

Paul Kim

Lab 03 Final Report

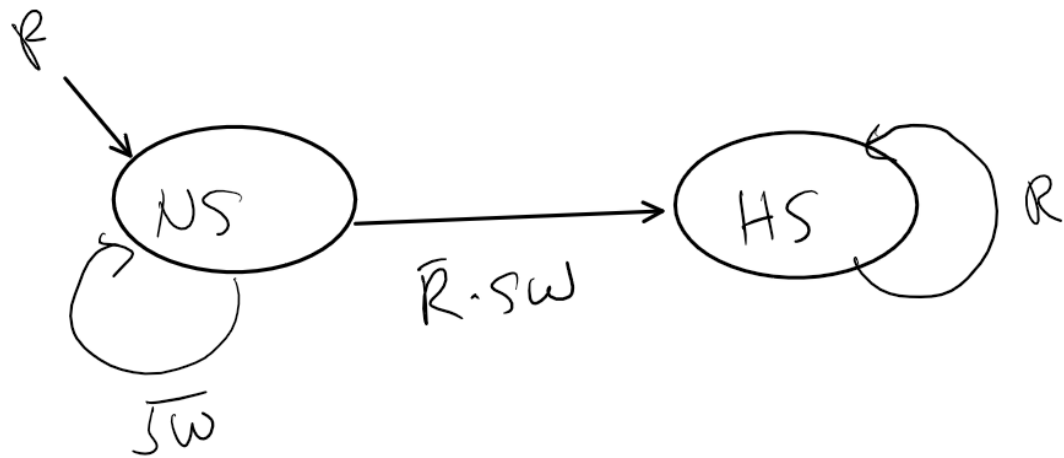
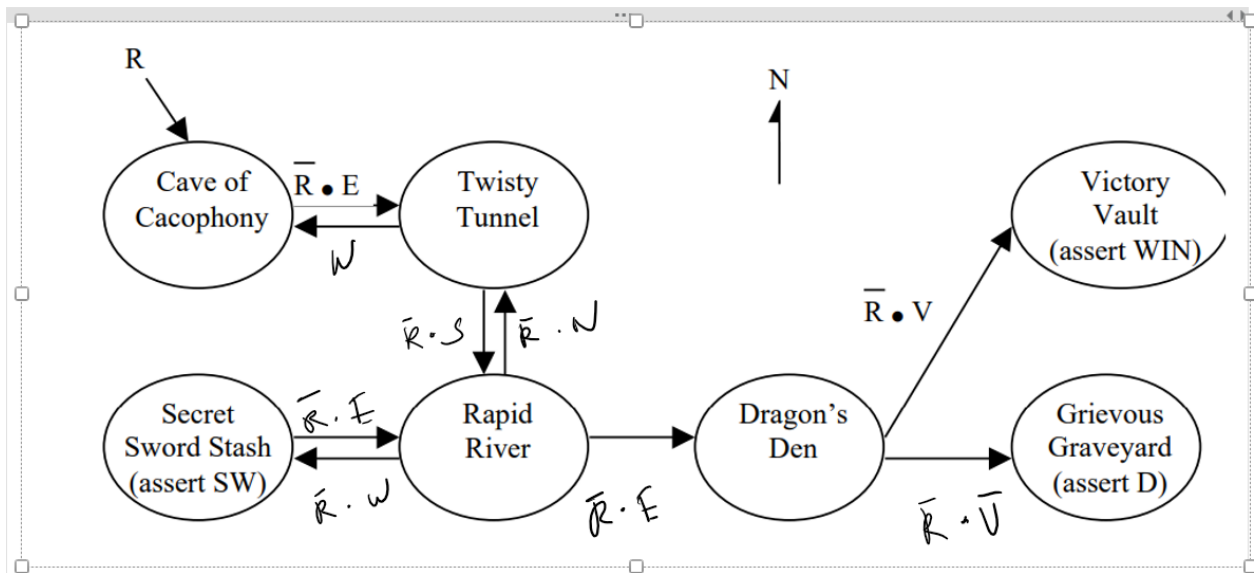
Friday section

I have spent about total 2 hours reading the "DSD lab03.pdf" lab instruction. I've tried to understand and grasp the idea fully.

