Unit 3.2: Asynchronous Counters

Content Area: **Science**
Course(s): **Digital Electro**
Time Period: **Semester 2**
Length: **3 weeks**
Status: **Published**

Standards

TEC.9-12.	Technology products and systems impact every aspect of the world in which we live.
TEC.9-12.8.1.12.F	Critical Thinking, Problem Solving, and Decision Making Digital tools facilitate local and global communication and collaboration in designing products and systems.

Enduring Understandings

Understandings

Students will understand that ...

1. Asynchronous counters, also called ripple counters, are characterized by an external signal clocking the first flip-flop. All subsequent flip-flips are clocked by the output of the previous flip-flop.
2. Asynchronous counters can be implemented using small scale integrated (SSI) and medium scale integrated (MSI) logic gates.
3. Asynchronous counters can be implemented with either D or J/K flip-flops.
4. Up counters, down counters, and modulus counters all can be implemented using the asynchronous counter method.

Essential Questions

Students will keep considering ...

1. How can D flip-flops or J/K flip-flops be arranged in order to create a desired asynchronous clock signal?
2. How would you use a design process to create asynchronous counters using small scale integration (SSI) and medium scale integration (MSI)?
3. Why is it important to have a counter/start at specific values?
4. How can an asynchronous counter be designed to start and stop/repeat a count at the desired values?

Knowledge and Skills

Knowledge

Students will ...

1. Recognize asynchronous counters.
2. Recognize that asynchronous counters are commonly referred to as ripple counters.
3. Recognize small scale integration (SSI) logic gates.

4. Recognize medium scale integration (MSI) logic gates.
5. Arrange asynchronous counters to count up or down over a specified range.

Skills

Students will ...

1. Describe the advantages and disadvantages of counters designed using the asynchronous counter method.
2. Describe the ripple effect of an asynchronous counter.
3. Analyze and design up, down, and modulus asynchronous counters using discrete D and J/K flip-flops.
4. Analyze and design up, down, and modulus asynchronous counters using medium scale integrated (MSI) circuit counters.
5. Describe where a count starts and where a count stops/repeats on a modulus asynchronous counter.
6. Use Circuit Design Software (CDS) and Digital Logic Board (DLB) to simulate and prototype SSI and MSI asynchronous counters.

Assessments

https://docs.google.com/document/d/1wR7bQF-8AQoRrt0g4C3hKja0yjwDjC9_BiAmONWbTcI/edit?usp=sharing

Modifications

https://docs.google.com/document/d/1ODqaPP69YkcFiyG72fIT8XsUIe3K1VSG7nxuc4CpCec/edit?usp=sharing

Resources

Technology Resources

- National Instruments Multiim circuit design and simulation software
- Microsoft Office Applications

Electronics Resources

- Electronics Trainers (power supply, function generator, breadboard)
- Electronics hand tools (diagonal cutters, needle-nosed pliers, wire strippers, etc.)
- Digital Multimeters
- Digital Transistor-Transistor Logic (TTL) integrated circuits
- TTL Chip Checker
- Dual Channel Oscilloscope
- Digital/Analog Function Generator