Implementing Binary Adders

Experiment 10

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Objective

* Design a half adder and a full adder by extracting the Boolean equation from a truth table.
* Construct the half adder and full adder circuits from a Boolean equation.
* Design and test a 3-bit adder circuit using Quartus II and Altera DE-2 Board

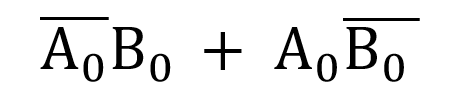
Materials

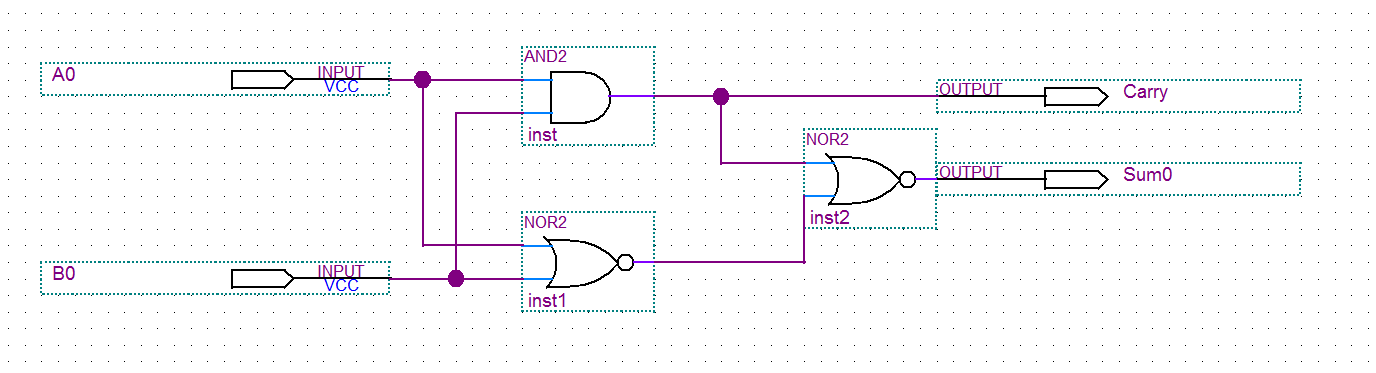
* PC (Altera Quartus II V9.1 installed)
* DE-2 board