Then I've first tried to write my own table, write my equations, and draw the schematic drawings. Then I've compared my answers to hint pdf. It really helped me a lot. Otherwise I might have much more hours to debug my design. Also whenever I was stuck on some problems on software or the lab itself during Thursday 2-4pm, I went to Mr. Feng's office hours 2-4pm Thursday while I was working downstairs on the computer lab. All these procedure took me about 5 hours.

Waveform simulation took me about 2 hours because my Quartus 'prime lite' on my pc was giving me node error. I've tried to figure out in my pc for awhile by remaking the project etc etc. But eventually I've gave up and decided to use the computer lab computer and rebuilt the project and I eventually got the result.

So This lab took me $2+5+2=9$ hours total



Room FSM									
	state transition table								
		inputs							output
		state	N	S	W	E	R	V	state
		X	x	x	x	x	1	x	CC
		CC	x	x	x	1	0	x	TT
		TT	x	x	1	x	0	x	CC
		TT	x	1	x	x	0	x	RR
		RR	x	x	1	x	0	x	SS
		RR	x	x	x	1	0	x	DD
		RR	1	x	x	x	0	x	TT
		SS	x	x	x	1	0	x	RR
		DD	x	x	x	x	0	1	VV
		DD	x	x	x	x	0	0	GG
	output table								
		current state	sw	d	win				
		CC	0	0	0				
		TT	0	0	0				
		RR	0	0	0				
		SS	1	0	0				
		DD	0	0	0				
		VV	0	0	1				
		GG	0	1	0				

Sword FSM					
	state transition table				
		input			output
		current state	sw	R	next state
		x	x	1	NS
		NS	0	0	NS
		x	1	0	HS
		HS	x	0	HS
	output table				
		input	output		
		current state	V		
		NS	0		
		HS	1		

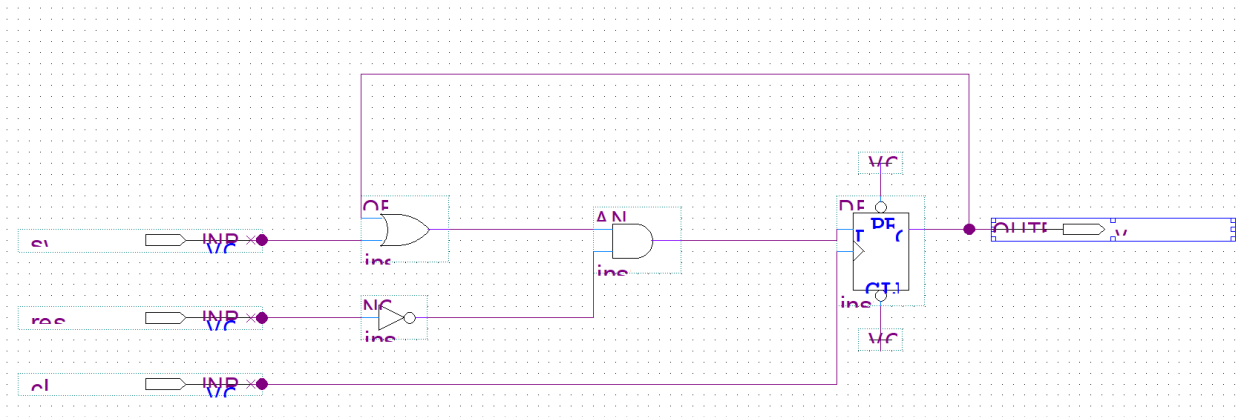
State encodings		
Room	CC	0000001
	TT	0000010
	RR	0000100
	SS	0001000
	DD	0010000
	GG	0100000
	VV	1000000
Sword	NS	0
	HS	1

Room FSM									
	binary state transition table								
		inputs							output
		state	N	S	W	E	R	V	state
		X	x	x	x	x	1	x	0000001
		0000001	x	x	x	1	0	x	0000010
		0000010	x	x	1	x	0	x	0000001
		0000010	x	1	x	x	0	x	0000100
		0000100	x	x	1	x	0	x	0001000
		0000100	x	x	x	1	0	x	0010000
		0000100	1	x	x	x	0	x	0000010
		0001000	x	x	x	1	0	x	0000100
		0010000	x	x	x	x	0	1	1000000
		0010000	x	x	x	x	0	0	0100000
	output table								
		current state	sw	d	win				
		0000001	0	0	0				
		0000010	0	0	0				
		0000100	0	0	0				
		0001000	1	0	0				
		0010000	0	0	0				
		0100000	0	0	1				
		1000000	0	1	0				

