Lab 1

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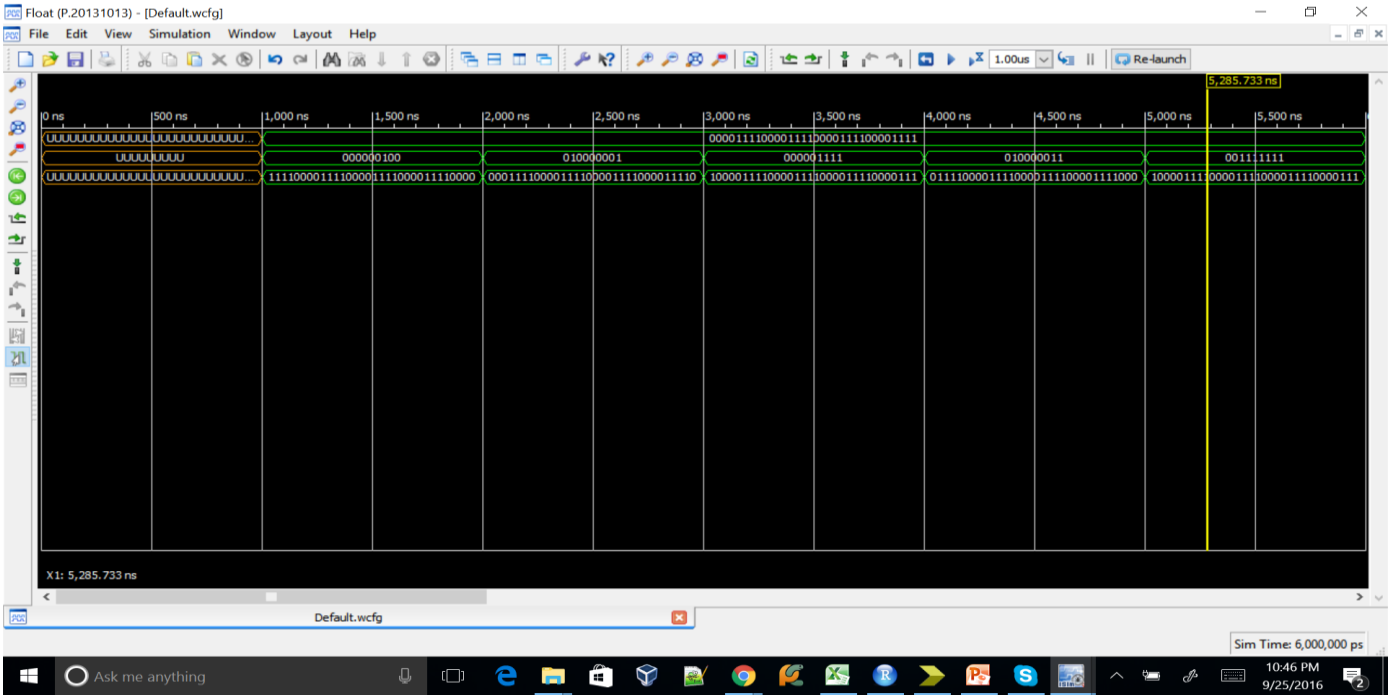
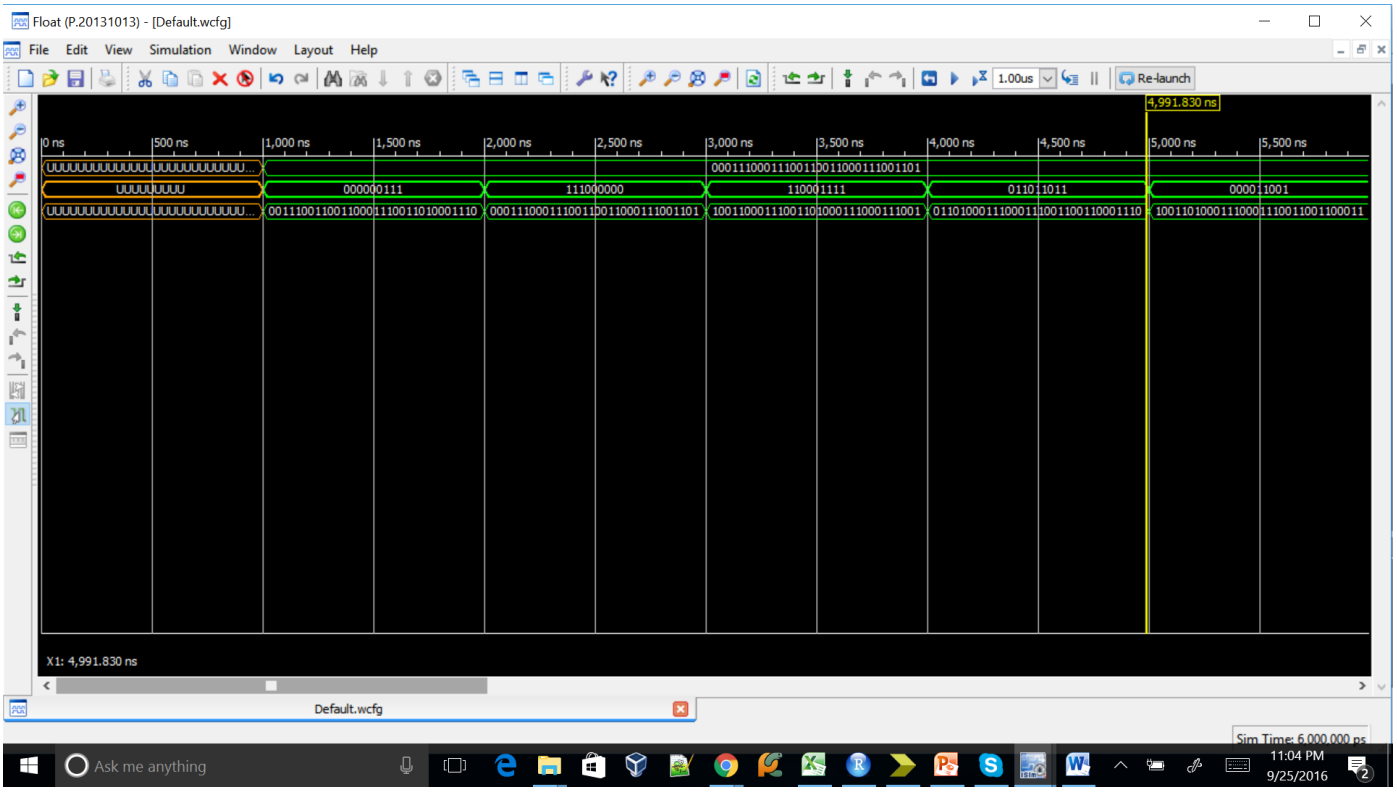
Below are the screenshots of the simulations:

1) **Circular Left Rotate:**





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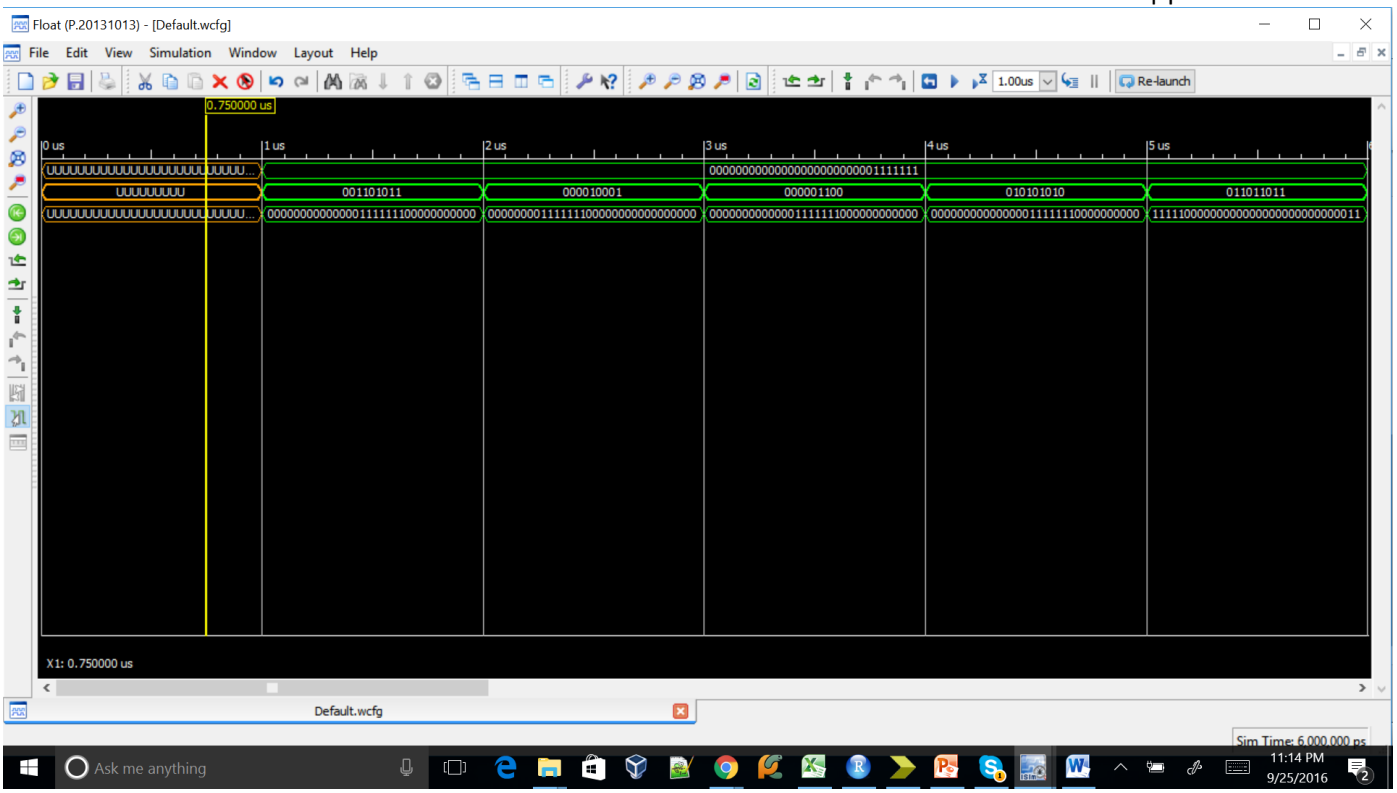

