

# COL216 Assignment 2

## Stage 1

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### 1 Objective

Construct an ALU, a register file, a primary memory unit and a data memory unit for an ARM processor in VHDL.

### 2 Technical Details

- The VHDL code was compiled and simulated using GHDL 1.0.0.
- The waveform viewer used is GTKWave Analyzer v3.3.104.

### 3 Documentation

The submission contains four VHDL files defining the units,

- `types.vhdl`,
- `alu.vhdl`,
- `reg_file.vhdl`, and
- `memory.vhdl`.

Along with four testbenches for testing these units

- `alu_testbench.vhdl`,
- `reg_file_testbench.vhdl`,
- `primary_memory_testbench.vhdl`, and

- `data_memory_testbench.vhdl`.

Along with an output folder, containing the waveforms on simulating the testbenches, in the form of `.ghw` and `.pdf` files.

#### `types.vhdl`

This file defines some custom types for words, half-words and bytes along with an enumerated type for opcodes. It's taken from Piazza post 163.

#### `alu.vhdl`

It defines the ALU satisfying the specifications given in the problem statement.

#### `reg_file.vhdl`

It defines the register file satisfying the specifications given in the problem statement.

#### `memory.vhdl`

It defines the primary memory and data memory satisfying the specifications given in the problem statement.

Since the contents primary memory had to be defined in the declaration itself, I decided to define it such that the entire memory contains 0, barring the index 1 which contains 0x0000FFFF.

## 4 Tests and Results

It was simulated using ghdl, the waveform was generated only till at most time 2500ns.

The output waveform of the testbench results can be viewed in `.ghw` and `.pdf` files.

The `.pdf` files don't contain the entire waveform due to a lack of space, however, the `.ghw` files can be opened in any waveform analyzer like GTKWave to view the output waveform.

The pdf files are also attached at the end of this report.