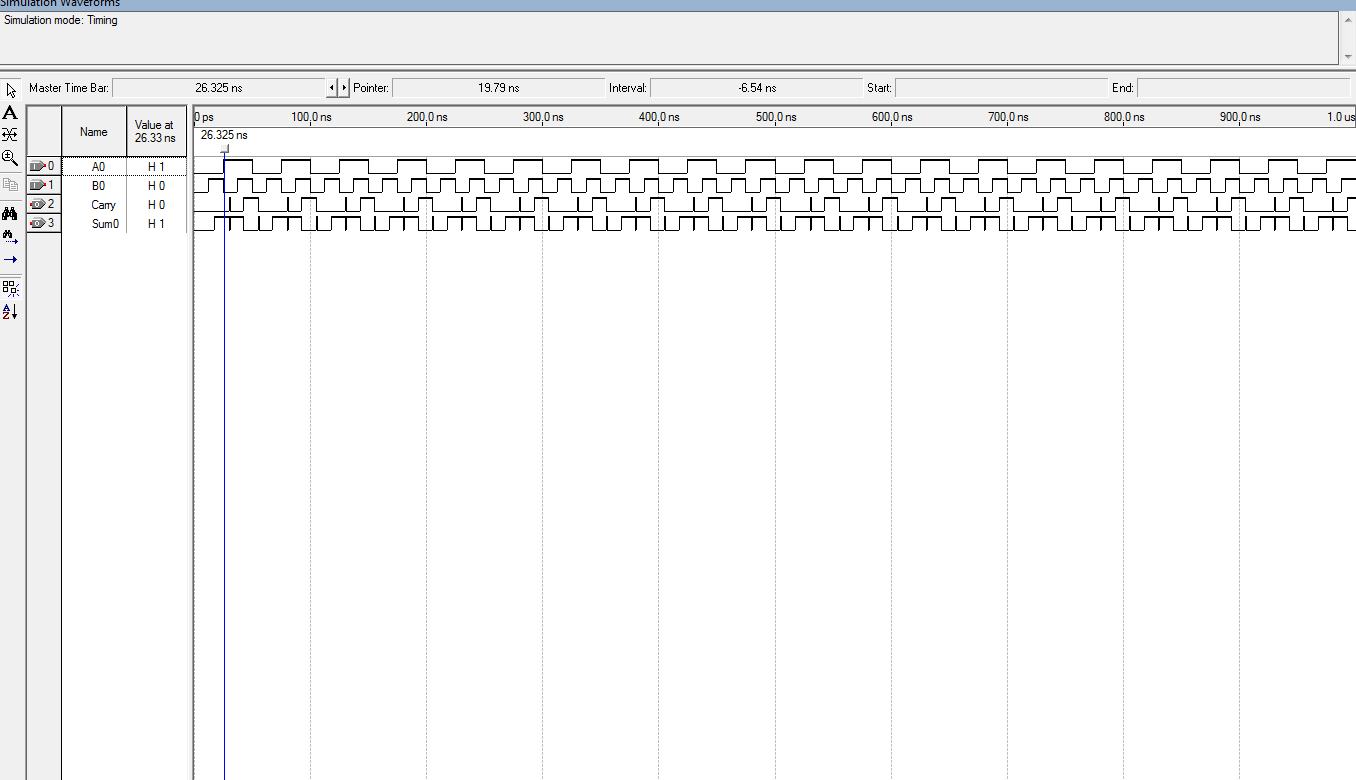
Part 1:Half Adder Circuit

Boolean Equations:

Carry= AOBO

Sum= 





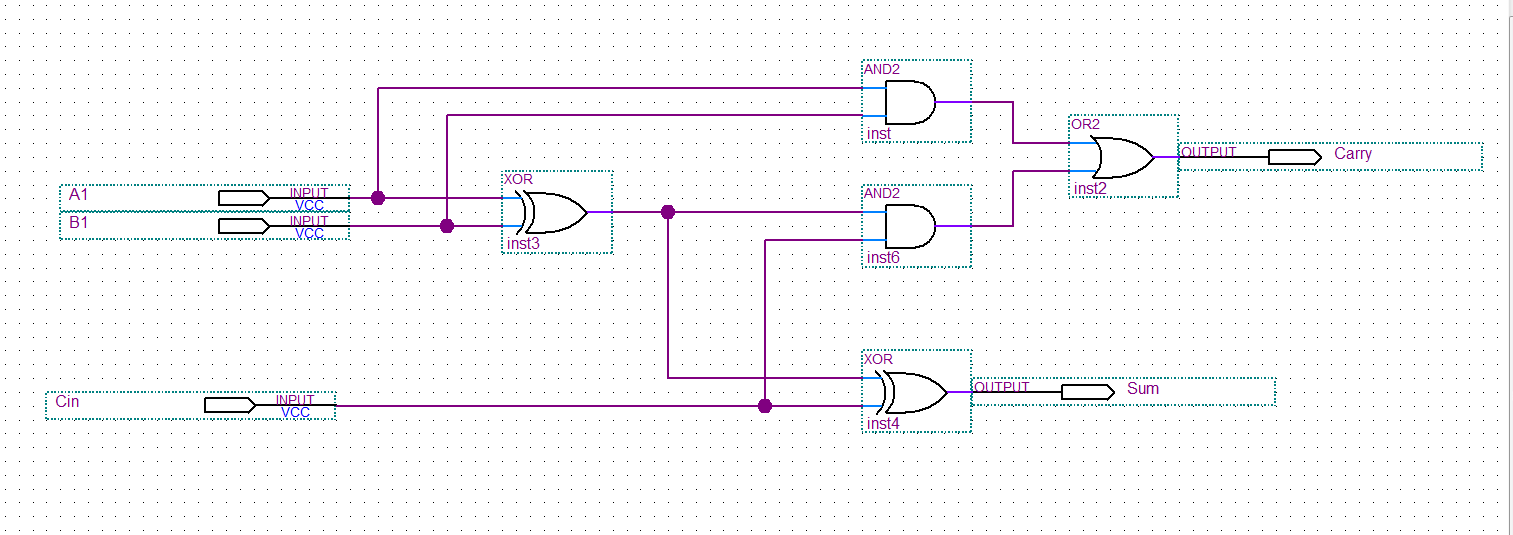
|  |  |  |  |
| --- | --- | --- | --- |
| A0 | B0 | Carry | Sum |
| 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 0 |

