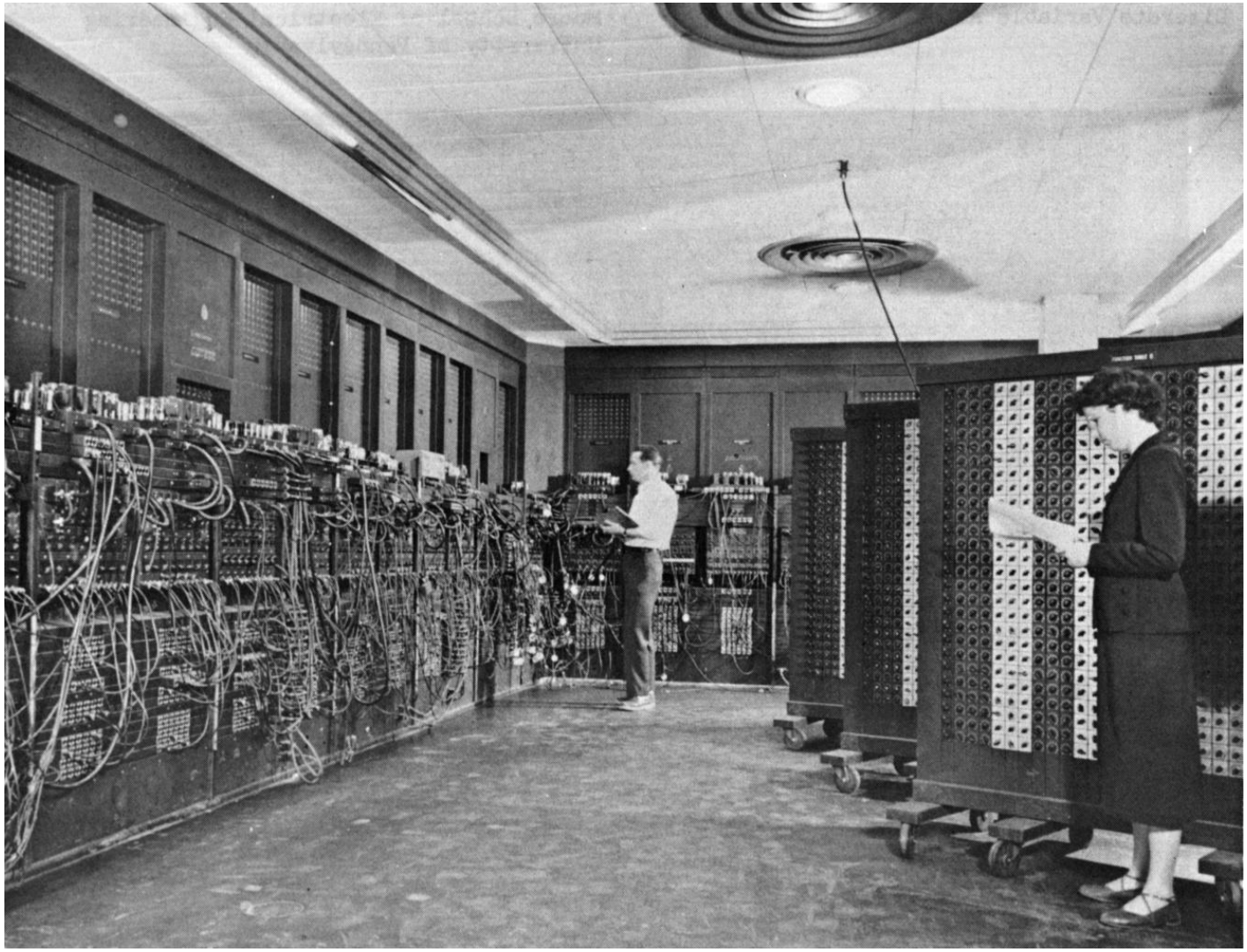



The Harvard Mark I

[image from wikipedia]

# Von-Neumann Architecture





The ENIAC

[image from wikipedia]

# Evaluation: Theory

| | |
|---|---|
| Quizzes | 35 % |
| Mid-semester | 25 % |
| End-semester | 40 % |

# Books

1. Computer Organization and Architecture, by Smruti Ranjan Sarangi, McGraw Higher Ed, 2017.
2. Computer Architecture A Quantitative Approach, Fifth edition, by David Patterson and John L. Hennesy, Morgan Kaufmann, 2017.

# Laboratory

- You will build a software model of a processor
- Programming will be in Java
- Recommended
  - Eclipse
  - Mercurial / bitbucket.org  OR  Git / github.com
  - Latex
  - Google!
- Evaluation
  - In-semester
    - auto-evaluation
    - viva
  - End-semester
    - programming examination where you will add a feature to your processor

| | |
|---|---|
| In-semester | 75 % |
| End-semester | 25 % |

# Today's Assignment