MITx 6.004.1x
Computation Structures 1: Digital Circuits

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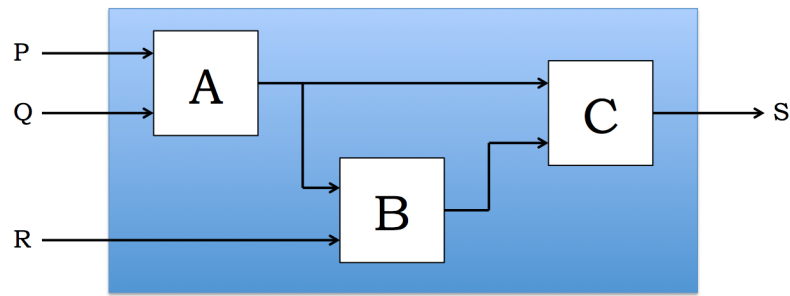Previous　　📹✓ 📹✓ ✏️✓ 📹✓ 📹✓ ✏️✓ 📹✓ ✏️✓ 📹✓ ✏️✓ 📹✓　　Next

LE2.2

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LE2.2.1: A combinational system

9/9 points (ungraded)

Let's roll up our sleeves and try to build the functional and timing specifications for a system of combinational devices using the specifications of the component devices. We'll use the system diagram from the previous video:

And here are the specifications for the A, B, and C components:

x	y	A(x,y)		x	y	B(x,y)		x	y	C(x,y)
0	0	0		0	0	0		0	0	0
0	1	0		0	1	1		0	1	1
1	0	0		1	0	1		1	0	1
1	1	1		1	1	1		1	1	0

$$t_{PD,A} = 3\text{ns} \qquad t_{PD,B} = 2\text{ns} \qquad t_{PD,C} = 4\text{ns}$$

We'll start by determining the functional specification for the system, expressing the result as a truth table which shows the value of the output S for the eight possible combinations of values for the P, Q, and R inputs. Given a particular set of input values, you can use the truth tables for the A, B, and C components to work your way through the circuit, from inputs to outputs. Please fill in the truth table below with the correct values for the S output:

P	Q	R	S
0	0	0	0 ✔
0	0	1	1 ✔
0	1	0	0 ✔
0	1	1	1 ✔
1	0	0	0 ✔
1	0	1	1 ✔
1	1	0	0 ✔
1	1	1	0 ✔

Finally, we need to derive the propagation delay, t_{PD}, of the system using the propagation delays of the components. To do this, consider all paths from the inputs (P, Q, R) to the outputs (S). For each path sum the propagation delays of the components along the path to compute how long it will take for a change in path's inputs to be reflected in the path's outputs. The system's propagation delay is the maximum of the path propagation delays. Please enter the system's propagation delay:

System t_{PD} in ns: 9   ✔

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☑ **Outputs**   7
   I don't understand the last two line answers of truth table. If C's inputs are both 1 why is the outcome 0?

☑ **How to determine which input is 'x'**   3
   For example, the inputs to component B come from component A and from a 'system input' R do I arrange them as B(A,R) or B(R,A)? I...

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