Curriculum Framework – Digital Electronics (2015-2016)
Unit 4 Controlling Real World Systems – Lesson 4.1 Introduction to State Machines

Desired Results *(stage 1)*

ESTABLISHED GOALS
It is expected that students will…

- G1 – Demonstrate an ability to identify, formulate, and solve engineering problems.
- G2 – Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- G3 – Demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data.
- G4 – Demonstrate an ability to apply knowledge of mathematics, science, and engineering.
- G5 – Demonstrate an ability to use the techniques, skills, and

Transfer

TRANSFER: *Students will be able to independently use their learning to …*

- T1 – Use the design process associated with state machines to create a state machine design and implement the circuit.

Meaning

UNDERSTANDINGS: *Students will understand that …*

- U1 – A state machine is a circuit design that sequences through a set of predetermined states controlled by a clock and other input signals.
- U2 – A state machine is designed through the creation of a state graph and a state transition table.
- U3 – State machines can be implemented using small and medium scale integrated gates and programmable logic devices.
- U4 – State machines are used to control common everyday devices such as elevator doors, traffic lights, and combinational (electronics) locks.
- U5 – There are many sensor inputs and outputs other than LEDs and seven segment displays in real world systems.

ESSENTIAL QUESTIONS: *Students will keep considering …*

- Q1 – Why are state machine designs used in electronics?
- Q2 – What are the common components of a state machine and how are they arranged to make state transitions based on inputs?
- Q3 – What are some common everyday devices that are controlled by state machines?

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	Acquisition	
modern engineering tools necessary for engineering practice. • G6 – Pursue the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. • G7 – Demonstrate an understanding of professional and ethical responsibility. • G8 – Demonstrate an ability to function on multidisciplinary teams. • G9 – Demonstrate an ability to communicate effectively. • G10 – Gain knowledge of contemporary issues. • G11 – Recognize the need for, and develop an ability to engage in life-long learning.	***KNOWLEDGE:*** *Students will…* • K1 – The basic function of a state machine?U1,U4 • K2 – Identify the parts of a state graph and a state transition table.U2,U3 • K3 – Recognize a state machine and identify examples of a state machine.U4 • K4 – Recognize a wide range of sensor inputs and outputs in real word systems.U5	***SKILLS:*** *Students will…* • S1 – Describe the components of a state machine.U2 • S2 – Draw a state graph and construct a state transition table for a state machine.U2 • S3 – Derive a state machine's Boolean equations from its state transition table.U2 • S4 – Implement Boolean equations into a functional state machine.U2 • S5 – Use Circuit Design Software (CDS) and a Digital Logic Board (DLB) to simulate and prototype state machine designs implemented with discrete and programmable logic.U1,U2,U3

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Evidence *(stage 2)*		
Activities (A) Projects (P) Problems(B)	Assessment FOR Learning	Assessment OF Learning
4.1.1.A Sensors and Motors: Copier Jam Detector:	• Essential Questions	• Print out of simulated circuits. • Conclusion Questions • Demonstration of completed circuit
4.1.2.A State Machines: Phone Number:	• Essential Questions	• Print out of simulated circuits. • Conclusion Questions • Demonstration of completed circuit
4.1.3.P State Machines: Tollbooth (VEX)	• Essential Questions	• Print out of simulated circuits. • Conclusion Questions • Demonstration of completed circuit.
4.1.3.P State Machines: Elevator Door (FT)	• Essential Questions	• Print out of simulated circuits. • Conclusion Questions • Demonstration of completed circuit

Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems(B)	Knowledge and Skills
4.1.1.A Sensors and Motors: Copier Jam Detector:	K4
4.1.2.A State Machines: Phone Number:	K1,K2,K3,S1,S2,S3,S4,S5
4.1.3.P State Machines: Tollbooth (VEX)	K1,K2,K3,S1,S2,S3,S4,S5
4.1.3.P State Machines: Elevator Door (FT)	K1,K2,K3,S1,S2,S3,S4,S5

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