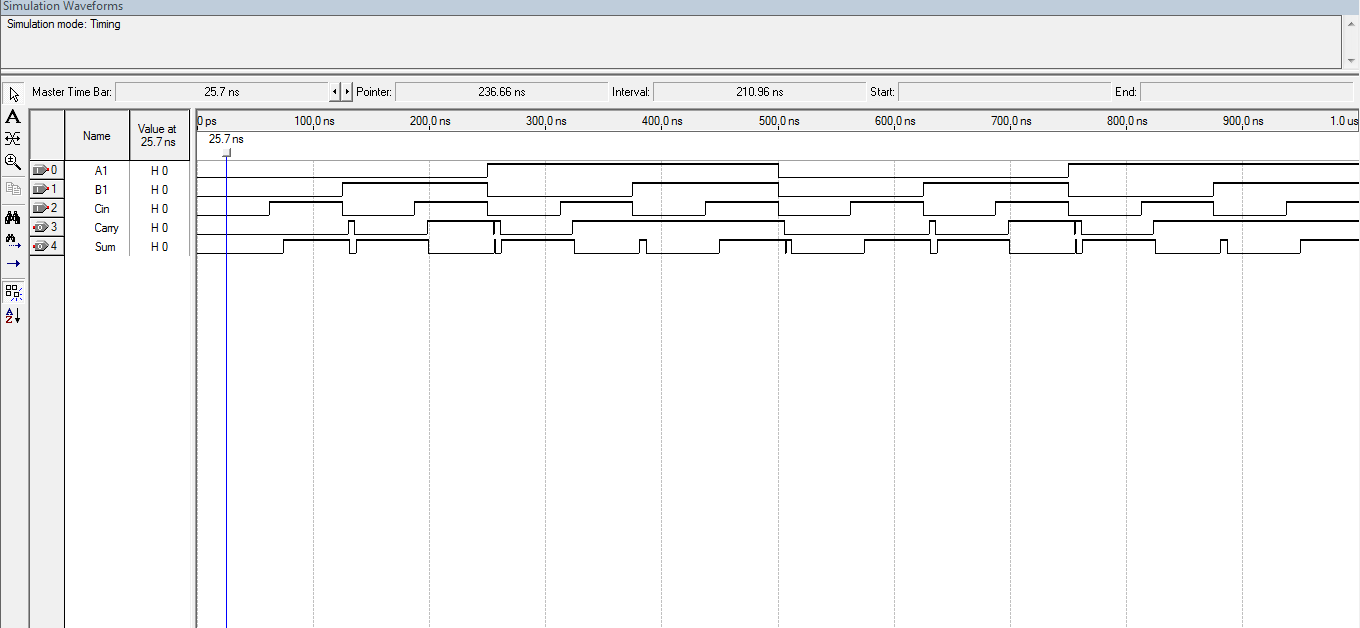
Part 2: Full adder circuit

Boolean equations:

Carry: (A⊕B)⊕Cin

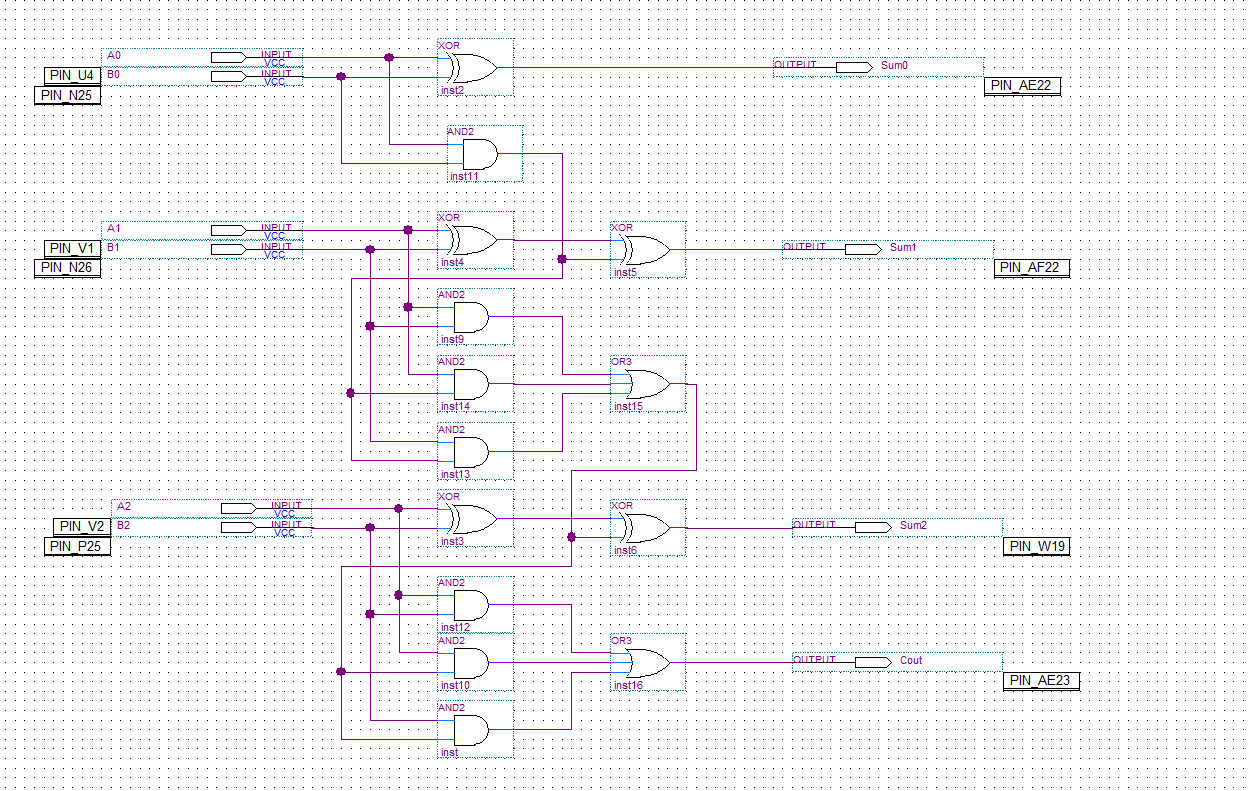
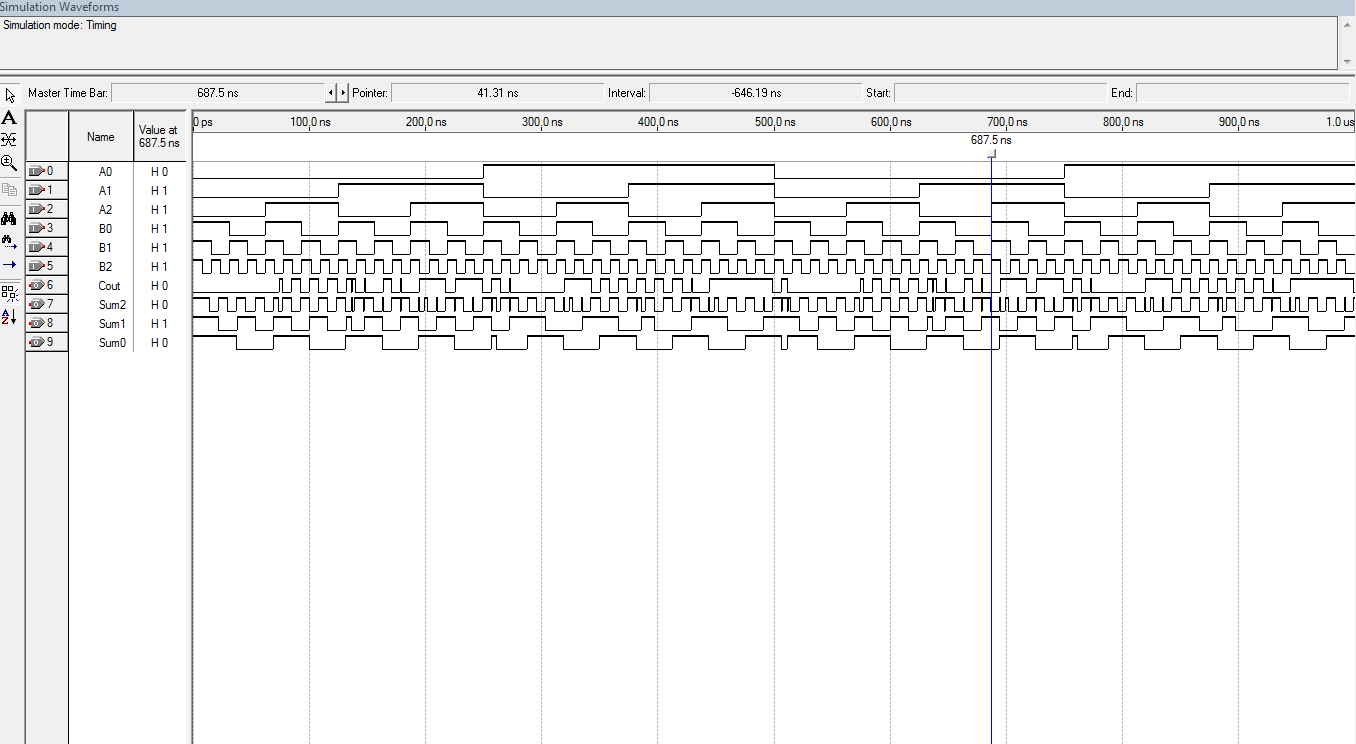
Sum:(A \* B) + ( Cin \* (A ⊕ B))