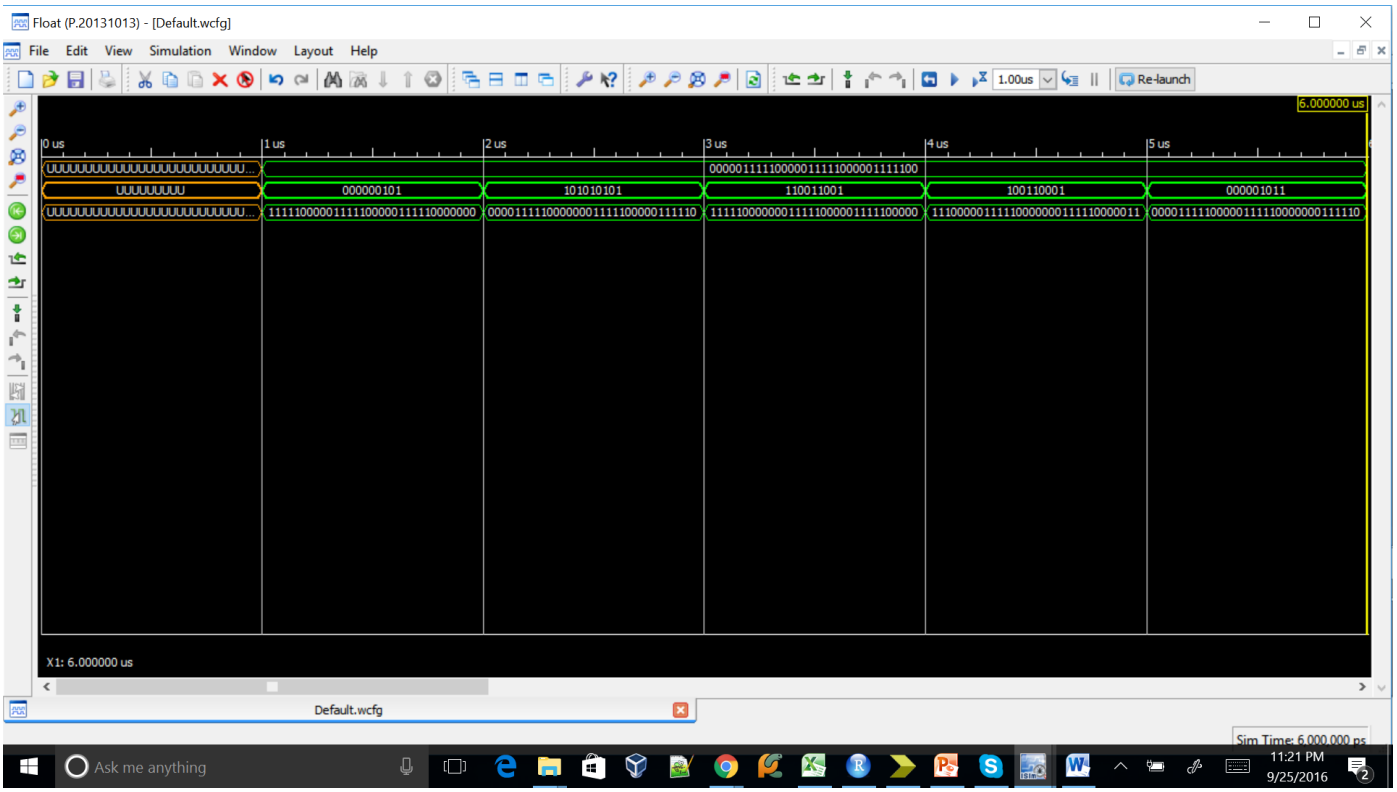

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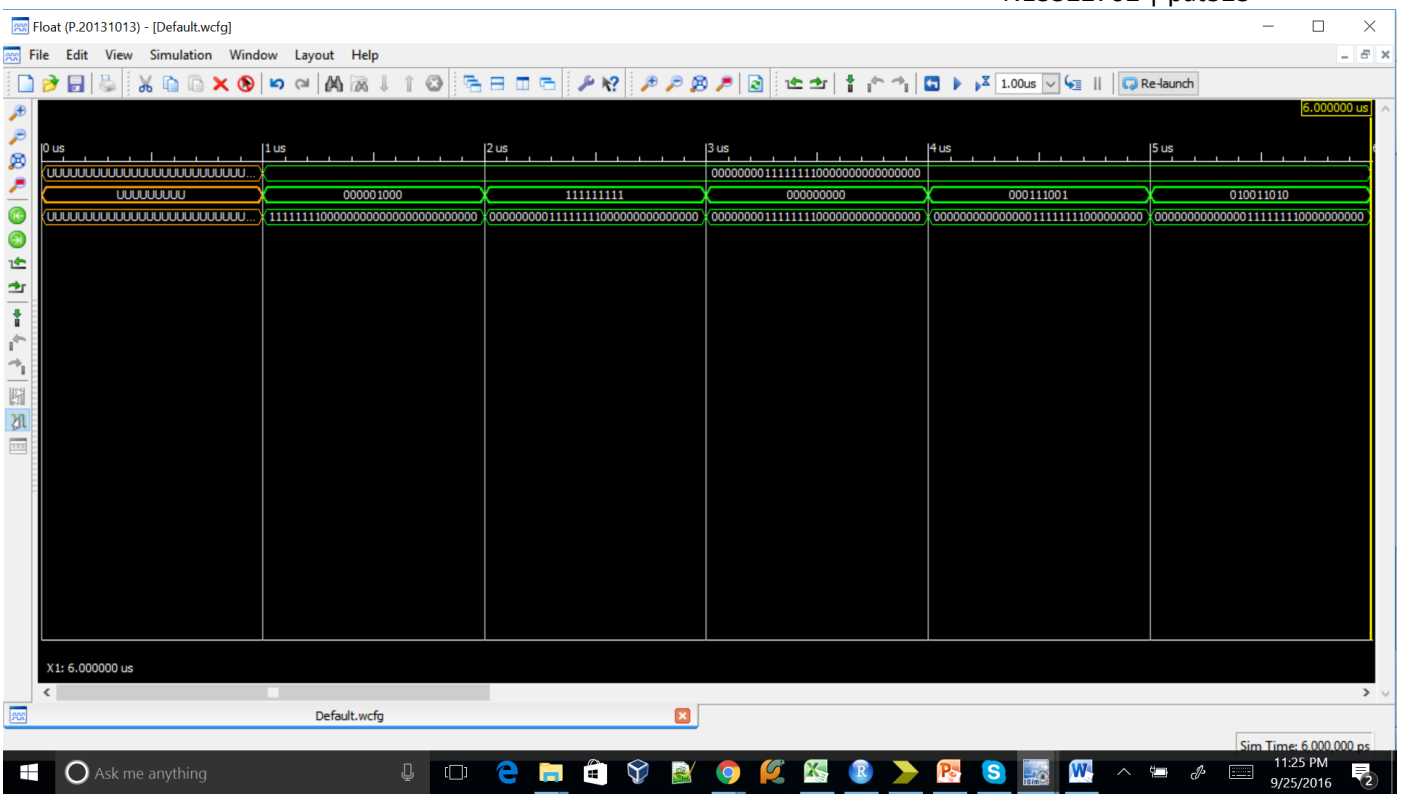

Screenshot of timing simulation:

