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**EE 477**

Revision History

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| Date | Version | List of changes | Author + Signature |
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C A T A L O G

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[2 Part 1: Multiplier 2](#_Toc99580878)

# Motivation

[Motivation](https://blackboard.usc.edu/webapps/blackboard/content/listContent.jsp?course_id=_294497_1&content_id=_8570577_1)

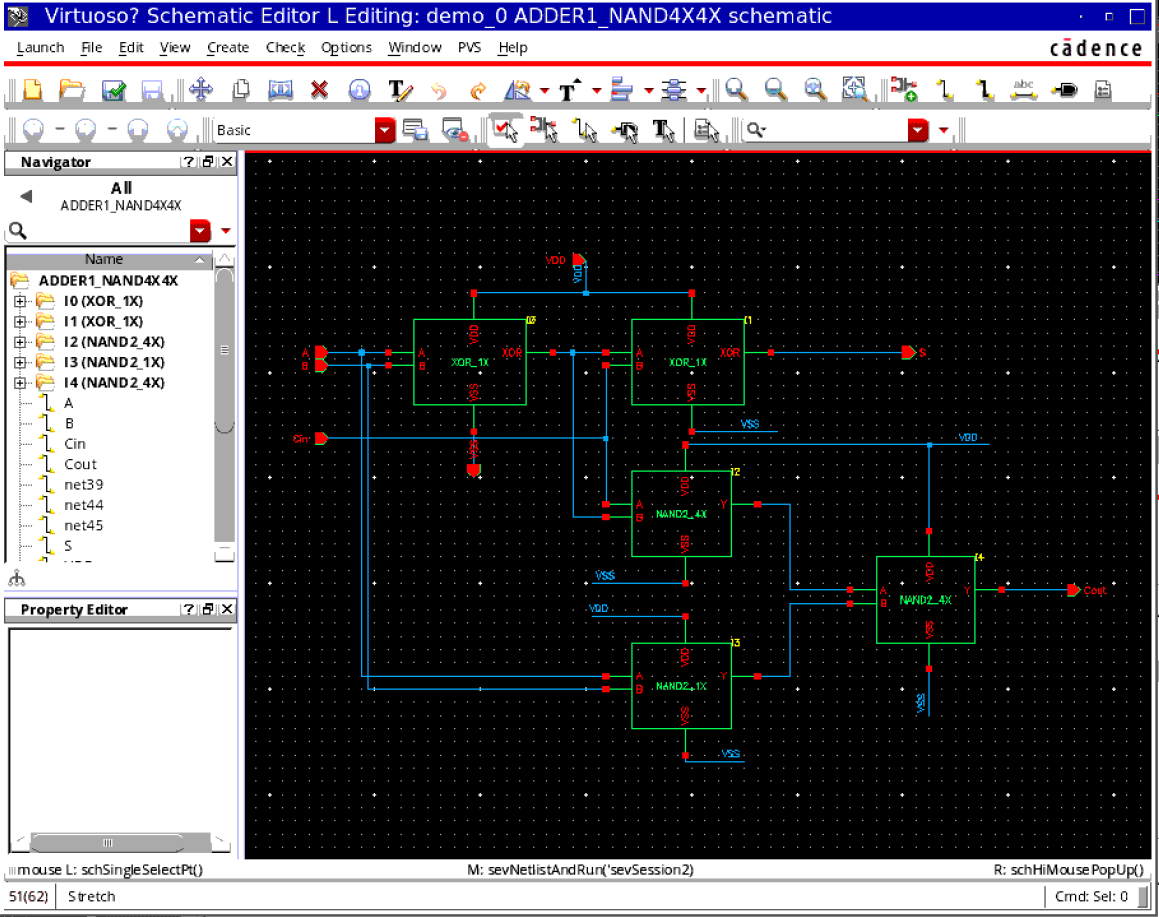
Multipliers and dividers are common arithmetic operations performed using the basic units adder and subtractor. For the final project, you will design a multiplier and divider to operate on 4-bit inputs.

