Digital Circuit Design

Design, simulation and synthesis of a microcontroller using VHDL in a programmable architecture component

1. ALU

The ALU is a combinational circuit that performs arithmetic and logic operations.

Simulation

Here are the commands that we used to simulate the ALU :

```
ghdl -a *.vhd
ghdl -e alu_tb
ghdl -r alu_tb --vcd=alu.vcd --stop-time=1000ms
gtkwave alu.vcd
```

Difficulties encountered

1. ALU

First, we are asked to use the std_logic_vector type to represent the inputs and outputs of the ALU. This means that every time that we do an operation, we need to add numbers of the same size. So, each time we need to add "0000" bits for the result to match the operation. We can use the resize() function as such.

```
s <= std_logic_vector(resize(unsigned(a), s'length));
```

However since we will always have the same amount of bits, it is better to simply add the bits.

```
s <= "0000" & a;
```

Checklist :

- [x] 1. ALU
- [x] 1. MEM_CACHE_1
- [ ] 1. MEM_CACHE_2
- [ ] 1. Buffer_A
- [ ] 1. Buffer_B
- [ ] 1. Buffer SR_IN_L
- [ ] 1. Buffer SR_IN_R
- [ ] 1. MEM_SEL_FCT
- [ ] 1. MEM_SEL_OUT
- [ ] 1. MEM_INSTR