Sword FSM					
	binary state transition table				
		input			output
		current state	sw	R	next state
		x	x	1	0
		0	0	0	0
		x	1	0	1
		1	x	0	1
	output table				
		input	output		
		current state	V		
		0	0		
		1	1		

Sword.bdf

$$V' = (sw * \bar{R}) + (V * \bar{R})$$



Room.bdf

Room FSM boolean equations

$$S_1' = R + S_2 W \bar{R}$$

$$S_2' = S_1 E \bar{R} + S_3 N \bar{R}$$

$$S_3' = S_2 S \bar{R} + S_4 E \bar{R}$$

$$S_4' = S_3 W \bar{R}$$

$$S_5' = S_3 E \bar{R}$$

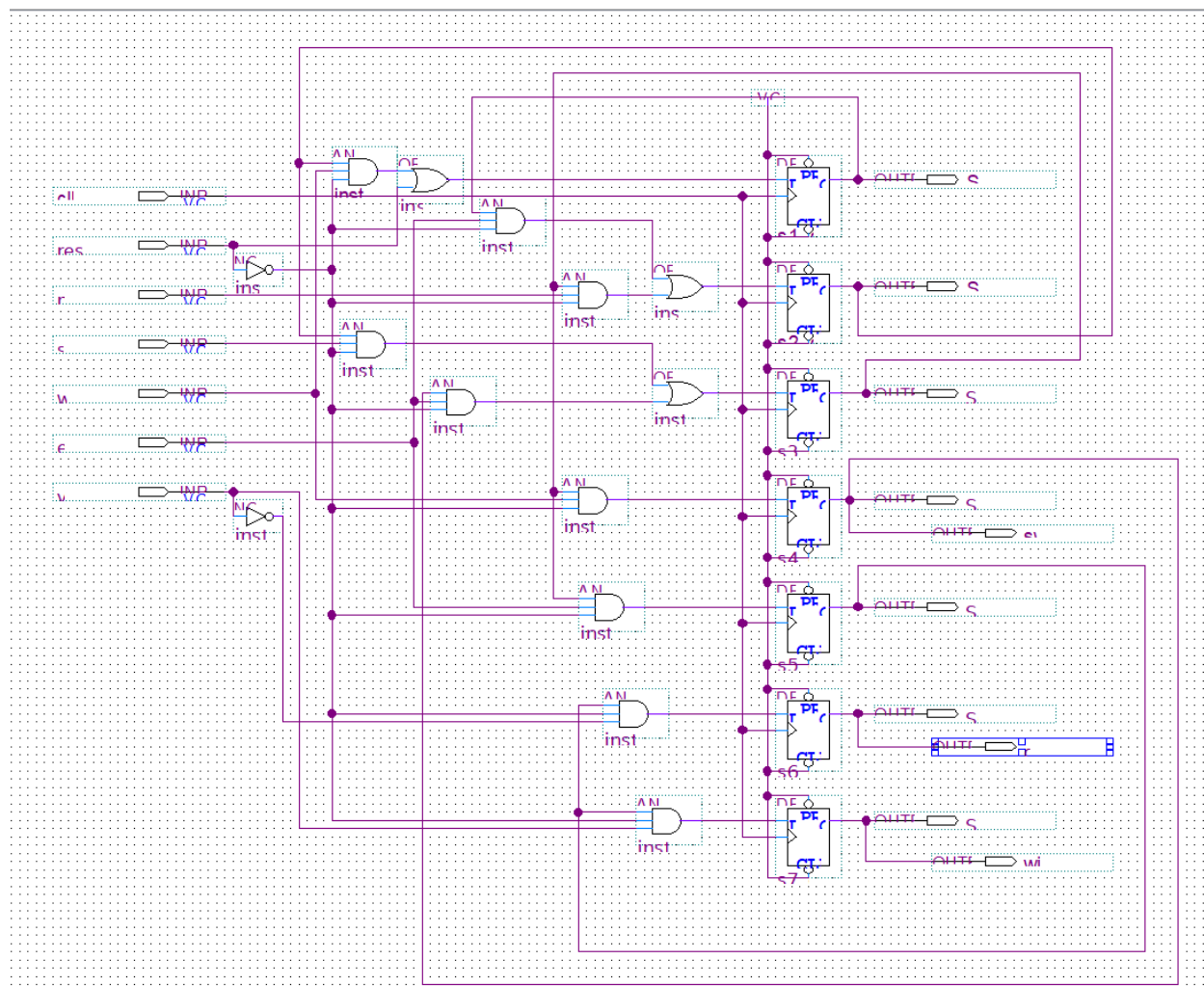
$$S_6' = S_5 \bar{R} \bar{V}$$

$$S_7' = S_5 \bar{R} V$$

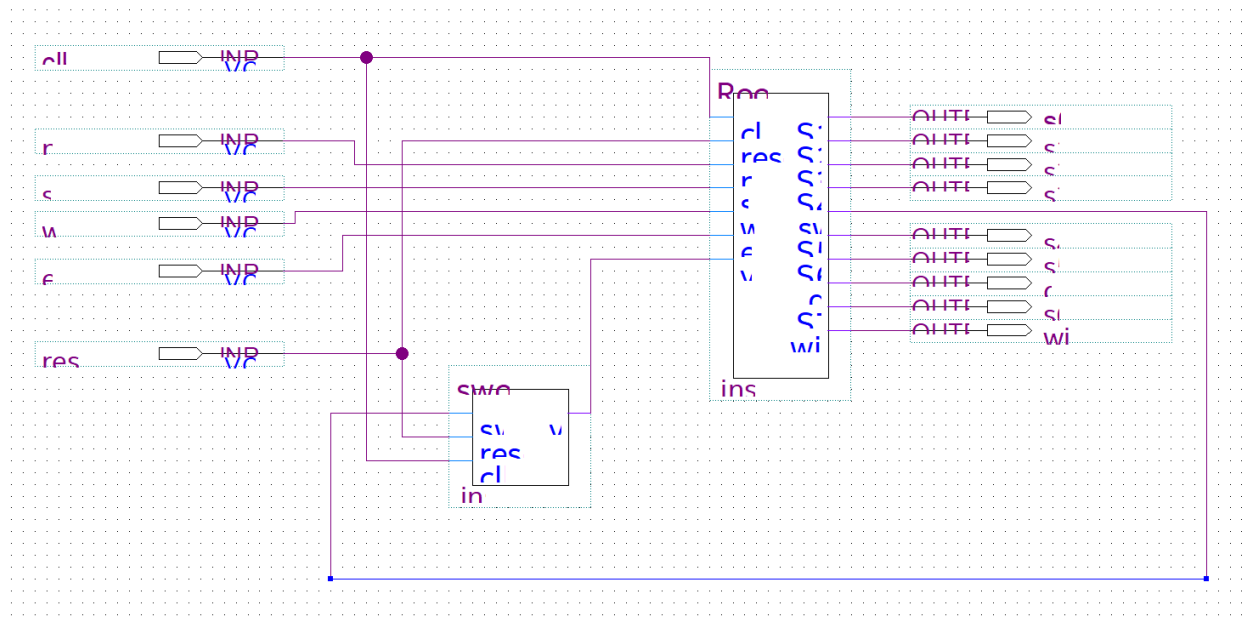
$$SW = S_4$$

$$D = S_6$$

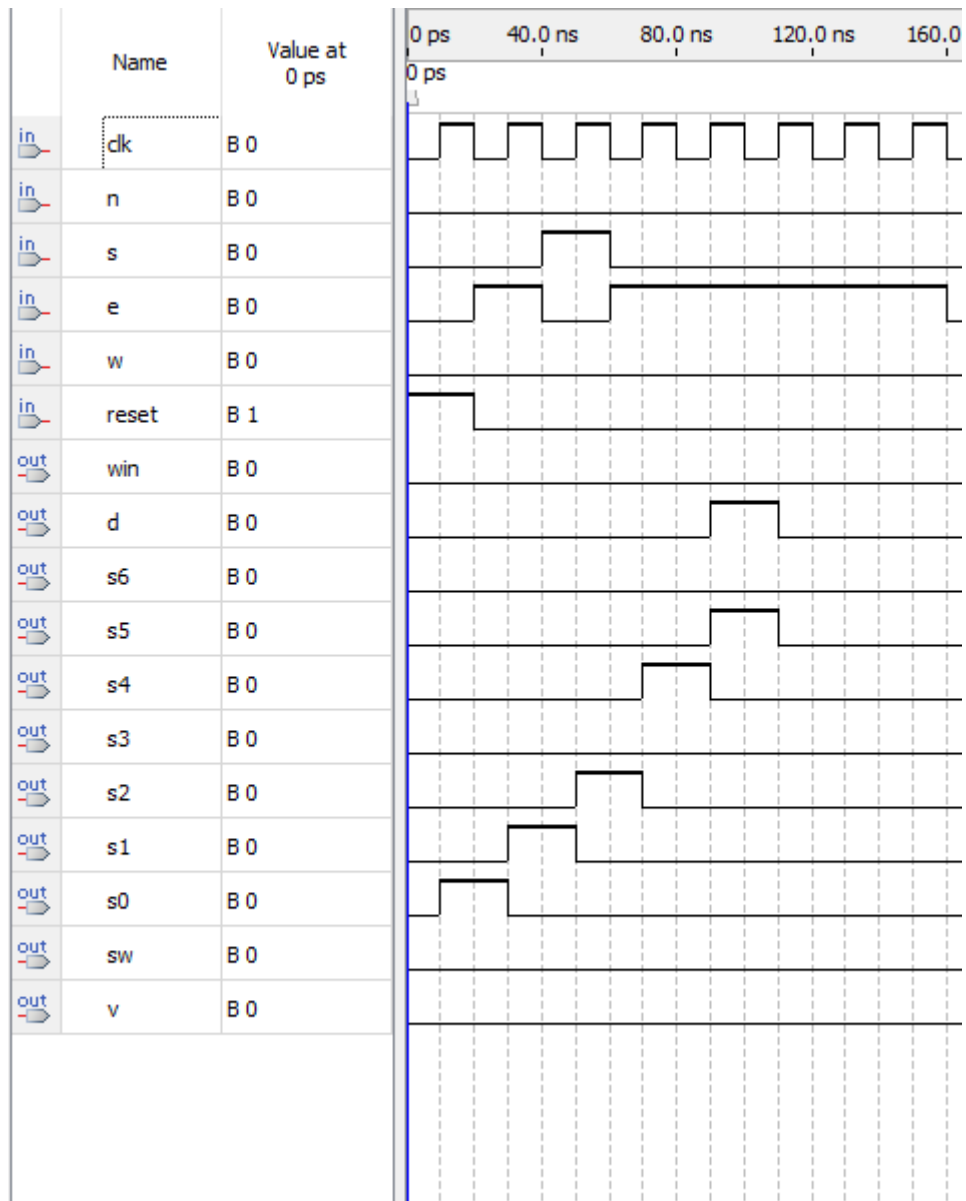
$$Wm = S_7$$



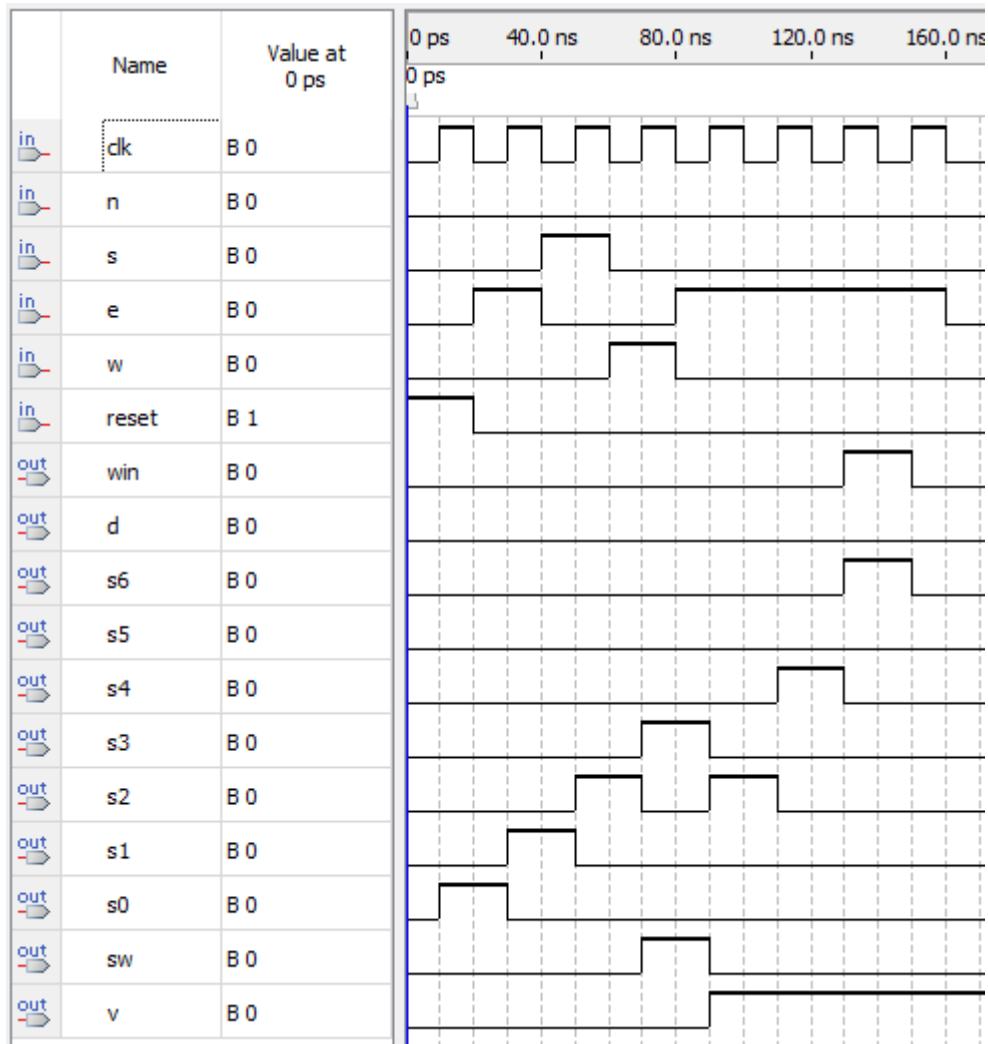
Lab03_PK.bdf


















Losing game

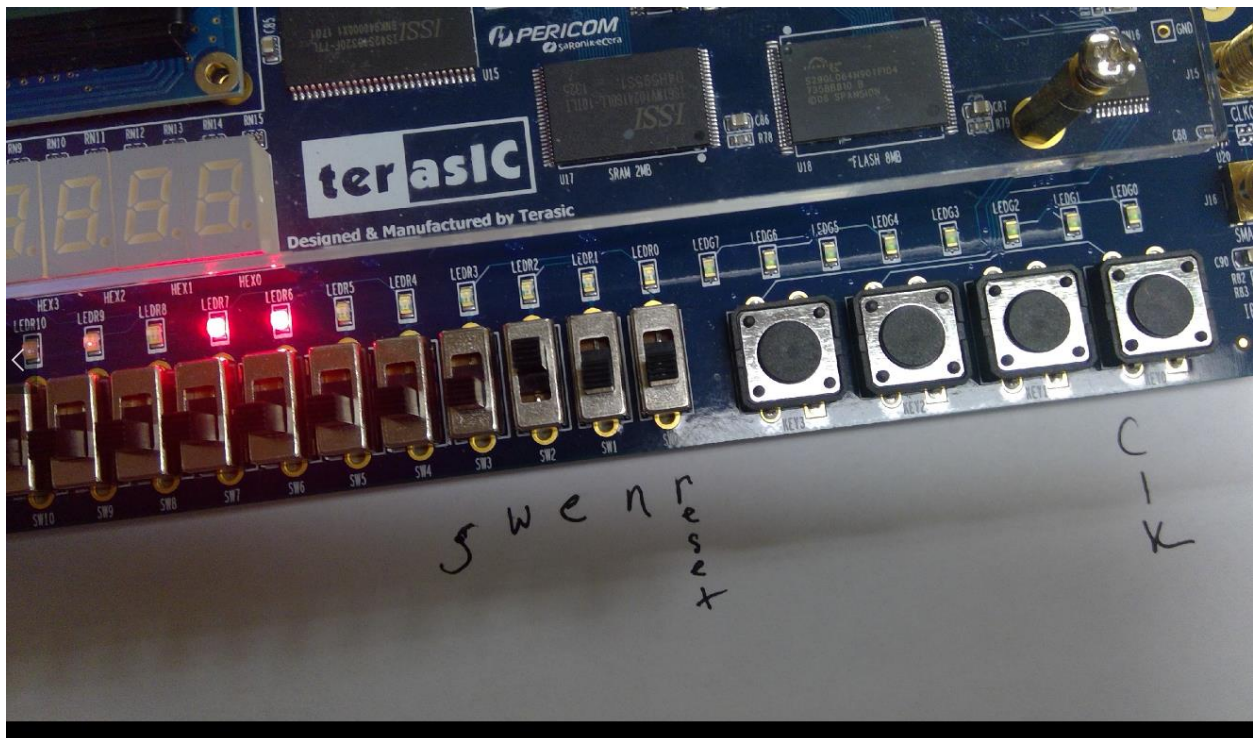
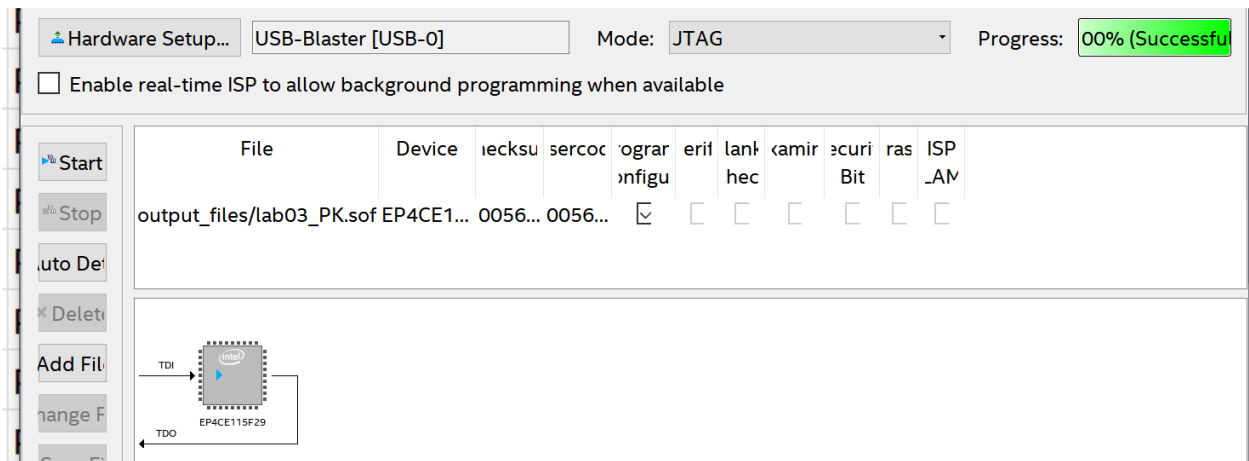


winning game



	tatu	From	To	nment f	Value	Enabled	Entity