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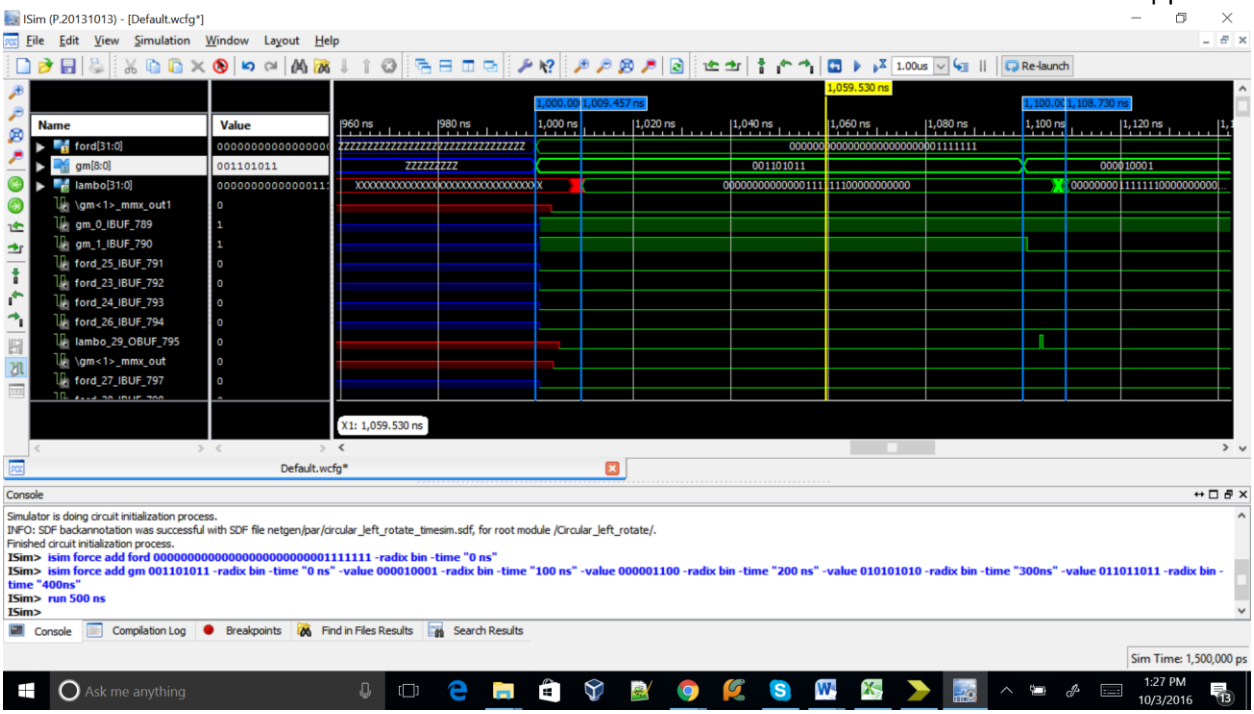
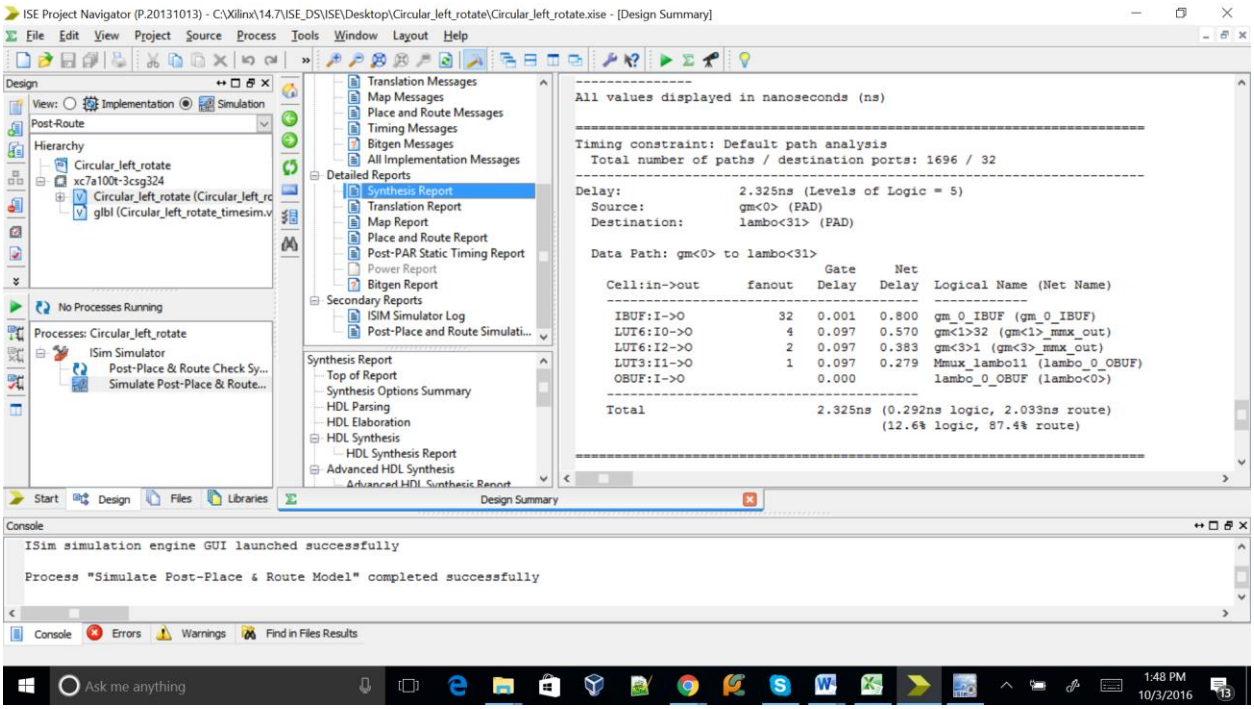


The propagation delay is approximately 9.457 ns as observed in the above screenshot.

This also verifies the design output with the hand design output.



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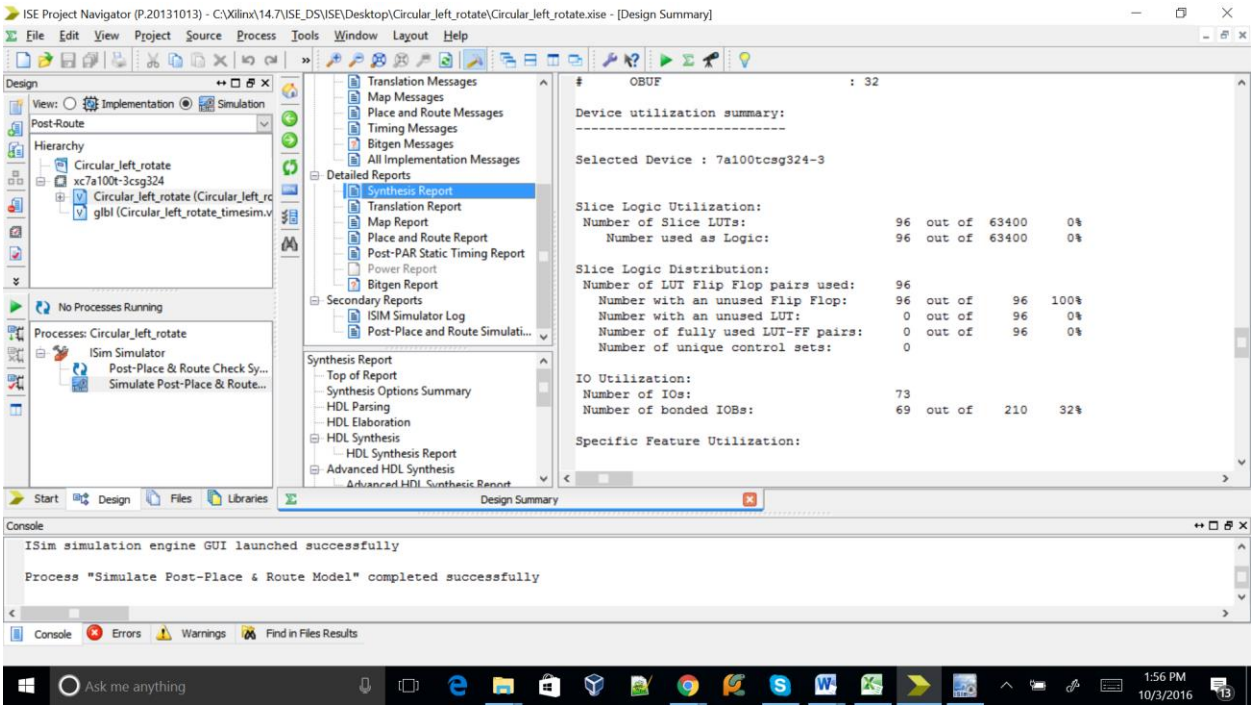
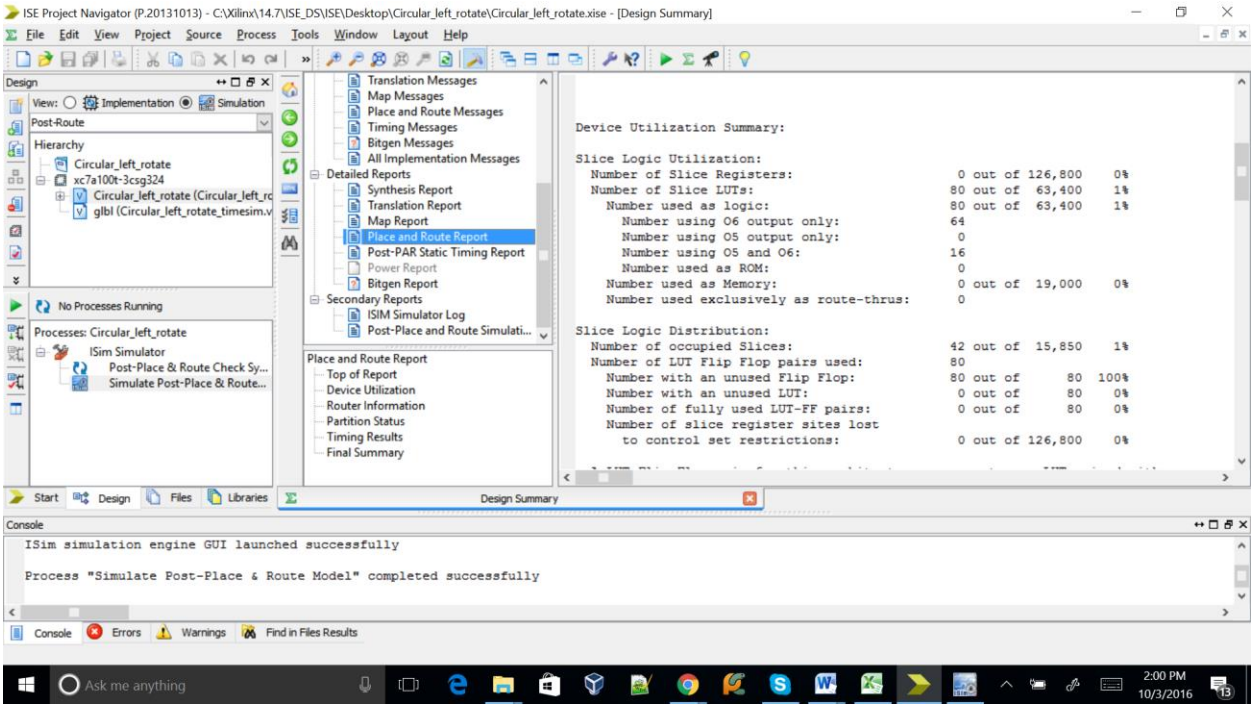
The delay of the circuit is 2.325 ns. The circuit can run at 1/2.325 ns i.e. 430MHZ.The screenshot above verifies that.





