Computer Architecture

Objectives	
2.1.1	Outline the architecture of the central processing unit (CPU) and the functions of the arithmetic logic unit (ALU) and the control unit (CU) and the registers within the CPU.
2.1.2	Describe primary memory.
2.1.3	Explain the use of cache memory.
2.1.5	Identify the need for persistent storage.

Before You Begin

The following diagram represents a simple *abstraction* of a computer system.

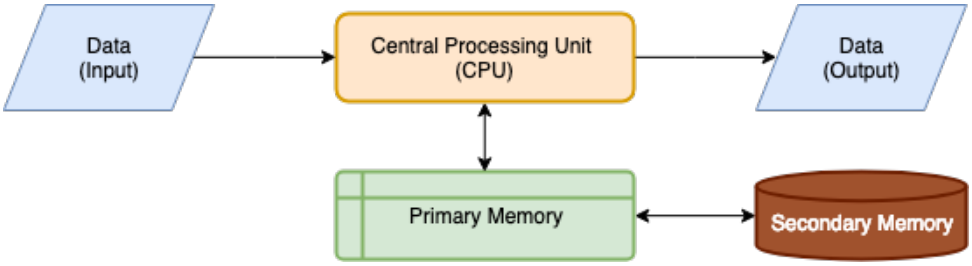

Figure 1: A simple abstraction of a computer system.

Based on your own knowledge of computers, complete the following table with a brief description of each component. Include examples of computer hardware which would fulfill each role, where appropriate.

Component	Description	Example
Data (Input)		
Central Processing Unit (CPU)		
Primary Memory		
Secondary Memory		
Data (Output)		

Question #1 *A diagram such as the one above is a form of* abstraction. *This abstraction hides the complexity of the specific inner workings of a computer system behind a simple flow diagram. Why do you think understanding abstractions such as these is important to the study of computer science?*

Important Terms

Term	Definition
Arithmetic Logic Unit (ALU)	
Bus	
Cache	
Control Unit (CU)	
Memory Unit (MU)	
Random Access Memory (RAM)	
Ready-Only Memory (ROM)	
Register	
Memory Address Register	
Memory Data Register	

Technical Background

Adding Complexity

The following diagram shows a more complete view of a computer system. Note the additional complexity outlined in the CPU and Primary Memory sections of the diagram.

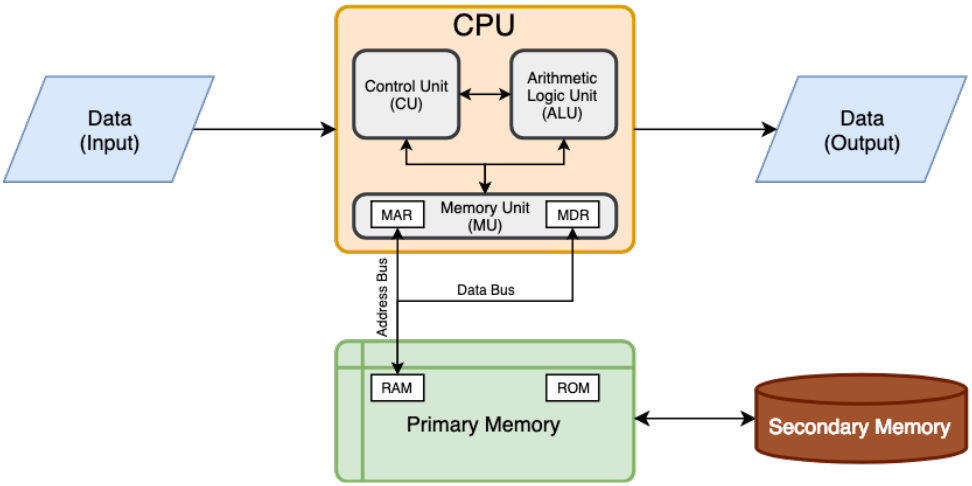

Figure 2: Adding complexity by "zooming in" on the CPU and Primary Memory.