# Part 1: Multiplier

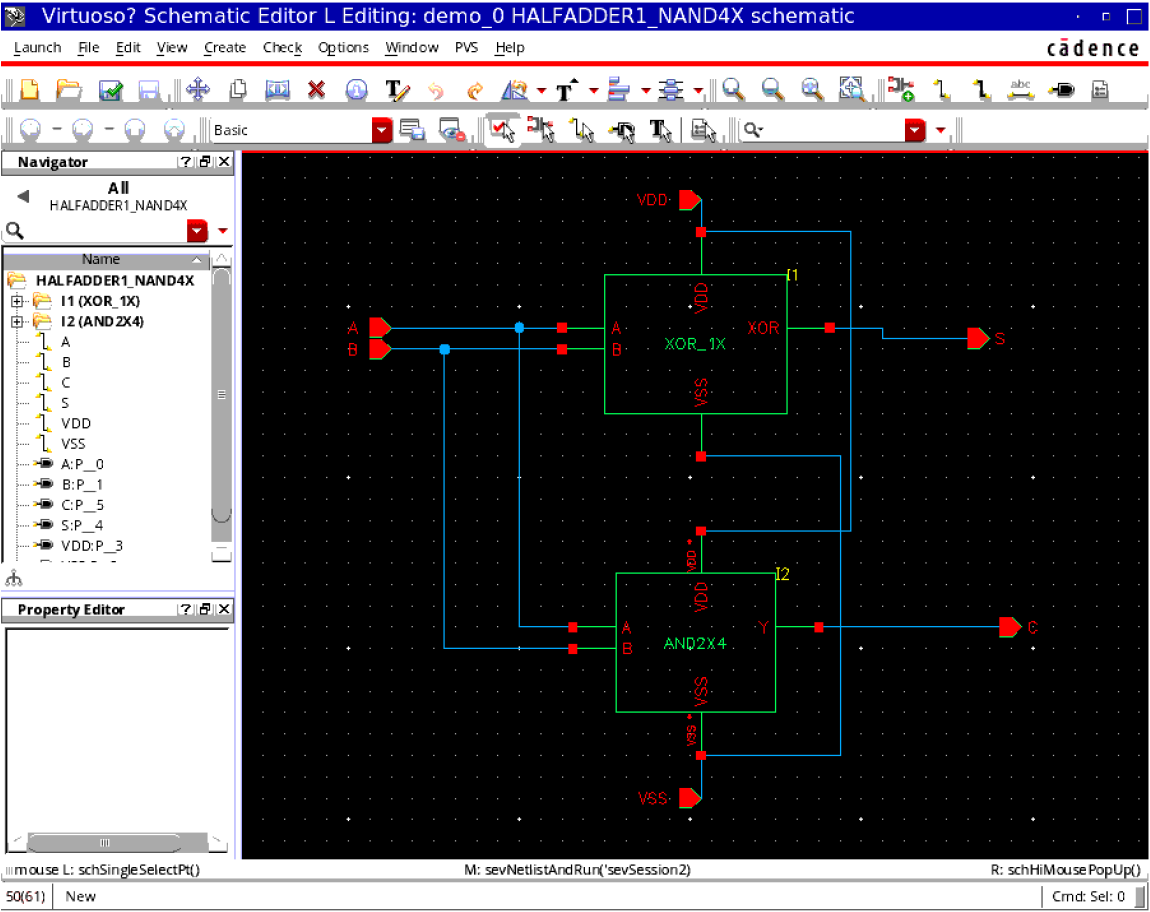
**Notes**:

Input A = {a3a2a1a0}, Input B = {b3b2b1b0}, Output product Z = {z7z6z5z4z3z2z1z0}