In the post route the circuit is simulated for the software program and hence only the required LUTs and flip flops are used. Thus the LUTs and Flip Flops used in post route phase are less than the one's shown in the synthesis report.

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Below is the block diagram for Circular Left Rotate

There are 32 inputs from I_0 to I_{31}. And there are 32, 32:1 multiplexers with 5 select lines and 32 data inputs and one select output. The select lines are actually the number of circular left rotate that has to be performed on input. Let us see the connections for Multiplexer 31 in the figure.

The input line I_{31} is connected to the 0 input in the multiplexer 31. So when the number of rotation is 0 the input line I_{31} is selected as output for multiplexer 31. If the input is rotated left by 1 bit then the input line I_{30} will be the output of multiplexer 31. So input line I_{30} is connected to 1 input in the multiplexer 31. So when the number of rotation is 1 the input line I_{30} is selected as output for multiplexer 31. Similarly it is for remaining inputs and the remaining 31 multiplexers.

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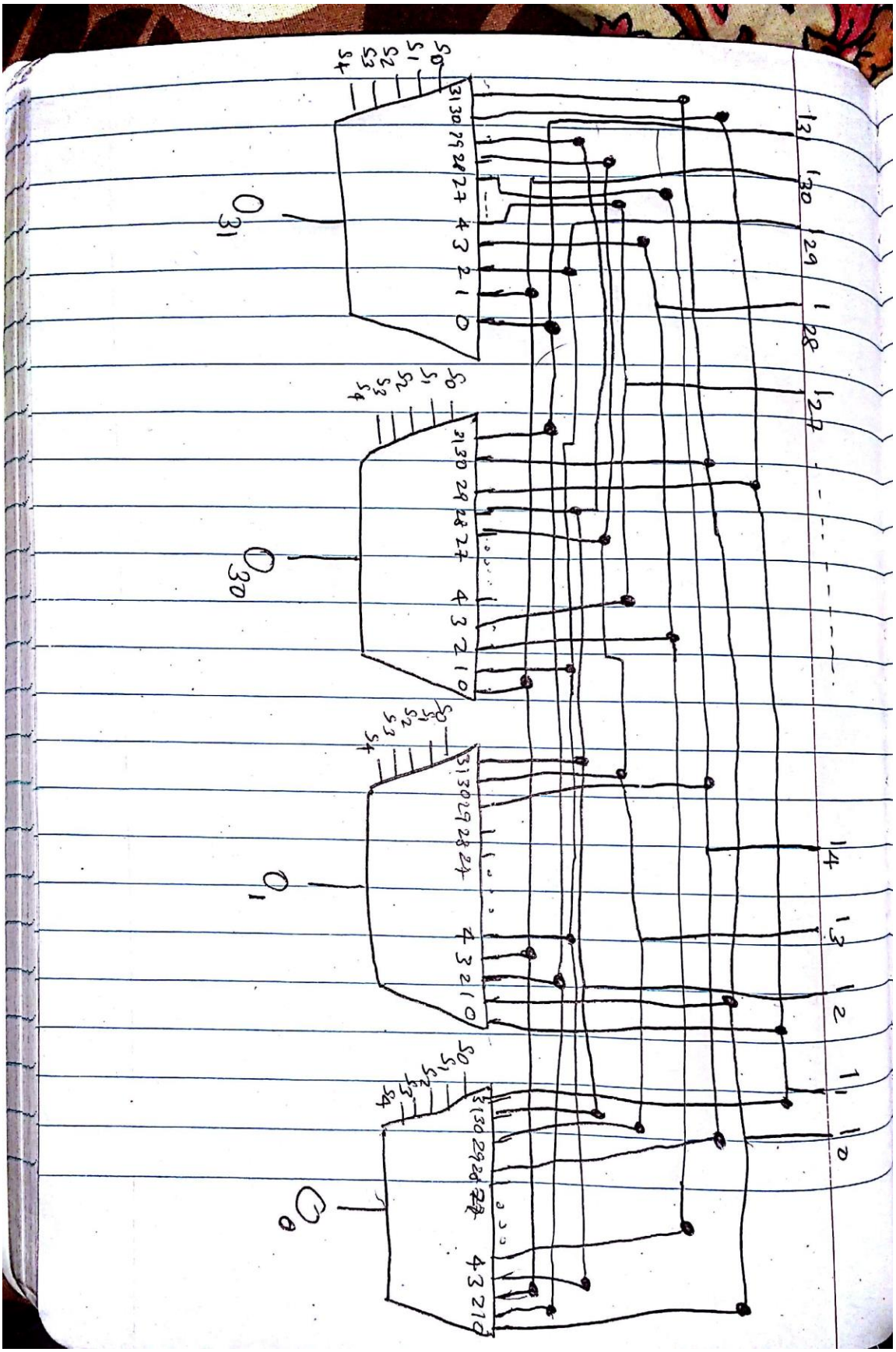

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Hand Calculations for Circular Left Rotate:

Variable representing 32 bit Input is “ford”.

Variable representing the number of rotations is “Gm”.

Variable representing 32 bit output is “lambo”.

Example:

Ford = 00000000000000000000000001111111

Gm = 001101011

Lambo = 00000000000000111111100000000000

In the above example the number of left rotation is 107 which is greater than 32. In this case we calculate the mod of the number with 32. 107 mod 32 is 11. Hence the input will be rotated 11 times to its left and we get the output.

Ford = 00000000000000000000000001111111

Gm = 000010001

Lambo = 00000000111111100000000000000000

In the above example the number of left rotation is 17. Hence the input will be rotated 17 times to its left and we get the output.

Ford = 00000000000000000000000001111111

Gm = 000001100

Lambo = 00000000000001111111000000000000

In the above example the number of left rotation is 12. Hence the input will be rotated 12 times to its left and we get the output.

Ford = 00000000000000000000000001111111

Gm = 010101010

Lambo = 00000000000000011111110000000000

In the above example the number of left rotation is 170 which is greater than 32. In this case we calculate the mod of the number with 32. 170 mod 32 is 10. Hence the input will be rotated 10 times to its left and we get the output.

