

Learning Guide Unit 4

Reading Assignment

As you read through the resources and watch the videos, consider the following:

- What is the significance of different number systems in digital computing, and how do they impact data representation and manipulation?
- Explain the process of converting a decimal number to its binary representation.
- How does an ALU handle arithmetic operations, logical operations, and conditional branching?

Textbook:

1. Ndjountche, T. (2016). *Digital electronics 1: Combinational logic circuits*. John Wiley & Sons, Incorporated.

- Log into the UoPeople library and go to LIRN. Click on Access to Library and Information Resource Network, go to Computer Science and click on EBook Central. Search for the entire name of the ebook. Use the Learning Resource Center to read on how to use the online library.
- Read Chapter 1: Number Systems (pp. 20-53)
 - Section 1.1: Introduction
 - Section 1.2: Decimal numbers
 - Section 1.3: Binary numbers
 - Section 1.4: Octal numbers
 - Section 1.5: Hexadecimal numeration
 - Section 1.6: Representation in a radix B
 - Section 1.7: Binary-coded decimal numbers
 - Section 1.8: Representations of signed integers
 - Section 1.9: Representation of the fractional part of a number
 - Section 1.10: Arithmetic operations on binary numbers
 - Section 1.11: Representation of real numbers
 - Section 1.12: Data representation
 - Section 1.13: Codes to protect against errors
- Sections 1.1 & 1.2: We will begin our journey into the world of Computer Arithmetic with an introduction to its fundamental principle and explore the significance of arithmetic operations in digital systems and their wide-ranging applications. We will dive into the realm of Decimal Numbers, understanding their representation and importance in everyday numerical systems.
- Sections 1.3: These sections will delve into the binary foundation of computer arithmetic with Binary Numbers. You will be able to grasp the concept of representing information using only two digits and uncover how computers leverage this system for their operations.
- Sections 1.5 & 1.6: These sections will explore Hexadecimal Numeration, a base-16 system that offers a compact representation for binary data, and also delve into the general concept of Radix B Representation, which forms the foundation for multiple numerical systems.
- Sections 1.7 & 1.8: You will gain an understanding of Binary-Coded Decimal (BCD) Numbers, where decimal digits are encoded using binary sequences. You will also be able to witness how BCD facilitates precise representation of decimal values in digital system and transition to the complex landscape of representations of signed integers. By reading these sections, you will learn techniques to express both positive and negative numbers within computers, allowing for a wider range of calculations.
- Sections 1.9 & 1.10: These sections will explore the intricacies of representing the fractional part of a number in digital systems and explain the significance of fixed-point and floating-point representations in handling fractions effectively. Immerse yourself in the world of Arithmetic Operations and gain a deep understanding on Binary Numbers.

- Sections 1.11 & 1.12: After reading these sections, you will understand the challenges of representing real numbers within computers. These sections will help you in transitioning to data representation, where you'll explore how computers store and manage various types of data and beyond.
- Sections 1.13: This section will help you to discover the critical role of Error-Correcting Codes in enhancing data integrity and reliability. You will also gain insights into different coding techniques employed to detect and rectify errors in digital communication.

2. Ndjountche, T. (2016). *Digital electronics 2: Sequential and arithmetic logic circuits*. John Wiley & Sons, Incorporated.

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- Read Chapter 4: Arithmetic and Logic Circuits (pp.117-149)
 - Section 4.1: Introduction
 - Section 4.2: [Adder](#)
 - Section 4.3: Comparator
 - Section 4.4: [Arithmetic and logic unit](#)
 - Section 4.5: Multiplier
 - Section 4.6: Divider

- Sections 4.1 & 4.2: Through these sections, you will embark on your exploration of Computer Arithmetic with a comprehensive Introduction to its principles and significance.

You will understand the fundamental role of arithmetic operations in digital systems and their real-world applications, and transition to Adder, a fundamental building block of computer arithmetic.

- Sections 4.3 & 4.4: You will be able to delve into the realm of Comparators, essential components for making comparisons between numbers in digital systems.

After reading these sections, you can transition to the Arithmetic and Logic Unit (ALU), a versatile component that executes arithmetic and logical operations.

These readings will help you to understand the internal structure of ALUs and how they form the computational heart of modern processors.

- Sections 4.5 & 4.6: You will be able to navigate the intricacies of Multipliers, circuits dedicated to performing multiplication operations within computers. These readings will help you to explore their design and operation, and witness how they enable efficient and complex computations.

Videos:

1. Learning vibes. (2023, January 9). [Number system in digital electronics | introduction to number system | digital electronics | Mruduraj \[Video\]](#). YouTube.

- This comprehensive video delivers a detailed exploration of the concept of number systems, illuminating its essence, rationale, and encompassing a discourse on diverse variants of number systems.



2. Learn computer science. (2022, May 31).

What is arithmetic logic unit? / ALU in computer architecture explained [Video].

[YouTube](#)

- This video offers a concise overview of an Arithmetic Logic Unit (ALU), delving into its functions, design, and pivotal role in digital computation.