FA = Single bit Full Adder,



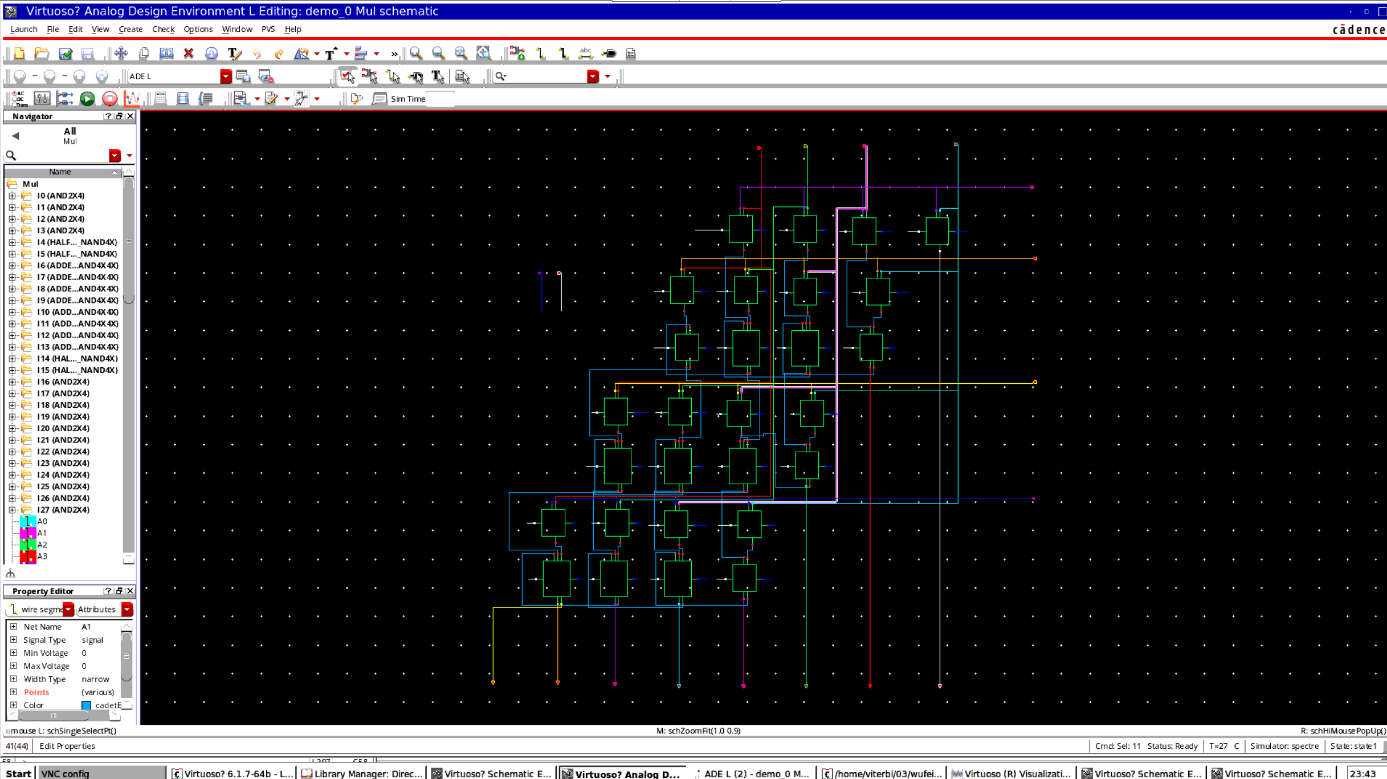
HA = Single bit Half Adder



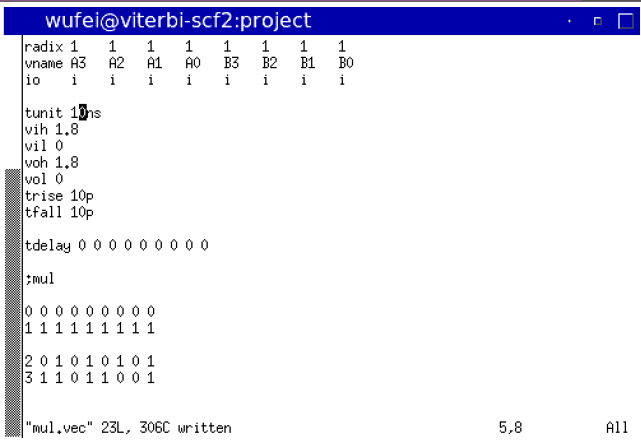
All blue-colored logic gates are 2-input AND