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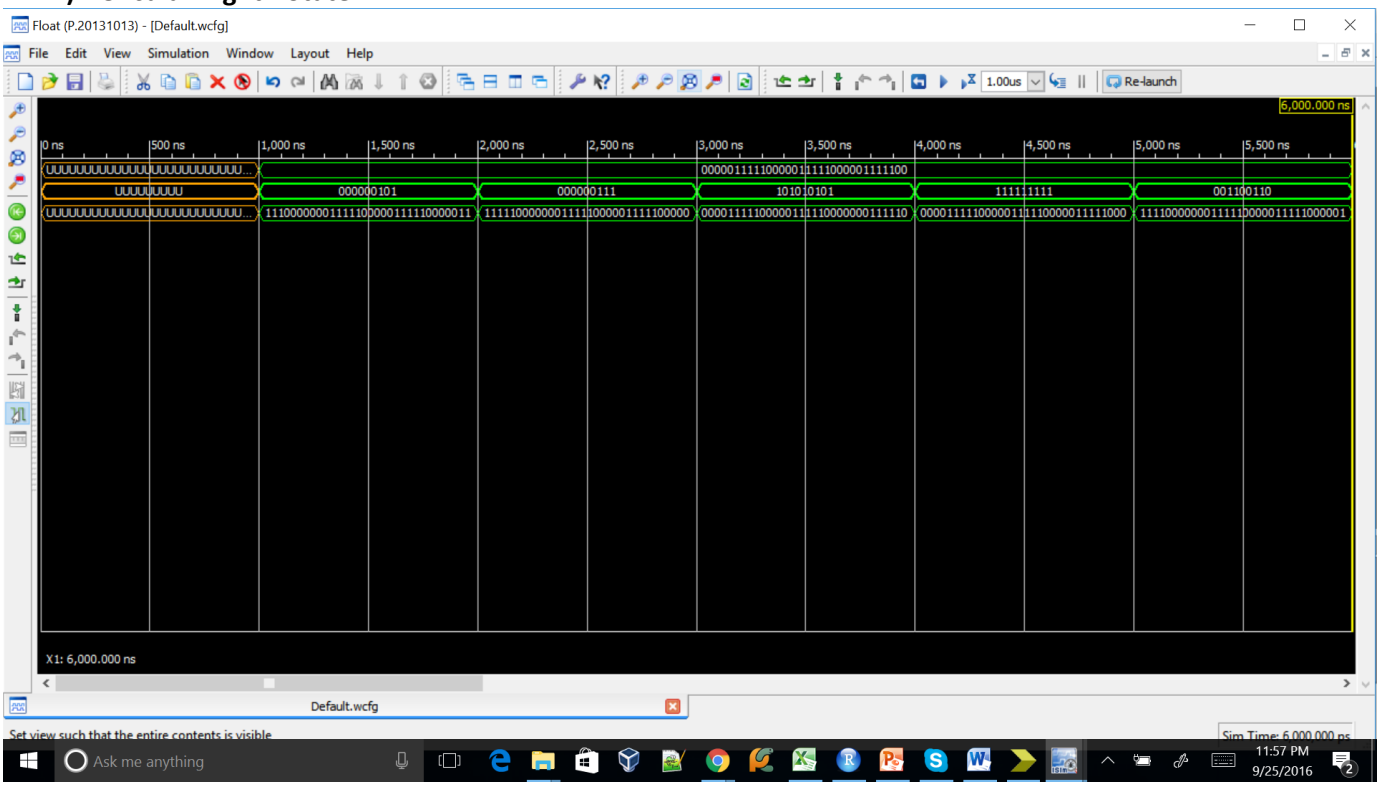
Ford = 00000000000000000000000001111111

Gm = 011011011

Lambo = 11111000000000000000000000000011

In the above example the number of left rotation is 219 which is greater than 32. In this case we calculate the mod of the number with 32. 219 mod 32 is 27. Hence the input will be rotated 27 times to its left and we get the output.

2) Circular Right Rotate:



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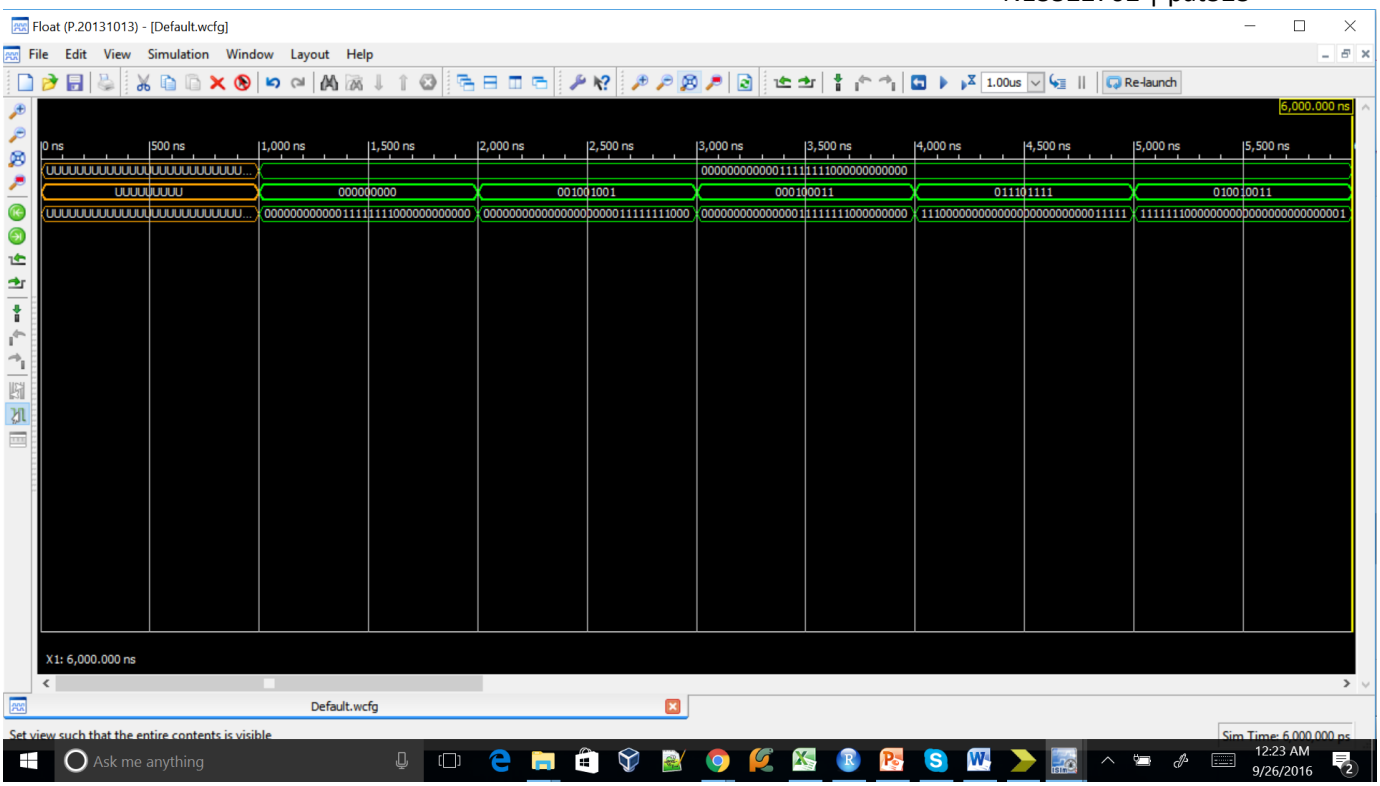

