

# TD1: Introduction to Logisim, counter by 4 and ALU

September 29<sup>th</sup>, 2021

INFO0012 – Computation Structures

For this course, you will have to build a simple – but working – computer called the  $\beta$ -machine in the Logisim simulation environment. This first practical session will introduce you to the Logisim software. You will build and simulate your first circuits: a counter by 4 and a ALU (arithmetic–logic unit). These components will then be useful for your future  $\beta$ -machine.

1. First, install the original version of Logisim from eCampus (Software / Logisim). You might need to install Java in order for the software to run. Familiarize yourself with the software. You can find the [documentation on the website](#). You may also want to watch the short tutorial podcast available on eCampus (Theoretical sessions / 99 - Logisim).
2. In Logisim, build a binary counter with the following properties:
  - The counter must hold a 32-bit value and count by steps of 4 at every clock cycle. You can use every building block available in Logisim you might need
  - Your circuit must include a single bit input signal to reset the counter, setting back its value to 0 when enabled, and a 32-bit output reflecting the current value of the counter
  - The counter must count up to the last 4 digits of your student number (e.g. up to 8765 for student ID 20198765), then come back to 0. If your student number is not a multiple of 4, you can round at the next multiple of 4 (8768 in our example).

Simulate your circuit to check its proper functioning.

3. Build an ALU with the following properties:
  - It should have two 32-bit inputs A and B, a 32-bit output and a 4-bit input ALUFN to select the operation.
  - It should support the same operations as the ALU presented in the theoretical course.
  - You may use plexers, adders, shifters, comparator, and all other logic and arithmetic boxes available in Logisim with any bit width. It would basically look like on slide 4-27. On slide 4-27, only the comparison box is not a Logisim library object (but it is made of a very few Logisim library objects).

Simulate your circuit and make sure that every operation works properly and gives correct answers, e.g. with A=6 and B=3.

Good luck and have fun building your first computer *from scratch* !

"If you wish to make an apple pie from scratch, you must first invent the universe."

— Carl Sagan, Cosmos