ECE 111 Winter 2022  
HW5  
Hao Le A15547504

**Gray to Binary Converter**

Code

Text

Description automatically generated

RTL netlist

Diagram, schematic

Description automatically generated

Resource usage

Graphical user interface

Description automatically generated with medium confidence

Testbench simulation waveform

Graphical user interface, timeline

Description automatically generated

* The testbench in this case was for a 4-bit Gray to Binary converter. From the waveform, we see initially rstn going low, thus binary\_value goes to 0 because of the negative edge which is expected. The converter will convert gray\_value upon every positive edge of clk. For example, when 0100 is loaded into gray\_value, binary\_value turns into 0111 which is the correct conversion according to the truth table. This correctness holds for all 15 other cases of gray\_value which has a one-to-one mapping to 15 binary\_value’s.
* Testbench was modified to instantiate the converter at different bit values by modifying the N parameter. The converter works for cases 2-8.

**Carry Lookahead Adder**

Code

Graphical user interface, text, application

Description automatically generated

RTL netlist

Diagram

Description automatically generated

* The netlist shows that all 4 full adders output to the result, and inputs do not depend on the outputs of any other full adder. Hence, the addition stage is all parallel which is the advantage of CLA.

Graphical user interface

Description automatically generated with medium confidenceResource usage

Testbench simulation waveform

Graphical user interface

Description automatically generated

Graphical user interface

Description automatically generated

Table

Description automatically generated with low confidence

* The testbench waveform shows that the CLA functions correctly as indicated by the transcript which converts the binary values to decimal for intuitive validation. For example, at 300 ns A=4, B=7, and CIN=1 is fed in, and the result is 12 which is correct since 4 + 7 + 1 = 12. This holds true for the other test cases. Also, as soon as A or B changes, the result changes to correct summation, indicating that the CLA is purely combinational which is expected.