**Ministerul Educaţiei și Cercetării al Republicii Moldova Universitatea Tehnică a Moldovei**

**Facultatea Calculatoare, Informatică și Microelectronică**

COMPUTER ARCHITECTURE

Laboratory work 3:

Simulating digital logic circuits using Logisim

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Chişinău – 2023

**Objective:**

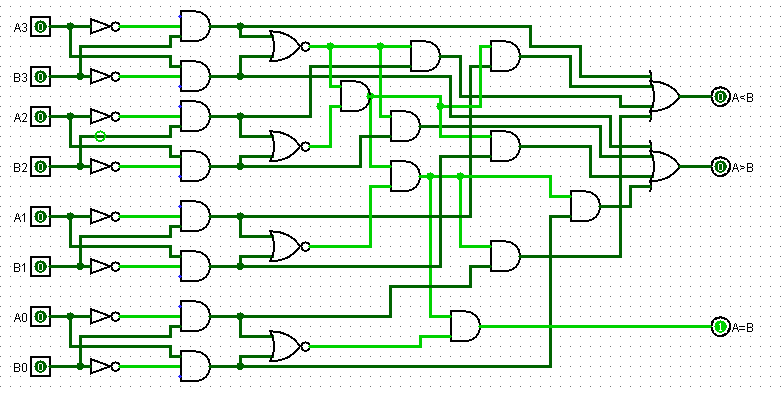
Implement various circuits using a digital logic simulator.

**Introduction:**

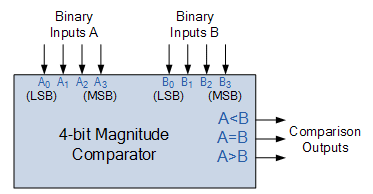
With the use of a graphical user interface, users of the robust digital logic simulator and design tool known as Logisim may construct and simulate digital circuits. A user-friendly environment is provided by this free, open-source program for creating and testing digital logic circuits. Complex circuits that include logic gates, arithmetic circuits, sequential circuits, and other digital components can be built using logic simulation. Using a drag-and-drop interface, users of Logisim may design, edit, and simulate circuits. The software comes with a library of digital components that can be used to construct circuits, but users can also utilize the software's built-in capabilities to design their own unique components.

**Tasks:**

**1H.** 4 bit comparator using logic gates.  
A comparator used to compare two binary numbers each of four bits is called a 4-bit magnitude comparator. It consists of eight inputs each for two four-bit numbers and three outputs to generate less than, equal to, and greater than between two binary numbers.

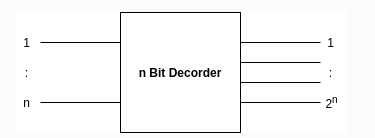


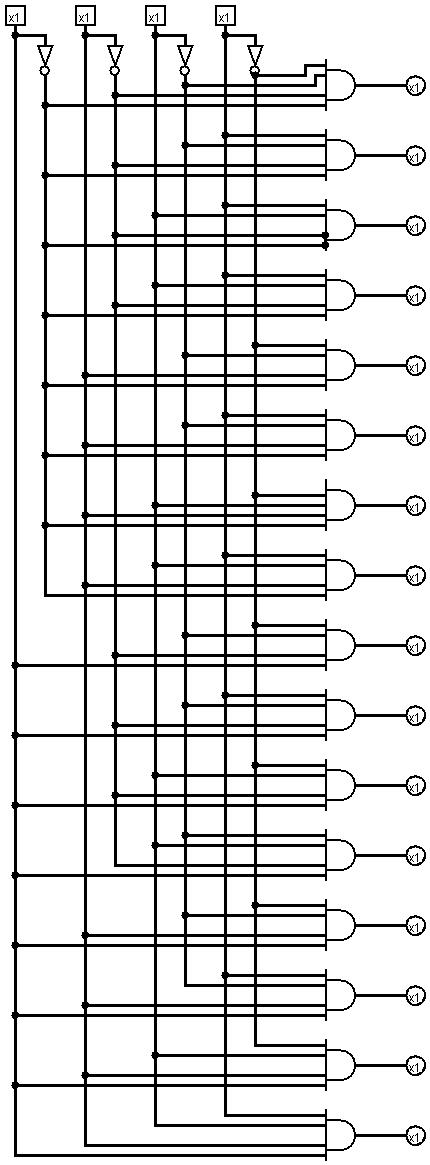
Digital Magnitude Comparators are made up from standard AND, NOR and NOT gates that compare the digital signals present at their input terminals and produce an output depending upon the condition of those inputs. Here, two 4-bit words (“nibbles”) are compared to each other to produce the relevant output with one word connected to inputs A and the other to be compared against connected to input B as shown below.



**2H.** 4 bit decoder with 16 outputs

Decoders are the combinational circuits that detect the presence of some code on its input and indicate the presence of that code by a specified output. Generally, a decoder has n input lines and 2n output lines.





Conclusion:

In conclusion, the laboratory work was a valuable opportunity to gain hands-on experience with digital logic circuits and the Logisim simulation software. Throughout the course of the project, I successfully implemented a range of different constructions including a clock, oscillation circuit, NOR gate, D flip flop, multiplexer, and T flip flop.

One of the most significant benefits of the laboratory work was the ability to experiment with different circuit designs and configurations. This allowed me to see firsthand how small changes to the circuit can have a significant impact on its behavior. Through trial and error, I was able to refine my designs and optimize their performance, which is a crucial skill in the field of digital logic.

Finally, the laboratory work allowed me to gain practical experience with Logisim, which is a widely used simulation software in the field of digital logic design. By becoming proficient with Logisim, I have developed a valuable skillset that will be beneficial in my future academic and professional pursuits.