

## CS-150 Worksheet 4 Architectures

This worksheet is about getting familiar with secondary storage and architectures. Complete each of the following tasks to see if you understand some of the materials covered in the lectures.

### □ Task 4.1 – Fetch-Decode-Execute

Describe the fetch-decode-execute cycle.

**Fetch** The next instruction is obtained from the memory location currently stored in the Program Counter. The instruction is placed into the Instruction Register. The Program Counter is updated to point to the next sequential memory address.

**Decode** The content of the Instruction Register is interpreted by the decoder into operations to be carried out by the hardware.

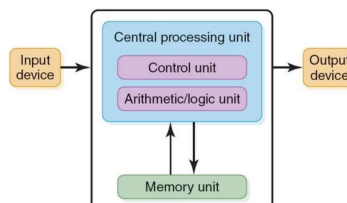
**Read from memory (optional)** Some instructions may utilise an addressing mode other than immediate addressing. In these cases, data is fetched from the memory location specified.

**Execute** The instruction is carried out by the hardware, this is performed by the control unit in the CPU sending control signals to functional units of the machine, such as the ALU.

**Repeat** The next Fetch operation is performed, repeating the cycle.

### □ Task 4.2 – von Neumann

Draw the Von Neumann architecture. Give a brief description of each component.



**Input Device** Allows users to enter information to the machine.

**Output Device** Allows users to receive information from the machine.

**CPU** Unit which houses the main processing units of the machine: the control unit and the ALU.

**Control Unit** Times signals passing around the machine, sends control signals to instruct the execution of instructions

**ALU** Performs the arithmetic and logical operations in the machine.

**Memory Unit** Storage locations for units of data. There is no distinction between instructions and data in the Von Neumann architecture.

### □ Task 4.3 – Secondary Storage

Match the names of the following components of a magnetic disk drive to its description:

- |          |   |   |  |
|----------|---|---|--|
| Track    | ○ | ○ | Set of concentric paths across multiple disks.         |
| Block    | ○ | ○ | A chunk of data on disk.                               |
| Cylinder | ○ | ○ | Minimal storage unit, portion of path around the disk. |
| Sector   | ○ | ○ | Path on surface of disk, where data is stored.         |

**Track** Path on surface of disk, where data is stored.

**Block** A chunk of data on disk.

**Cylinder** Set of concentric paths across multiple disks.

**Sector** Minimal storage unit, portion of path around the disk.

### □ Task 4.4 – Pop Quiz

Answer the following:

1. True or False: Seek time = Access time + Latency  
**False. Access time = Seek time + Latency**
2. Of RAM and ROM, which is classed as volatile memory?  
**RAM**
3. What is the purpose of the Program Counter?  
**It points to the memory address of the next instruction to be fetched.**
4. Which of the following is **not** one of the four main approaches to parallelism in computing:
  - (a) Instruction-level
  - (b) User-level
  - (c) Task-level
  - (d) Bit-level
  - (e) Data-level

**User-level is not one of the 4 main approaches.**

### □ Challenge Task

Annotate your drawing of the Von Neumann architecture to show how messages move through the system during the fetch-decode-execute cycle.