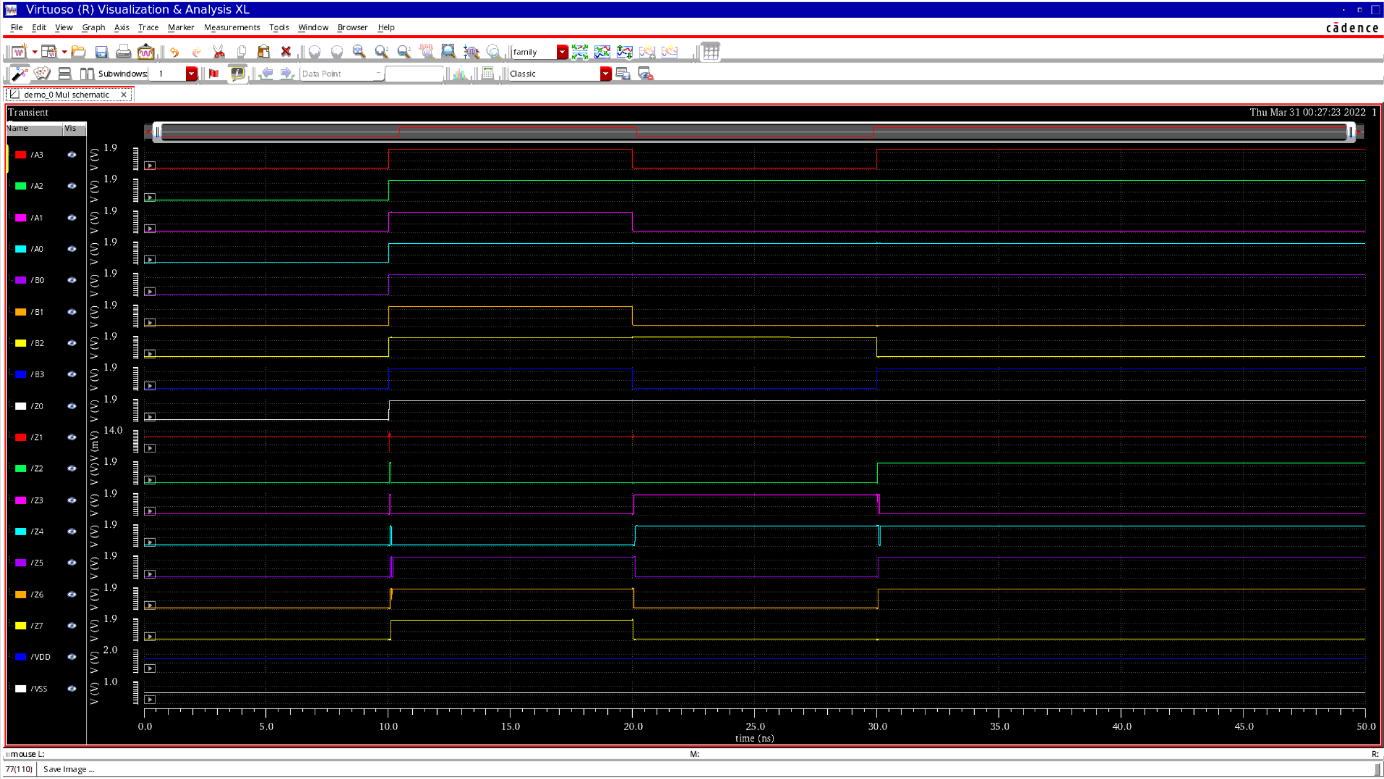
**Procedure**:

Design the schematic for the 4x4 multiplier as shown.



