

24 Lecture - CS302

Important Subjective

1. **Explain the operation of an edge-triggered D flip-flop with a timing diagram.**

Answer: In an edge-triggered D flip-flop, the output changes its state only on the edge of the clock signal. The input D is stored in the flip-flop when the clock signal changes from low to high or high to low, depending on whether it is a positive or negative edge-triggered flip-flop. The timing diagram shows the transitions of the input, clock, and output signals over time.

What is the significance of edge-triggering in D flip-flops?

Answer: Edge-triggering allows the D flip-flop to be synchronized with an external clock signal, ensuring that the output changes state only on the rising or falling edge of the clock. This eliminates the possibility of metastability, where the output may oscillate or remain in an unknown state due to timing uncertainties.

What are the advantages of using edge-triggered D flip-flops in synchronous circuits?

Answer: Edge-triggered D flip-flops are widely used in synchronous circuits because they provide a means of synchronizing the state changes with the clock signal, which simplifies timing analysis and reduces the risk of timing violations. Additionally, they are less susceptible to glitches and noise on the input signal.

How is a D flip-flop used as a frequency divider?

Answer: A D flip-flop can be used as a frequency divider by connecting its output to its input, effectively creating a feedback loop. The input signal is then applied to the clock input, and the output signal is divided by two for each cycle of the clock. The output frequency is therefore half the input frequency.

What is a register and how is it implemented using D flip-flops?

Answer: A register is a collection of flip-flops that store a set of binary values. It can be implemented using D flip-flops by connecting the output of each flip-flop to the input of the next flip-flop in the chain. The first flip-flop is clocked by the system clock, and the subsequent flip-flops are clocked by the output of the preceding flip-flop. This creates a shift register that can shift data in or out serially.

What is a shift register and how is it used in digital circuits?

Answer: A shift register is a type of register that can shift its contents one bit at a time in a specified direction. It is commonly used in digital circuits for tasks such as serial-to-parallel conversion, parallel-to-serial conversion, and delay line generation.

How is an edge-triggered D flip-flop used in a counter circuit?

Answer: In a counter circuit, an edge-triggered D flip-flop is used to store the current count value. The output of the flip-flop is connected to a logic circuit that generates the next count value based on the current value and the clock signal. The output of the logic circuit is then fed back to the input of the flip-flop, creating a feedback loop that increments the count value on each clock cycle.

What is the difference between a synchronous and asynchronous reset in a flip-flop?

Answer: A synchronous reset is a reset signal that is synchronized with the clock signal, so that

the flip-flop is reset on the rising or falling edge of the clock. An asynchronous reset is a reset signal that is not synchronized with the clock signal, and can occur at any time. Synchronous resets are preferred in most designs because they ensure that the reset occurs at a known time relative to the clock.

How is a D flip-flop used in a data transfer circuit?

Answer: A D flip-flop is commonly used in a data transfer circuit as a latching element that captures the data on the