EXPERIMENT NO: 13

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Date: March 16, 2016

Aim of the Experiment:

Analysis of Binary to Gray converter using eSim.

Theory:

An interesting application for the exclusive - OR gate is a logic gate to change a binary number to its equivalent in gray code. The logic circuit in Figure - 1 can be used to convert a 4-bit binary number into its gray code equivalent, G0, G1, G2 and G3. As an example,the binary number 0011 will be converted into its gray-code equivalent of 0010 by the circuit. Following are the steps involved:

1. The M.S.B. of the gray code will be exactly equal to the first bit of the given binary number.
2. Now the second bit of the code will be exclusive-or of the first and second bit of the given binary number, i.e if both the bits are same the result will be 0 and if they are different the result will be 1.
3. The third bit of gray code will be equal to the exclusive-or of the second and third bit of the given binary number.

Thus the binary to gray code conversion goes on.

Procedure:

1. Create the schematic of the Binary to Gray Converter as shown in Figure-1.
2. Annotate the schematic.
3. Test Electric rules.
4. Generate the netlist.
5. Insert analysis for transient analysis from 0 to 100 ms with a step time of 10 us.

6. Insert Source Details.
7. Insert values for Ngspice Models.
8. Convert KiCad netlist to Ngspice netlist.
9. Simulate the Ngspice netlist using Ngspice simulator.

Source Parameters:

Following are the Pulse input parameters for V1:

1. Enter Initial Value - 0
2. Enter Pulsed Value - 5
3. Enter Delay Time - 0
4. Enter Rise Time - 0
5. Enter Fall Time - 0
6. Enter Pulse Width - 40m
7. Enter Period - 80m

Following are the Pulse input parameters for V2:

1. Enter Initial Value - 0
2. Enter Pulsed Value - 5
3. Enter Delay Time - 0
4. Enter Rise Time - 0
5. Enter Fall Time - 0
6. Enter Pulse Width - 20m
7. Enter Period - 40m

Following are the Pulse input parameters for V3:

1. Enter Initial Value - 0
2. Enter Pulsed Value - 5
3. Enter Delay Time - 0

4. Enter Rise Time - 0
5. Enter Fall Time - 0
6. Enter Pulse Width - 10m
7. Enter Period - 20m

Following are the Pulse input parameters for V4:

1. Enter Initial Value - 0
2. Enter Pulsed Value - 5
3. Enter Delay Time - 0
4. Enter Rise Time - 0
5. Enter Fall Time - 0
6. Enter Pulse Width - 5m
7. Enter Period - 10m

Schematic Diagram:

The circuit schematic of binary to gray in eSim is as shown below:

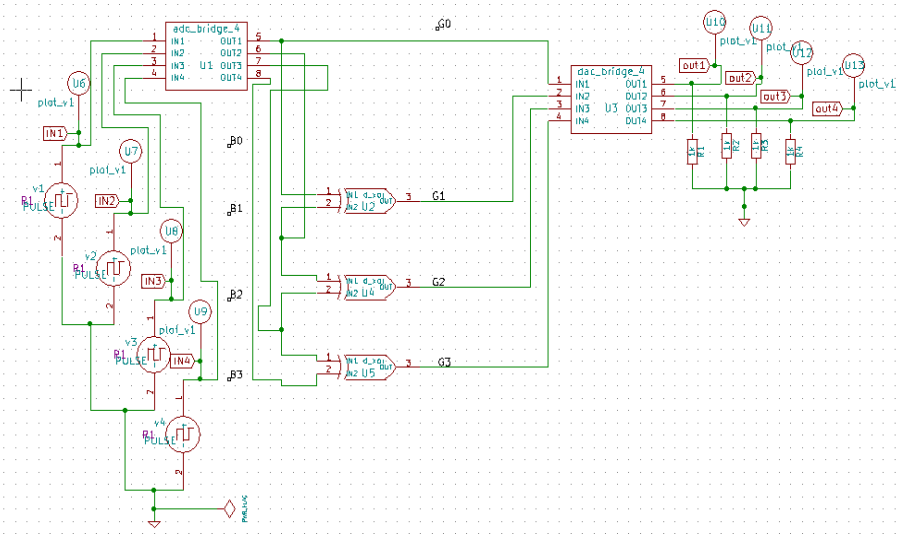

Figure 1: Binary to Gray Converter

Simulation Results:

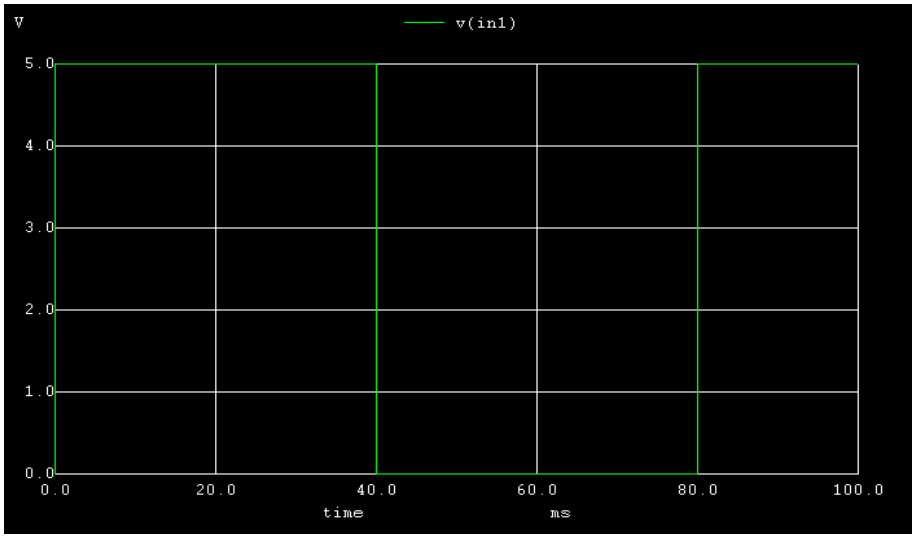

Figure 2: Ngspice Input-1 Plot

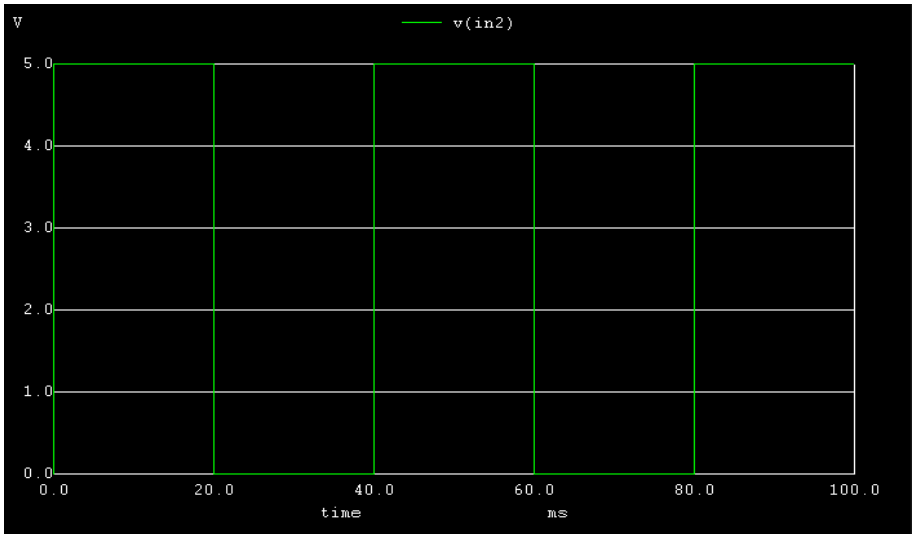

Figure 3: Ngspice Input-2 Plot

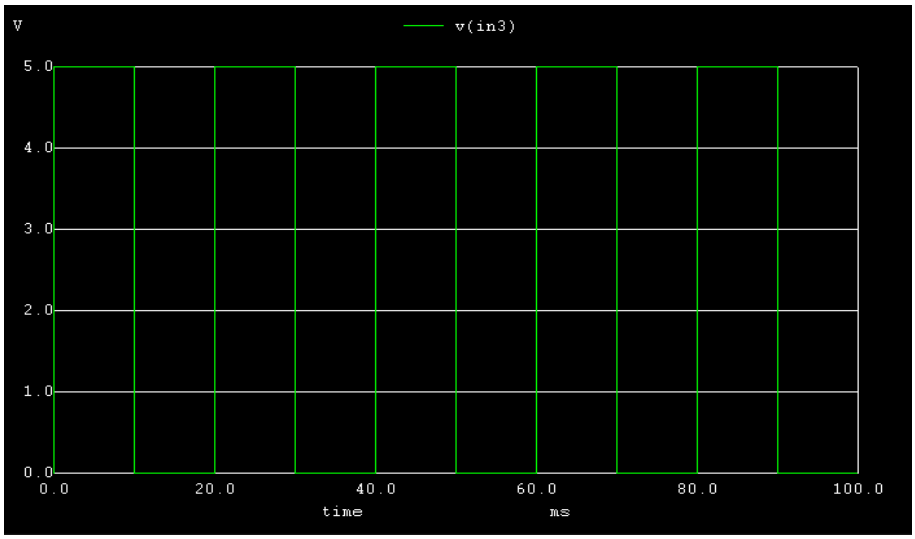

Figure 4: Ngspice Input-3 Plot

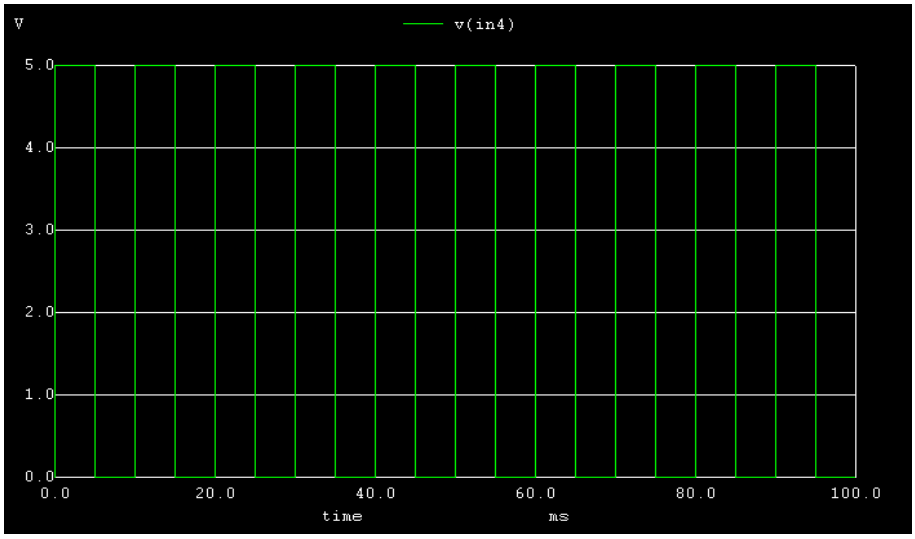

