EEM16 Quiz 2

DANIEL SCHWARTZ

TOTAL POINTS

20 / 20

QUESTION 1

1 (a), (b), (c) 12 / 12

✓ **- 0 pts Correct**

- 1 pts (a) overspecified arc

- 2 pts (a) missing/incorrect arc for busy/~busy or button/~button

- 2 pts (a) incorrect busy/button on arc

- 4 pts (b) incorrect

- 2 pts (c) not Moore or incomplete table.

- 4 pts (c) incorrect

QUESTION 2

2 (d), (e) 8 / 8

✓ **- 0 pts Correct**

- 1 pts (d) incorrect variable in equations.

- 1.5 pts (d) missing term in next_state

- 1.5 pts (d) incorrect actuate

- 1.5 pts (d) excess literals in expressions

- 1 pts (d) missing term in actuate

- 4 pts (d) incorrect

- 1 pts (e) incorrect conditions on shut/open

- 1 pts (e) incorrect conditions on opening/closing

- 2 pts (e) missing conditions on arcs

- 2.5 pts (e) missing arcs

- 4 pts (e) incorrect

Quiz #2

Name (Last, First): Schwartz, Daniel

Student Id #:

Do not start working until instructed to do so.

1. *You must answer in the **space provided** for answers after every question. We will ignore answers written anywhere else in the booklet. **All pages in this booklet must be accounted** for otherwise it will not be graded.*
2. *This quiz is closed book/notes.*
3. *You may not use any electronic device.*

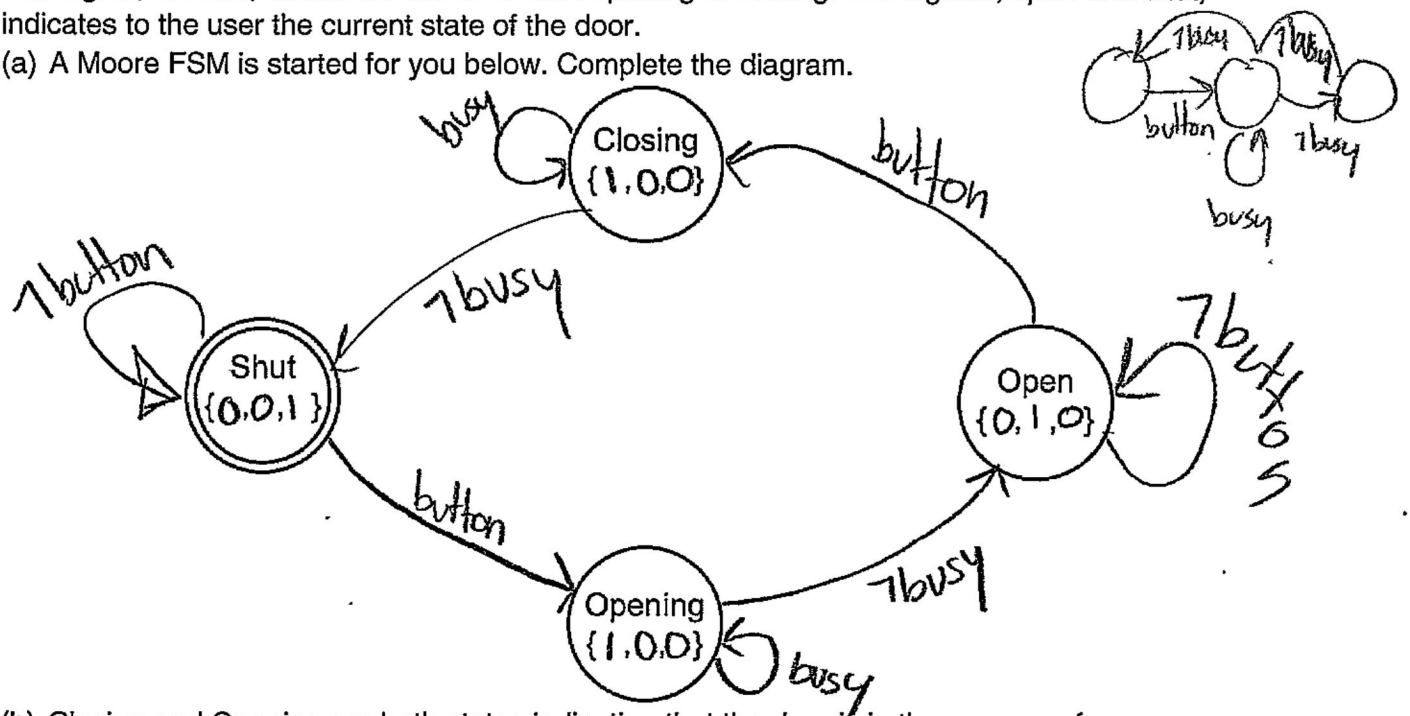
Following table to be filled by course staff only

	Maximum Score	Your Score
TOTAL	**20**	

This page is left intentionally blank and can be used for scratch work.

You are to design a state machine that controls the opening and closing of a garage door. This machine accepts 2 inputs and produces 3 outputs. The two inputs are *button* and *busy*. The signal, *button*, indicates when the garage door button is pushed. The signal, *busy*, is from the motor that indicates when the motor is still in the process of opening or closing. To make this easier, you can assume that *button is never pushed when the motor is busy* and that the *motor is never busy when the door is either Shut or Open*. The three outputs are {*actuate*, *open*, *shut*}. The signal, *actuate*, directs the motor to start opening or closing. The signals, *open* and *shut*, indicates to the user the current state of the door.

(a) A Moore FSM is started for you below. Complete the diagram.



(b) Closing and Opening are both states indicating that the door is in the process of opening/shutting. Explain if you think they can be merged into a single state. Why or why not.

No. When it stops receiving the busy signal, for example, it cannot know whether the next state is open or Shut.

(c) A part of the state-transition table is shown below. Fill in the blanks for the FSM you built in (a). You do not need to complete the entire table.

state	button	busy	actuate	open	shut	nx_state
Shut	0	d	0	0	1	Shut
Shut	1	d	0	0	1	Opening
Opening	d	0	1	0	0	Open
Opening	d	1	1	0	0	Opening

(d) Let us encode the states {*Shut, Opening, Open, Closing*} as one-hot encoding where *state[3:0] ={4'b0001, 4'b0010, 4'b0100, 4'b1000}* respectively. Using your FSM in (a), write the Boolean function for *next_state[0]* (corresponding to entering the *Shut* state} and the signal, *actuate*.

next_state[0] = $(state[3] \wedge \neg busy) \vee (state[0] \wedge \neg button)$

actuate = $state[1] \vee state[3]$

(e) Repeat (a) but instead design a Mealy FSM. The added constraints are that (1) all outputs must be present 1 cycle earlier (in comparison to the Moore implementation), and (2) actuate is only asserted for 1 cycle. Complete the state diagram.