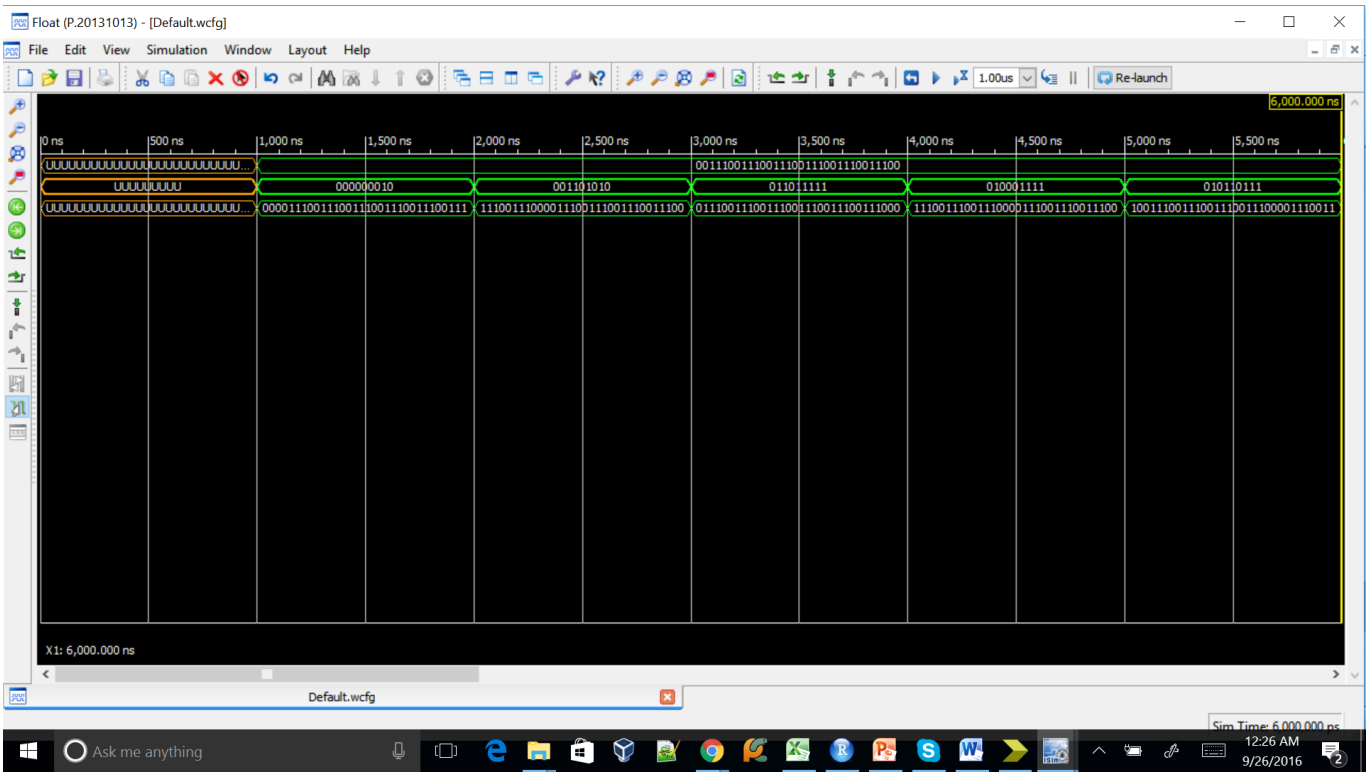

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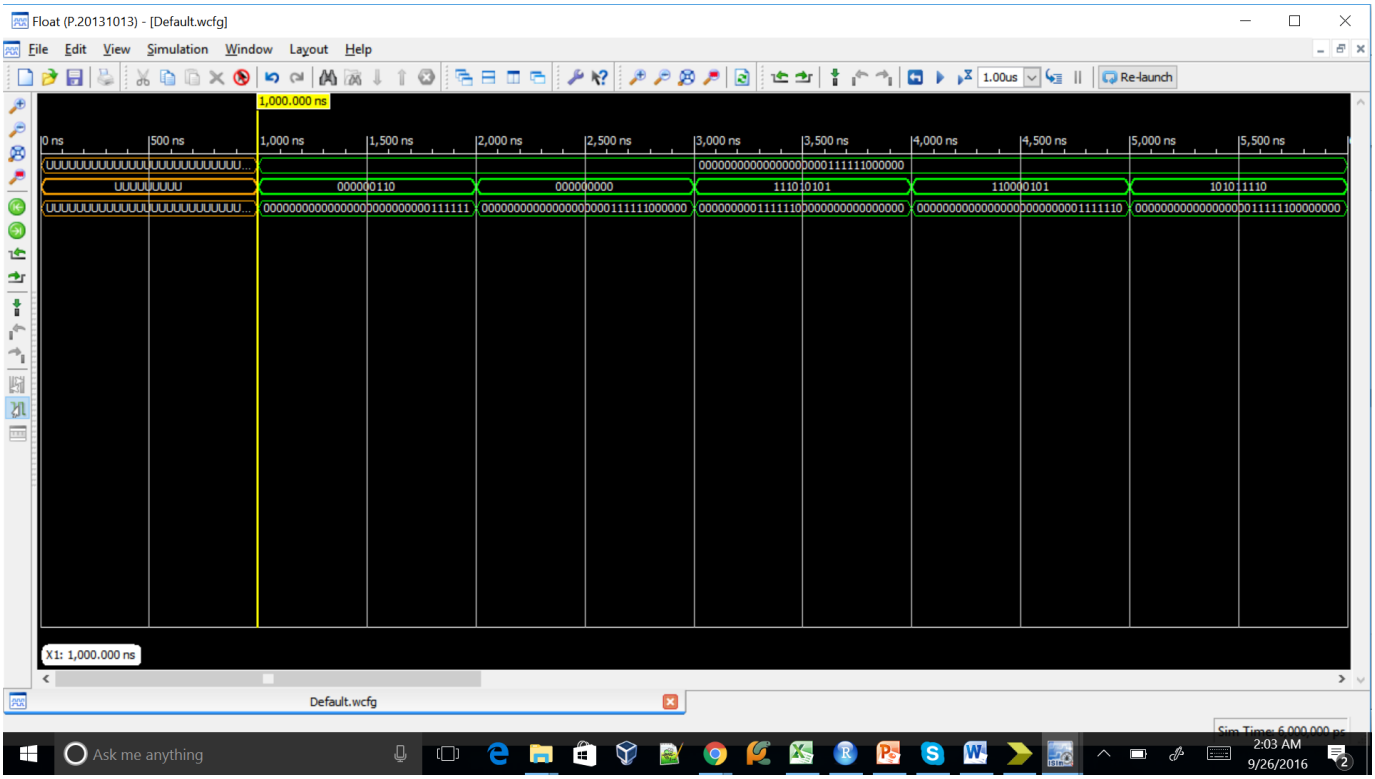