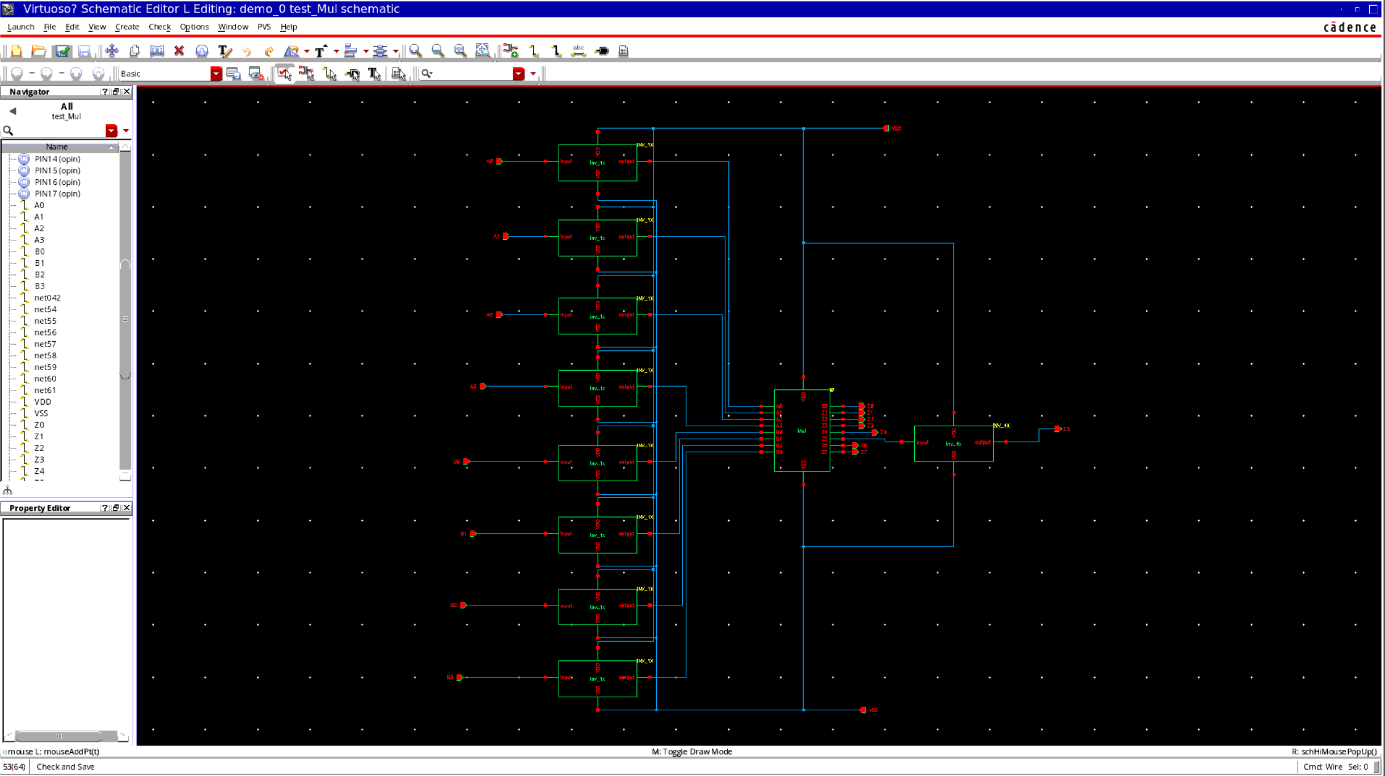
Do functionality verification using at least 3 input combinations.