Notes

Question #2 *Although the above diagram has an increased level of complexity, it still represents only an abstraction of a computer system. Why might we want to represent the same system at different levels of abstraction?*

Question #3 *Secondary memory devices, such as traditional hard disk drives (HDDs) and solid-state drives (SSDs) are extremely common in computer systems. Briefly explain the need for these secondary memory devices. Are there any computer systems that might not require secondary memory?*

Even More Complexity

The following diagram represents the most complex abstraction of a computer system we will be discussing. It includes the L1/L2/etc. caches as part of the CPU.

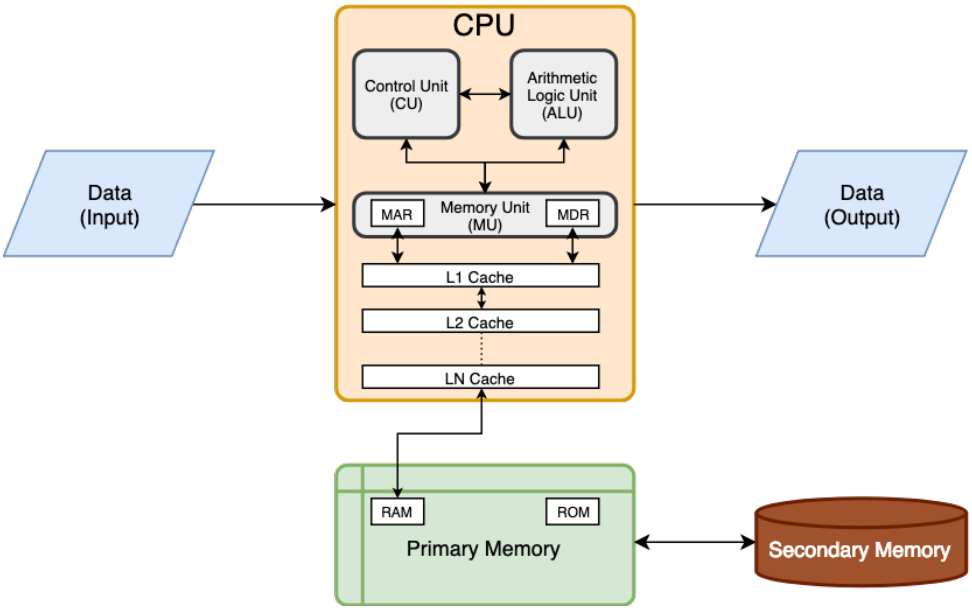

Figure 3: Adding even more complexity by examining the CPU's cache memory.

Notes

Question #4 *Modern processors often include many different "levels" of caches, numbered according to their "closeness" to the main control unit. What impact do you think this has on the performance of the computer system? Why do you think different levels of caches are used rather than increasing the size of a single cache?*

Developing Technical Skills

Examining Computer Specifications

Use the following steps to discover system information about your personal computer.

Windows (7/8/10)	Mac OSX
1. Press ⊞ + r. 2. Type "msinfo32" and hit enter.	1. Click the logo. 2. Hold the option key and select "System Information".

Using the information provided by your operating system, as well as supplemental information from online sources, fill out the following information about your system.

Component	Description
Processor	
Model	
Speed	
Cores	
Caches	
Cache Size (L1)	
Cache Size (L2)	
Cache Size (L3)	
Memory	
Ram	
Secondary Memory (HDD/SDD)	

Question #5 *Why do you believe computer systems vary as much as they do? What impact does this variance have on the computer industry as a whole?*

Reflections

Question #6 *Why is it important for computer scientists to have some knowledge of a computer's inner workings?*

Question #7 *Why do you think we have no tincluded specific input and output devices in our abstract models of a computer system?*

Question #8 *Describe at least one new thing you have learned from this lesson. How might you apply this knowledge in the future?*

Question #9 *Select the option which best reflects how confident you are in applying what you have learend in this lesson.*



Question #10 *What further questions do you still have about this lesson's content?*