

UNIVERSITY OF VIRGINIA
DIGITAL LOGIC DESIGN
STUDIO ASSIGNMENT 4

*This assignment is to be completed without any aid from anyone other than the teaching staff for this class. You may use only the class text, other materials provided to you by the teaching staff for this class, and your own class notes to complete this assignment. **You must not offer or provide aid to others taking this class. You must create your own Logisim files; you may not share Logisim files with anyone else.** Submission of any part of this assignment represents your affirmation that you have complied with these requirements.*

OBJECTIVE

This studio assignment will give you the opportunity to work with Prof. Dugan's favorite device, the MUX (multiplexer).

PROBLEM DESCRIPTION

Design and implement a 4-to-1 multiplexer (MUX). Using your 4-to-1 MUX design as a building block, design a 4-bit wide 4-to-1 MUX and a 1-bit-wide 16-to-1 MUX.

PRE-WORK

Before reporting for your scheduled lab meeting, you are required to complete the following tasks:

1. Design a combinational logic circuit to realize the 6-input 1-output 4-to-1 multiplexer. Implement your design using *Logisim*. You may use a decoder, NAND gates, NOR gates but nothing else.
2. In *Logisim*, use (multiple instantiations of) your 4-to-1 MUX (from step 1) to design a 4-bit wide 4-to-1 MUX that has 4 4-bit-wide inputs plus one 2-bit-wide input and produces one 4-bit wide output. **Label the inputs and outputs clearly and logically.** Use the subcircuit function in *Logisim* to realize your design. Refer to section 2.9 of the text to see what a reasona-

ble naming process looks like for a similar device (specifically Figure 2.69)

3. In *Logisim*, use (multiple instantiations of) your 4-to-1 MUX (from step 1) to implement a 16-to-1 MUX. Clearly label all the inputs (there are 20 of them) and the output. Note that this is different from what you did in step 2.

IN STUDIO

Bring your completed *Logisim* file and your documented design procedure to the studio to be reviewed by your studio instructor. Be prepared to answer questions about your design and make suggested changes to demonstrate understanding.

GRADE SCALE

2 points for each of the MUXes (steps 1,2,3)

1 points for complete and clear naming & labeling of all inputs and outputs

1 points for beauty of the circuit, proper use of subcircuits, all gates appropriately sized etc.

2 points for professionalism and ability to describe your approach and answer questions