1	✓ ...		 s	Locati...	PIN_AB27	Yes	
2	✓ ...		 reset	Locati...	PIN_AB28	Yes	
3	✓ ...		 e	Locati...	PIN_AC27	Yes	
4	✓ ...		 n	Locati...	PIN_AC28	Yes	
5	✓ ...		 w	Locati...	PIN_AD27	Yes	
6	✓ ...		 s5	Locati...	PIN_E18	Yes	
7	✓ ...		 s2	Locati...	PIN_E19	Yes	
8	✓ ...		 s4	Locati...	PIN_F18	Yes	
9	✓ ...		 s1	Locati...	PIN_F19	Yes	
10	✓ ...		 s3	Locati...	PIN_F21	Yes	
11	✓ ...		 s0	Locati...	PIN_G19	Yes	
12	✓ ...		 win	Locati...	PIN_H19	Yes	
13	✓ ...		 d	Locati...	PIN_J17	Yes	
14	✓ ...		 s6	Locati...	PIN_J19	Yes	
15	✓ ...		 clk	Locati...	PIN_M23	Yes	
16		<<...>>	<<...>>	<<ne...			

My LED signals and switches assignment values



In this lab, we've created a simple game on the board. A player has seven rooms that he can go through and the player can only win if he goes to specific room with an object that can be only acquired by going through another specific room.

First, we had to design by making room FSM and another separate FSM for sword. Then we had to make state transition table for both room and sword. And turn those tables into binary form. From there, output boolean equations were able to be acquired. Then using those equations, we implemented schematic drawing and made hierarchical design by creating each individual Room and Sword FSM's. And the top entity lab3_PK.bdf combined and connected all the inputs(directions, reset, clk), room and sword.