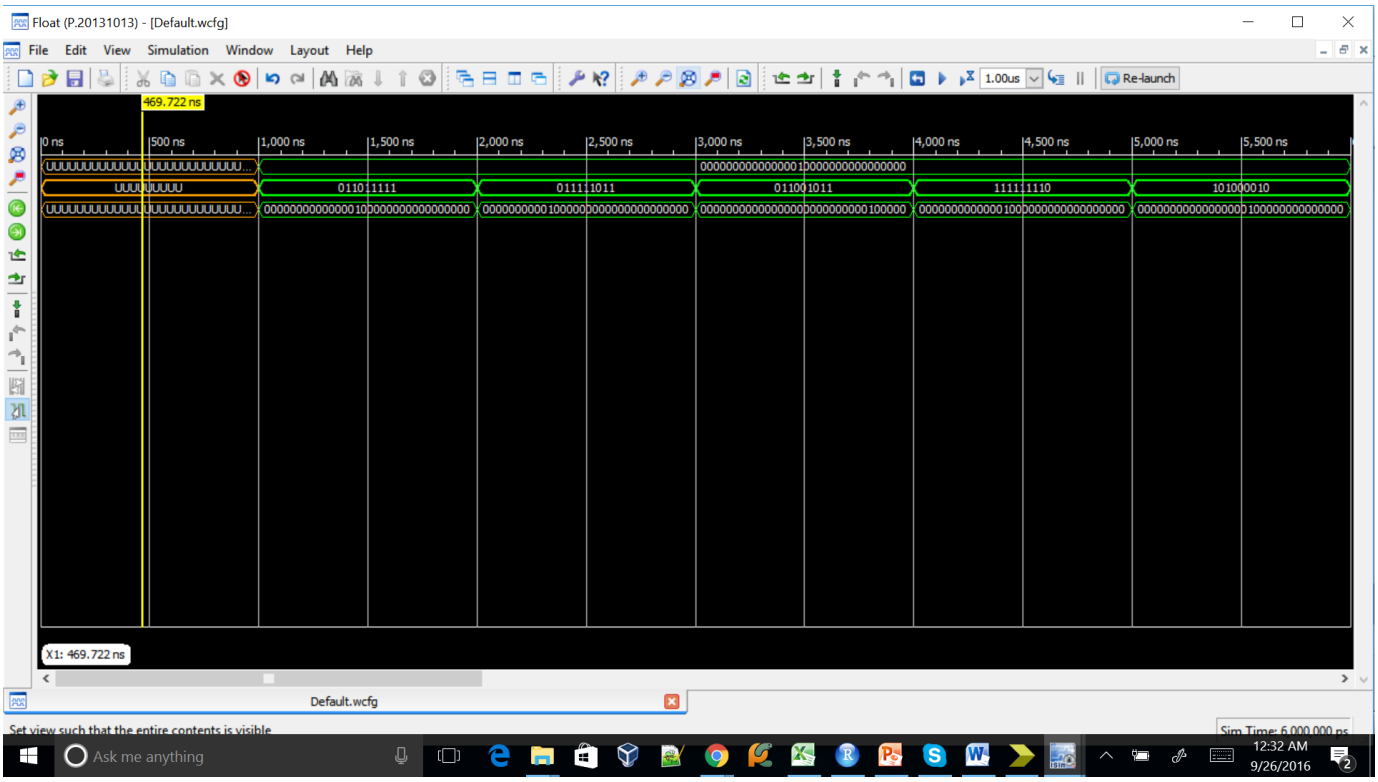

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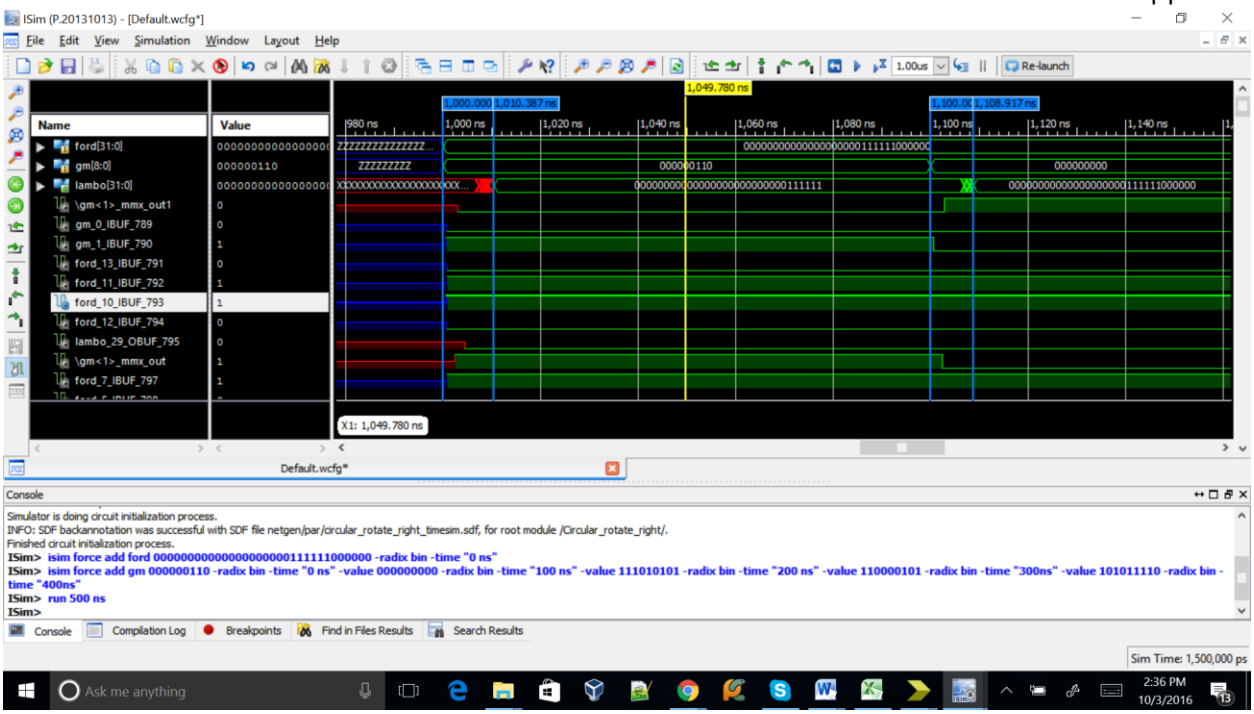
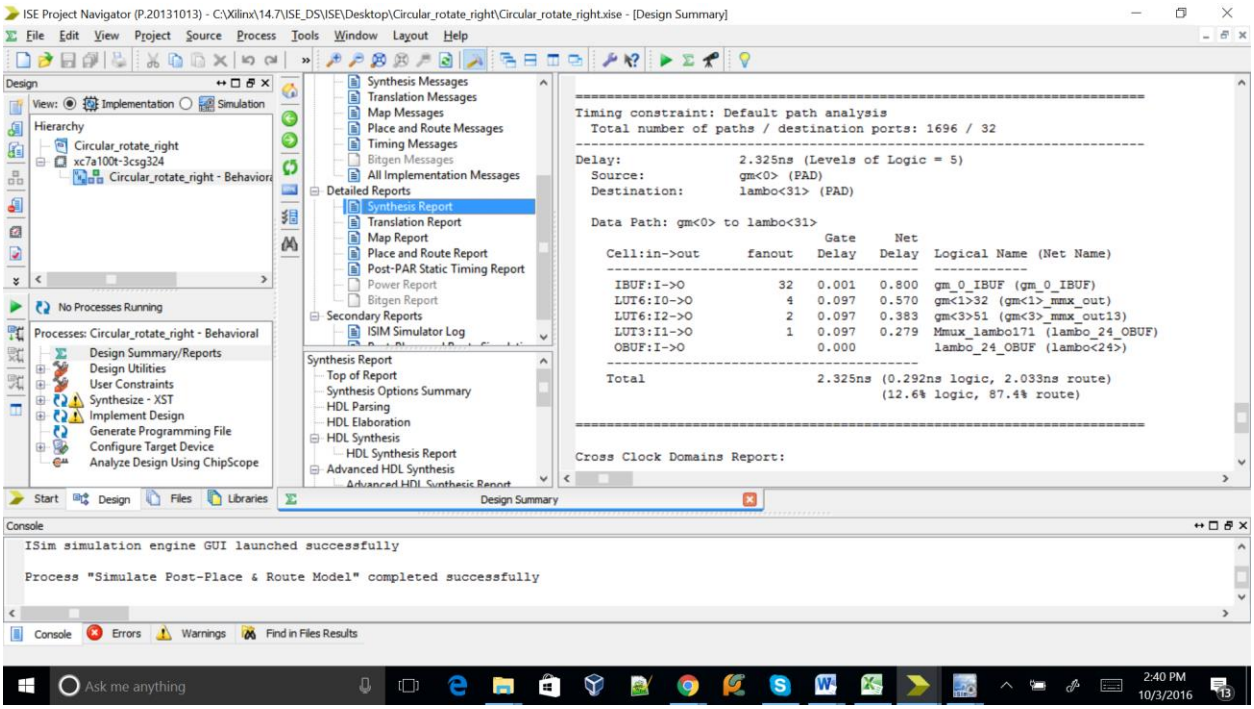


The propagation delay is approximately 10.38 ns as observed in the above screenshot.

This also verifies the design output with the hand design output.



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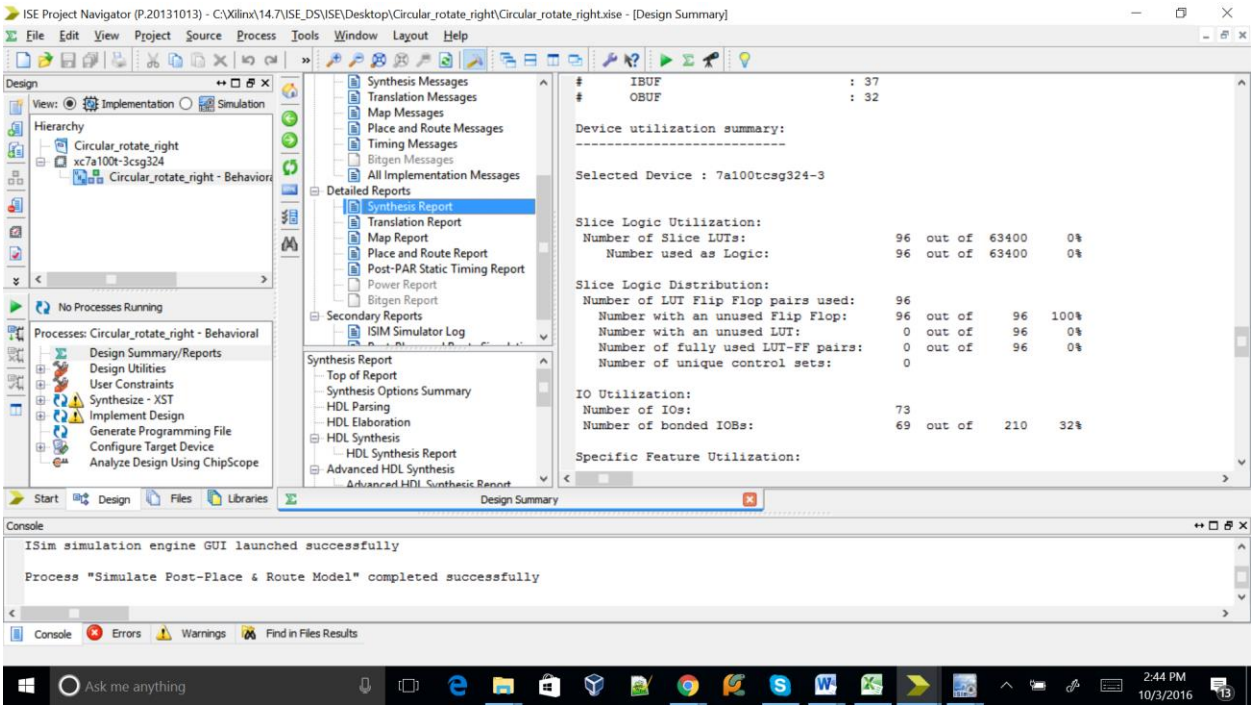
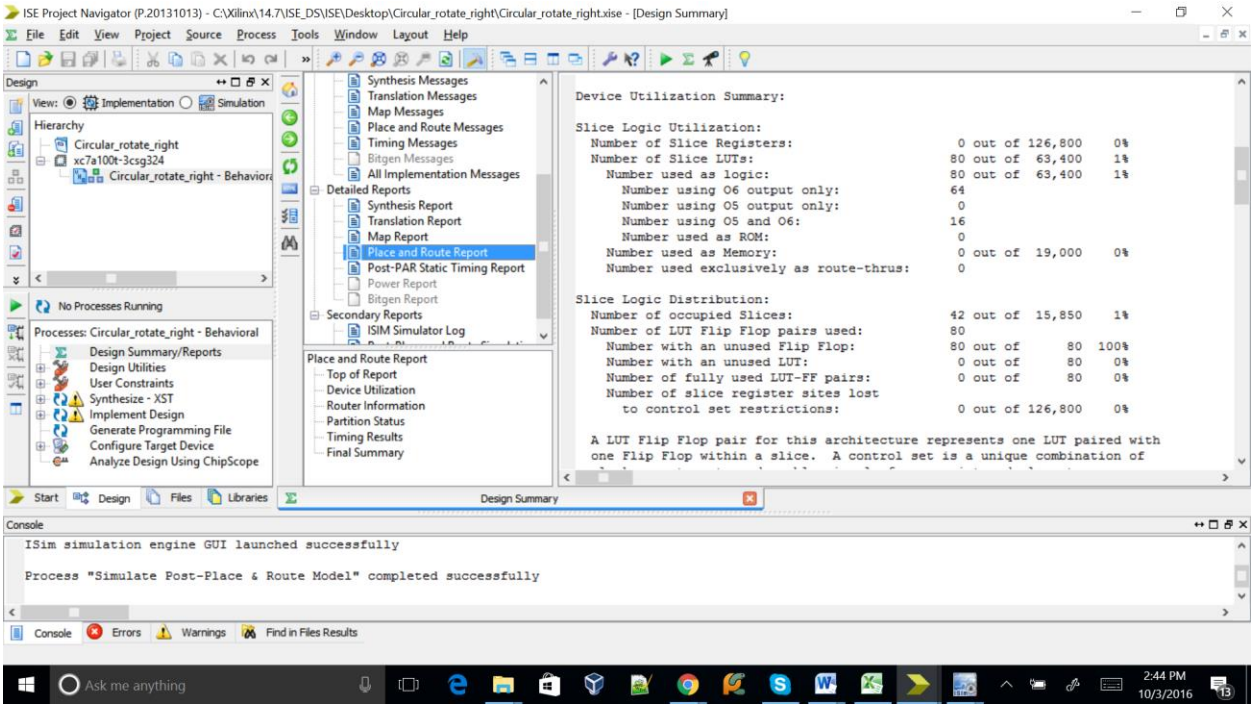
The delay of the circuit is 2.325 ns. The circuit can run at 1/2.325 ns i.e. 430MHZ.The screenshot above verifies that.





