

Learning Guide Unit 3

Reading Assignment

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

- What are flip-flops and latches, and how do they differ from basic logic gates in terms of their functionality and purpose?
- Explain the concept of bistability in flip-flops and latches. How does this property enable them to store binary information effectively?
- Compare and contrast different types of flip-flops and latches, such as D flip-flops, JK flip-flops, SR flip-flops, and gated D latches. How do their characteristics impact their applications?

Textbook:

1. Ndjountche, T. (2016). *Digital electronics 2: Sequential and arithmetic 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: Latch and Flip-Flop (pp.1-34)
 - Section 1.1: Introduction
 - Section 1.2: General overview
 - Section 1.3: Gated SR latch
 - Section 1.4: Gated D latch
 - Section 1.5: Basic JK flip-flop
 - Section 1.6: T flip-flop
 - Section 1.7: Master-slave and edge-triggered flip-flop
 - Section 1.8: Flip-flops with asynchronous inputs
 - Section 1.9: Operational characteristics of flip-flops
- Sections 1.1 & 1.2: These sections talk about the introduction & the general overview. In this combined section, you will be introduced to the fundamental concepts of latches and flip-flops, the building blocks of sequential logic circuits.
- Sections 1.3 & 1.4: You will delve into the world of gated latches and learn about the operation of the gated SR latch and how it adds control to the basic SR latch. You will also explore the functionality of the gated D latch and its significance in digital systems.
- Sections 1.5 & 1.6: These sections talk about Basic JK Flip-Flop & T Flip-Flop; where you will discover the workings of the basic JK flip-flop and its application in memory and data storage. You will also learn the T flip-flop and understand its role in toggling between binary states.
- Sections 1.7 & 1.8: These sections talk about Master-Slave and Edge-Triggered Flip-Flop, Flip-Flops with asynchronous inputs. You will understand how these flip-flops synchronize data and enable precise control of memory elements.
- Sections 1.9: You will learn about the operational characteristics of flip-flops and gain insights into the operational characteristics of flip-flops, including setup and hold times, propagation delays, and clock skew. You will understand how these factors impact circuit behavior.
- Read Chapter 2: Binary Counters (pp.51-66)
 - Section 2.1: Introduction
 - Section 2.2: Modulo 4 counter
 - Section 2.3: Modulo 8 counter
 - Section 2.4: Modulo 16 counter
 - Section 2.5: Counter with parallel load

- Section 2.6: Down counter
- Section 2.7: Synchronous reversible counter
- Section 2.8: Decoding a down counter

- Sections 2.1 & 2.2: You will embark on a journey into the world of binary counters and begin with an introduction to their significance and then delve into the specifics of modulo 4 counters.
- Sections 2.3 & 2.4: Through these readings, you will continue exploring binary counters with discussions on modulo 8 and modulo 16 counters. This will help you gain an understanding of how these devices enable counting and sequencing in digital systems.
- Sections 2.5 & 2.6: These sections will help you in studying the counter with parallel load and its applications. You will also learn the concept of down counters, which perform counting in the reverse order.
- Sections 2.7 & 2.8: You will be able to uncover the synchronous reversible counter and learn about its unique characteristics. You will also gain insights into decoding down counters for effective utilization.

- Read Chapter 3: Shift Register (pp.85-116)

- Section 3.1: Introduction
- Section 3.2: Serial-in shift register
- Section 3.4: Parallel-in shift register
- Section 3.5: Bidirectional shift register
- Section 3.6: Register file
- Section 3.7: Shift register based counter

- Sections 3.1 & 3.2: Through these readings, you will learn the concepts of shift registers and understand their fundamental principles. You will explore the serial-in shift register and its applications.
- Sections 3.3 & 3.4: These sections will aid in understanding the parallel-in shift register and then delve into the bidirectional shift register. It will also help you to discover how bidirectional shift registers enable data movement in both directions.
- Sections 3.5 & 3.6: These sections will help you in learning the concept of a register file and its role in data storage. You will also learn about the shift register based counter, which combines shift register elements with counting functionality.
- Sections 3.7: These exercises will put your knowledge to the test and help you better understand shift registers.

Videos:

1. Computer science. (2016, July 29). *Latches and flip-flops 1 - the SR Latch* [Video]. YouTube.

- This extensive video provides a thorough explanation of the SR latch, aiming to enhance understanding and offer deeper insights into the subject matter.



2. Down to the wires. (2020, October 4). *Registers and counters* [Video]. YouTube

- o This comprehensive video provides a demonstration of how registers and counters are utilized, offering a more in-depth understanding of the subject matter.