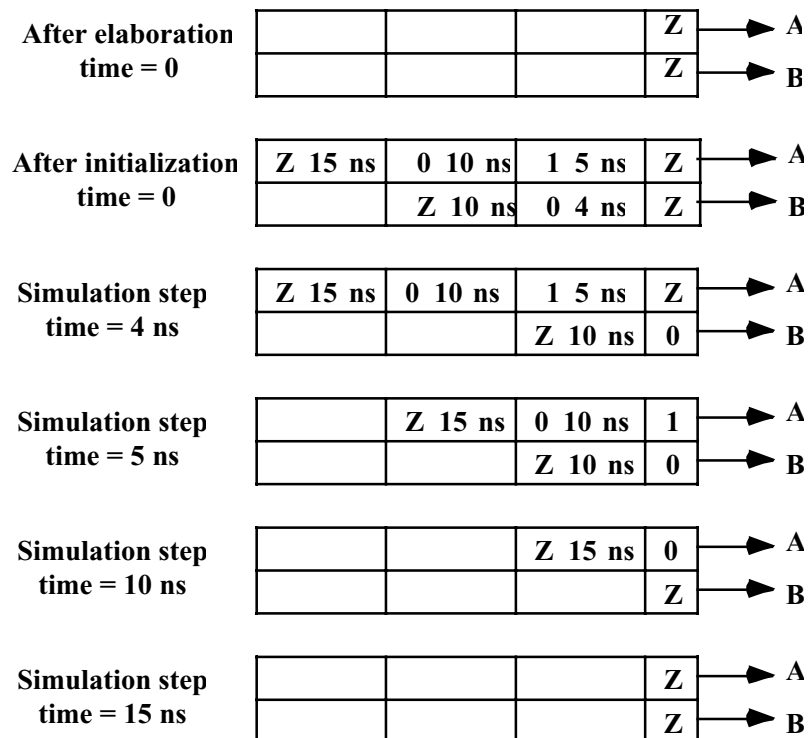


**The University of Alabama in Huntsville**  
**Electrical & Computer Engineering**  
**CPE/EE 422/522**  
**Spring 2004**  
**Homework #4 Solution**

- 8.1 See file hw\_solutions/hw4/dt\_product.vhd
- 8.2 See file hw\_solutions/hw4/decode.vhd
- 8.4 See file hw\_solutions/hw4/less.vhd
- 8.6 A <= transport 1 after 5 ns, 0 after 10 ns, Z after 15 ns;  
 B <= transport 0 after 4 ns, Z after 10 ns;  
 C <= A after 6 ns;  
 C <= transport A after 5 ns;  
 C <= reject 3 ns B after 4 ns;
- C2 <= B after 3 ns;  
 C <= C2 after 1 ns;

(a) Draw drivers for signals A and B



(b) Draw the three drivers s0, s1, and s2 for C. Assume that C drives an open-collector bus with a pull-up resistor.

After elaboration  
time = 0

			Z	→ s0
			Z	→ s1
			Z	→ C2
			Z	→ s2

Simulation step  
time = 4 ns

			Z	→ s0
			Z	→ s1
		0 7 ns	Z	→ C2
			Z	→ s2

Simulation step  
time = 5 ns

		1 11 ns	Z	→ s0
		1 10 ns	Z	→ s1
		0 7 ns	Z	→ C2
			Z	→ s2

Simulation step  
time = 7 ns

		1 11 ns	Z	→ s0
		1 10 ns	Z	→ s1
			0	→ C2
		0 8 ns	Z	→ s2

Simulation step  
time = 8 ns

		1 11 ns	Z	→ s0
		1 10 ns	Z	→ s1
			0	→ C2
			0	→ s2

Simulation step  
time = 10 ns

	0 16 ns	<del>1 11 ns</del>	Z	→ s0
		0 15 ns	1	→ s1
		Z 13 ns	0	→ C2
			0	→ s2

Simulation step  
time = 13 ns

		0 16 ns	Z	→ s0
		0 15 ns	1	→ s1
			Z	→ C2
		Z 14 ns	0	→ s2

Simulation step time = 14 ns			0 16 ns	Z	→ s0
			0 15 ns	1	→ s1
				Z	→ C2
				Z	→ s2

Simulation step time = 15 ns		Z 21 ns	<del>0 16 ns</del>	Z	→ s0
			Z 20 ns	0	→ s1
				Z	→ C2
				Z	→ s2

Simulation step time = 20 ns			Z 21 ns	Z	→ s0
				Z	→ s1
				Z	→ C2
				Z	→ s2

Simulation step time = 21 ns				Z	→ s0
				Z	→ s1
				Z	→ C2
				Z	→ s2

- (c)
- |              |   |    |
|--------------|---|----|
| time = 0 ns  | C | W  |
| time = 8 ns  | C | 0  |
| time = 10 ns | C | X  |
| time = 14 ns | C | 1  |
| time = 15 ns | C | 0[ |
| time = 20 ns | C | W  |