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The input line I_{31} is connected to the 0 input in the multiplexer 31. So when the number of rotation is 0 the input line I_{31} is selected as output for multiplexer 31. If the input is rotated right by 1 bit then the input line I_0 will be the output of multiplexer 31. So input line I_0 is connected to 1 input in the multiplexer 31. So when the number of rotation is 1 the input line I_0 is selected as output for multiplexer 31. Similarly it is for remaining inputs and the remaining 31 multiplexers.

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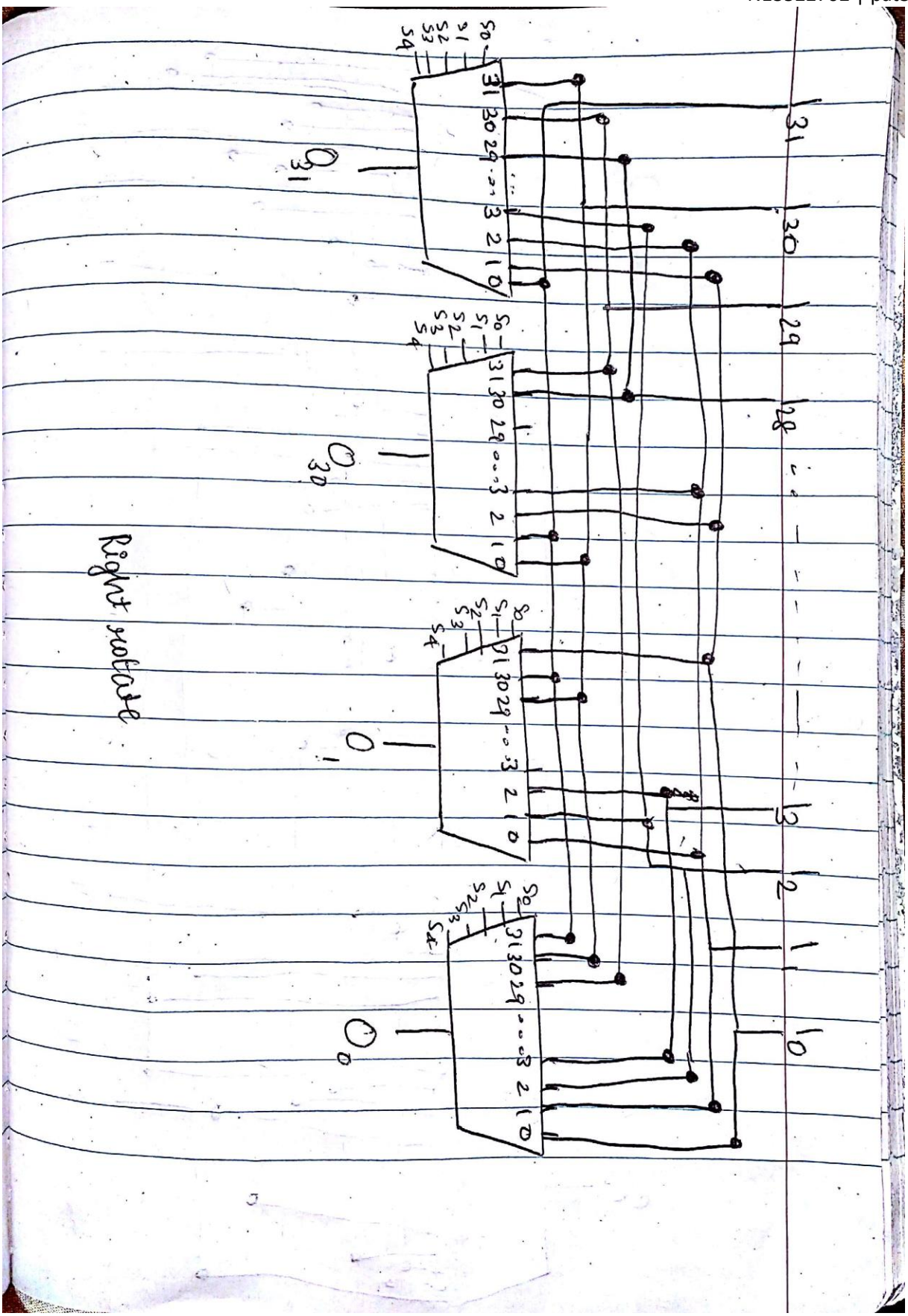

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Hand Calculations for Circular Right Rotate:

Variable representing 32 bit Input is “ford”.

Variable representing the number of rotations is “Gm”.

Variable representing 32 bit output is “lambo”.

Example:

Ford = 00000000000000000000111111000000

Gm = 000000110

Lambo = 00000000000000000000000000111111

In the above example the number of right rotation is 6. Hence the input will be rotated 6 times to its left and we get the output.

Ford = 00000000000000000000111111000000

Gm = 000000000

Lambo = = 00000000000000000000111111000000

In the above example we right rotate the input by 0. Hence there is no change in the output. That means the output is same as input.

Ford = 00000000000000000000111111000000

Gm = 111010101

Lambo = 00000000011111100000000000000000

In the above example the number of right rotation is 469 which is greater than 32. In this case we calculate the mod of the number with 32. 469 mod 32 is 21. Hence the input will be rotated 21 times to its right and we get the output.

Ford = 00000000000000000000111111000000

Gm = 110000101

Lambo = 00000000000000000000000001111110

In the above example the number of right rotation is 389 which is greater than 32. In this case we calculate the mod of the number with 32. 389 mod 32 is 5. Hence the input will be rotated 5 times to its right and we get the output.

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Ford = 00000000000000000000111111000000

Gm = 101011110

Lambo = 00000000000000000011111100000000

In the above example the number of right rotation is 350 which is greater than 32. In this case we calculate the mod of the number with 32. 350 mod 32 is 30. Hence the input will be rotated 30 times to its right and we get the output.

LINK OF THE YOUTUBE VIDEO:

https://youtu.be/PDJ2HI2ZMjU

What are glitches? Where do they come from in your circuit?

A glitch is nothing but a short lived fault in the circuit. It is basically a short lived signal generated because of fault or design error in the digital circuit.

Glitches are normally caused due to inequalities in the path length of the circuit. Since the path lengths are not same between the gates glitches are caused.