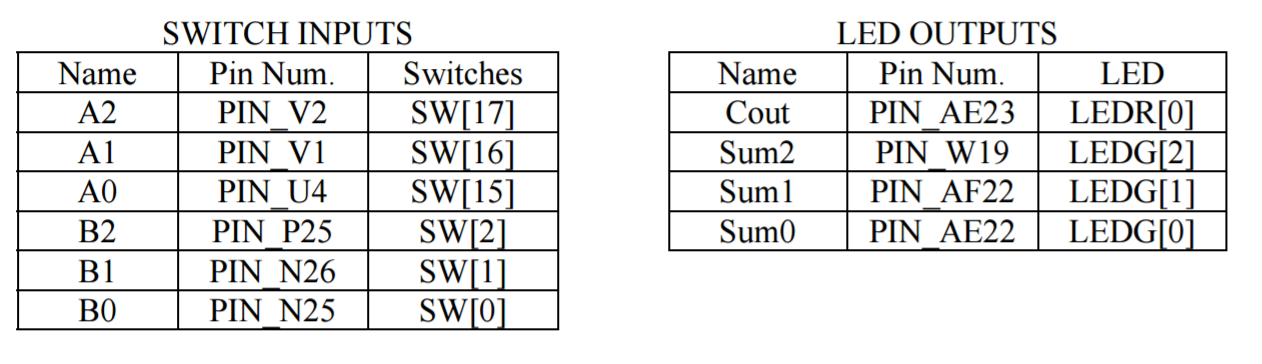


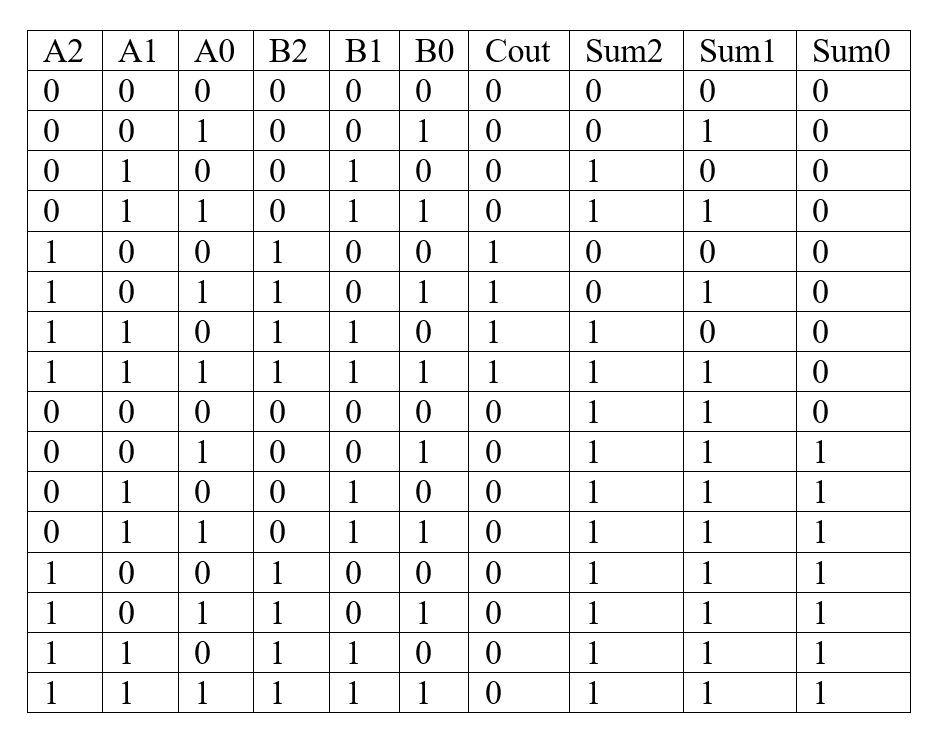


|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A1 | B1 | Cin | Carry | Sum |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 1 |
| 0 | 1 | 0 | 0 | 1 |
| 0 | 1 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 1 | 0 |
| 1 | 1 | 1 | 1 | 1 |

Part 3: 3-bit Full adder circuit







Questions:

1. What is the range of values for an 8-bit unsigned binary number?

0-255

Conclusion

In this laboratory exercise we learned to design half adders and full adders onto a circuit using Quartus II software. In addition, we learned how to design and test a 3-bit adder circuit onto the Altera DE-2 board.