Figure 5: Ngspice Input-4 Plot

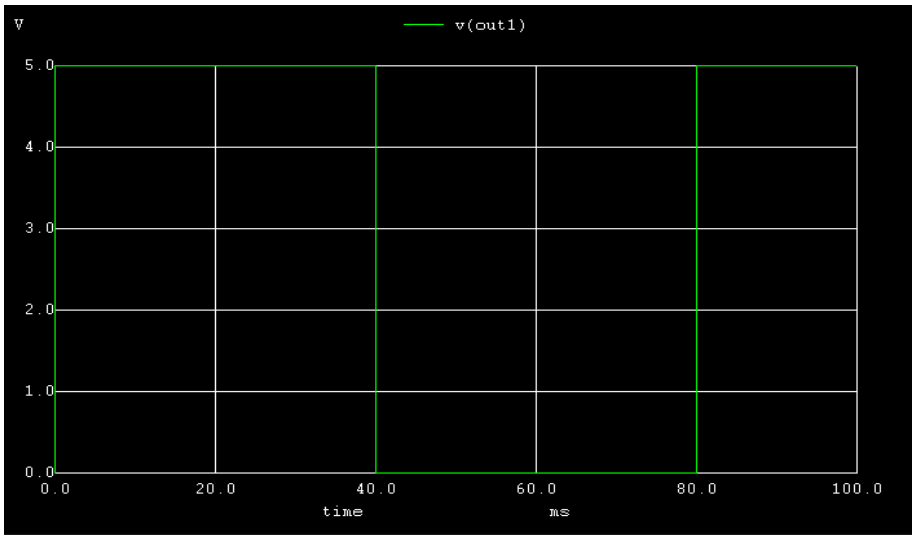

Figure 6: Ngspice Output-1 Plot

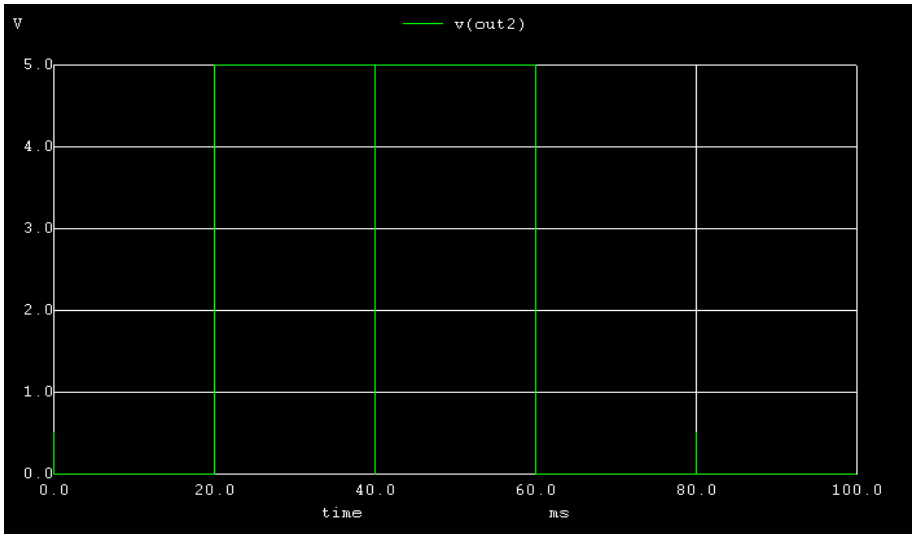

Figure 7: Ngspice Output-2 Plot

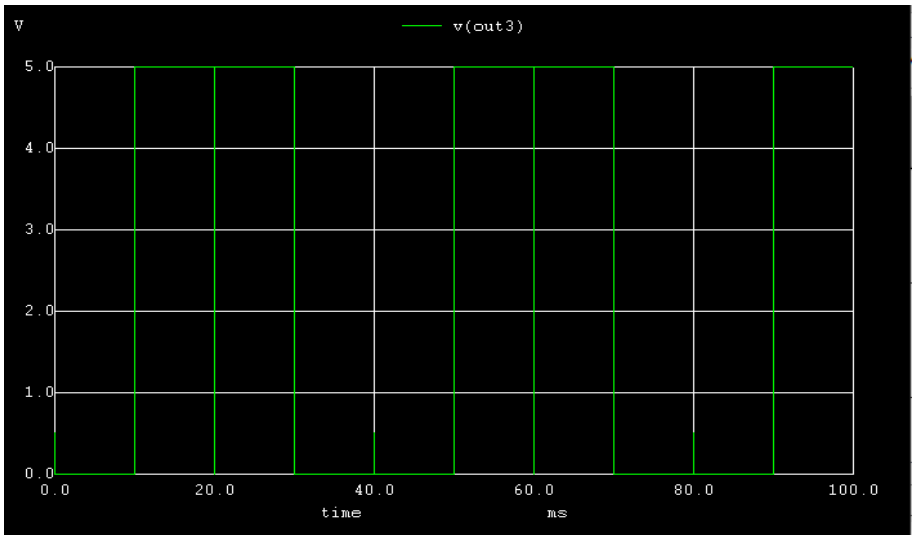

Figure 8: Ngspice Output-3 Plot