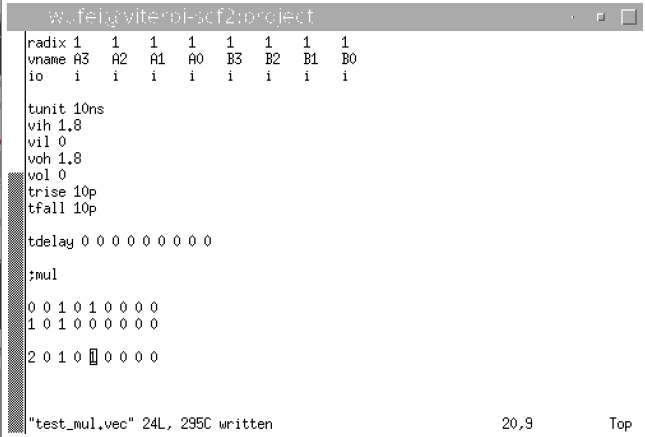
Design a delay measurement circuit where each input has inv\_1X preceding it.

Connect inv\_4X to output z5. Use this input transition:

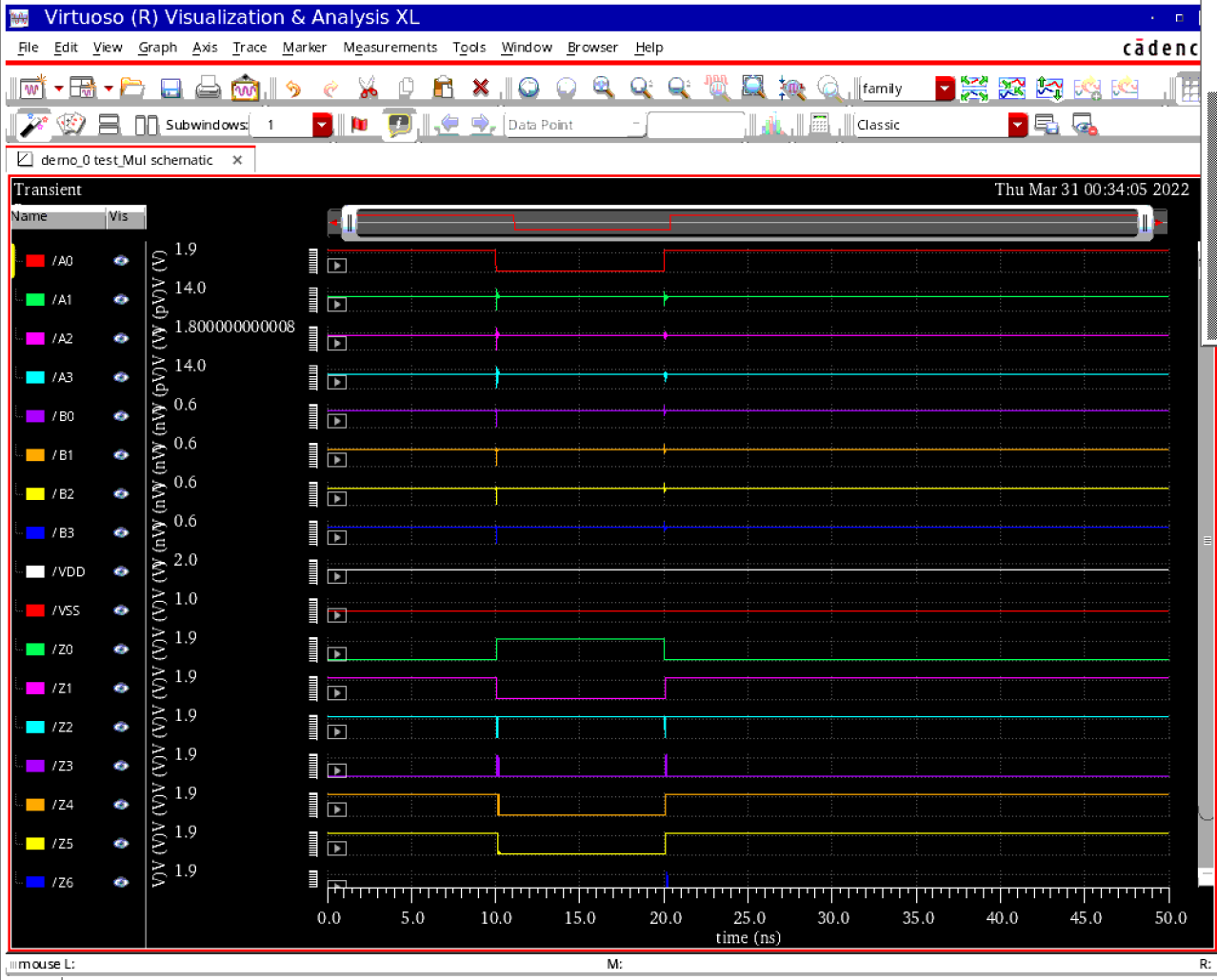


    b3,b2,b1,b0,a3,a2,a1 = 1 1 1 1 1 0 1 (fixed)

a0 goes from 0->1->0

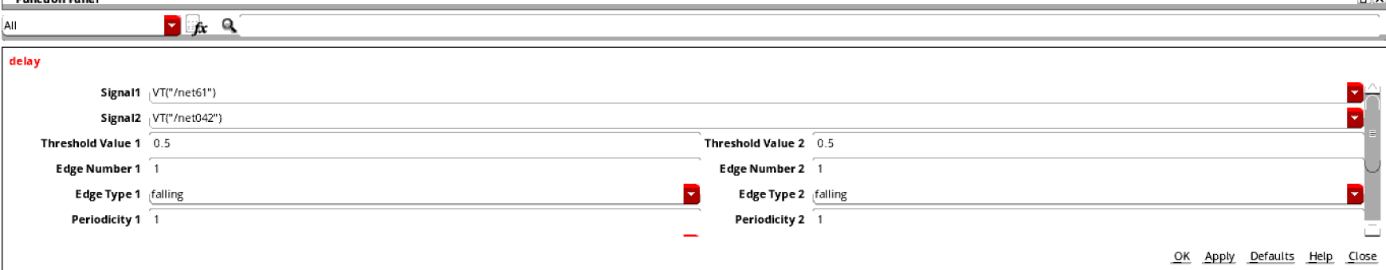


