COMPUTER TECHNOLOGY
PRACTICAL SESSION P2 (LOGISIM)
COMBINATIONAL MODULES: SIMULATION.

INTRODUCTION

The goal of this practical session is to present and use basic combinational modules, particularly multiplexer and decoder, in digital circuits. In the session, we will deal with the functionality, implementation and utility of the DEC and MUX modules.

PART 1: SIMULATION USING LOGISIM.

Decoder simulation (Simulate the functionality of a decoder)

Take a DEC3x8 of the library panel (in *Plexers*) and test its performance for all combinations of the control inputs. Use *Splitter* (in *Wiring*) to provide the inputs and don't forget to include the ENABLE input.

Multiplexer simulation (Simulate the functionality of a multiplexer)

Implement a MUX 4x1 using gates. ~~Use *Splitter* (in *Wiring*) to provide the control inputs and don't forget to include the ENABLE input.~~ Test the performance of the MUX 4x1 for all combinations of the control inputs.

PART 2. DESIGNING A LOGIC FUNCTION USING COMBINATIONAL MODULES.

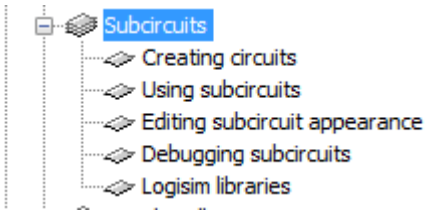
Simulate in Logisim the function $F(A,B,C) = A\bar{B}C + B\bar{C}$

- First simulation exercise. Implement F with one active-high output DEC 3x8. Take the module from the Logisim library

- Second simulation exercise. Implement F with one MUX 8x1. Take the module from the Logisim library

PART 3. DESIGNING A LOGIC FUNCTION USING SUBCIRCUITS

1) Create a subcircuit named "dec2x4" that contains a DEC 2x4 implemented with gates. Don't forget to include the input Enable in this subcircuit. Make use of the Logisim Help (Click *Help* → *Tutorial* → *Subcircuits*) to learn how subcircuits are created and used in Logisim.



2) Implement a circuit that receives a 2-bit number ($N=N_1N_0$) and provides the following output S (note that S is not a binary variable):

- S=N2+N+4 if N is an odd number

- S=N2+7 if N is an even number.

Use the subcircuit designed in 1) and the necessary gates.