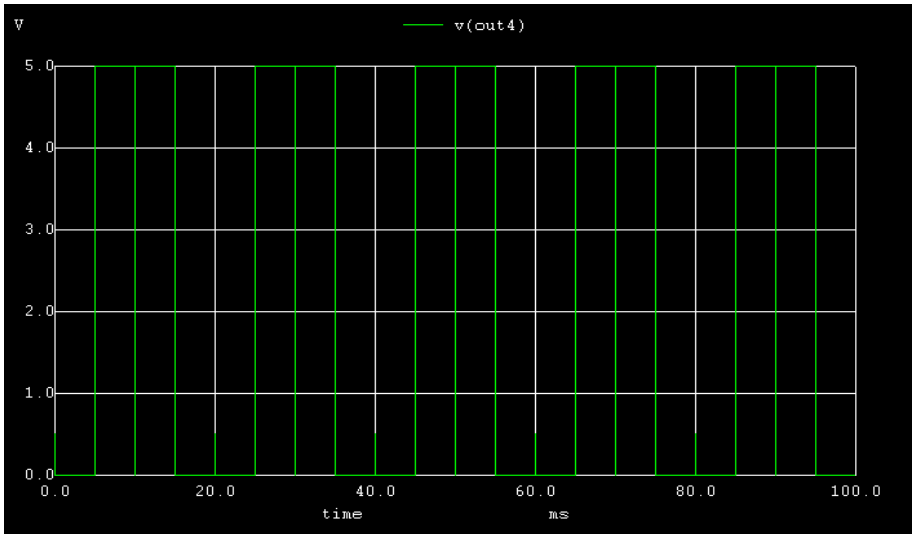

Figure 9: Ngspice Output-4 Plot

Conclusion:

Thus, we have studied the binary to gray converter using eSim and we get the appropriate waveforms.

References:

http://www.electrical4u.com/gray-code-binary-to-gray-code-and-that-to-binary-conversion/