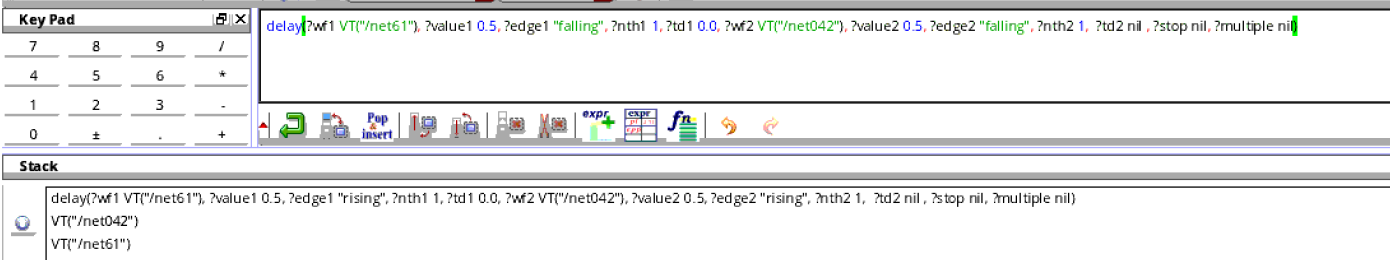
This will make z5 go from 0->1->0

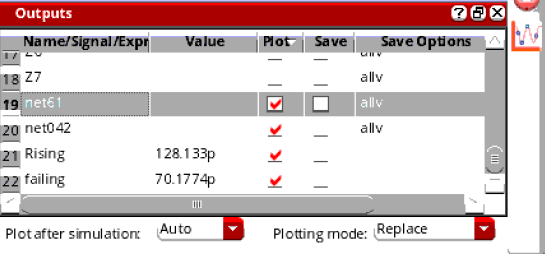




Measure the rising and falling propagation delay from a0 to z5







**Remember**: Given a and b values are inputs to the actual multiplier, so inputs to the preceding inverters should be the opposite.