Introduction to Digital Systems

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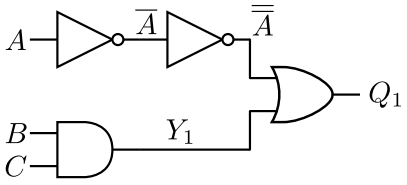
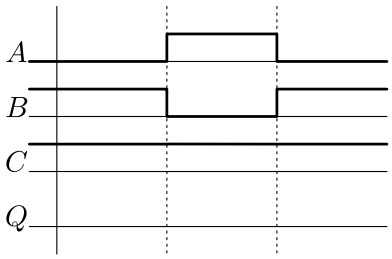
Exercise 1. [Truth Table, Digital Waveform, Glitch]

- Determine the truth table of the following digital circuit.

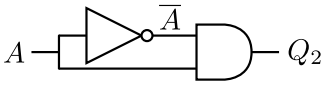


- Draw the output of the previous circuit considering that the inputs change their values (from ABC=$\{011\}$ to ABC=$\{101\}$ and again to ABC=$\{011\}$) as is shown below. Consider that all the gates introduce a fixed delay Δ. Don't forget to draw all the *intermediate* signals needed to determine the output.

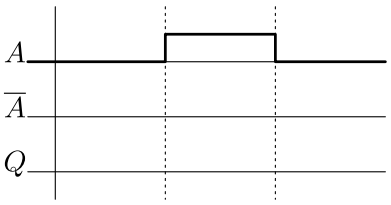


Exercise 2. [Truth Table, Digital Waveform, Glitch]

- Determine the truth table of the following digital circuit.

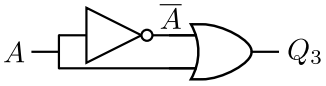


- Draw the output of the previous circuit considering that the input changes its value (from A=$\{0\}$ to A=$\{1\}$ and again to A=$\{0\}$) as is shown below. Consider that all the gates introduce a fixed delay Δ.

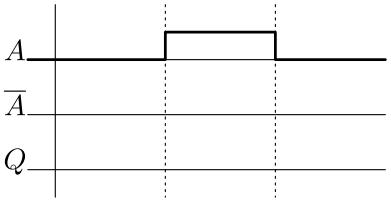


Exercise 3. [Truth Table, Digital Waveform, Glitch]

- Determine the truth table of the following digital circuit.



- Draw the output of the previous circuit considering that the input changes its value (from A={0} to A={1} and again to A={0}) as is shown below. Consider that all the gates introduce a fixed delay Δ.

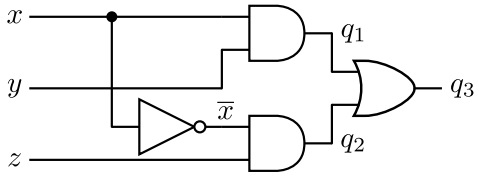


Exercise 4. [Consensus (or Race Hazard) Theorem, Digital Waveform, Glitch]
The *Consensus theorem* is the identity:

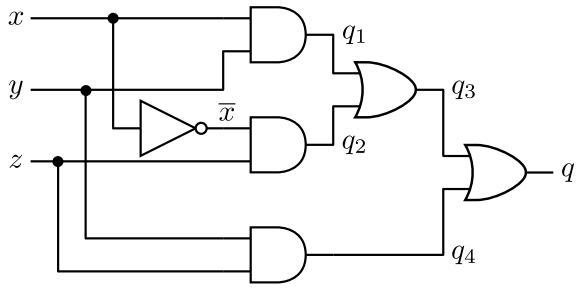
$$xy + \overline{x}z = xy + \overline{x}z + yz.$$

This identity can be used to simplify the right side of the identity to the left side. But the main interest of this identity is in avoiding race hazards. That is the reason it is also called the *Race hazard theorem.*

- Prove the consensus theorem comparing the truth table of both sides of the identity.
- Verify that the following circuit is an implementation of the left side of the identity.



- Draw the output of the previous circuit considering that the input changes its value (from xyz={111} to xyz={011}. Consider that all the gates introduce a fixed delay Δ.
- Verify that the following circuit is an implementation of the rigth side of the identity.



- Draw the output of the previous circuit considering that the input changes its value (from xyz=$\{111\}$ to xyz=$\{011\}$. Consider that all the gates introduce a fixed delay Δ.
- Take conclusions comparing the results of both circuits.