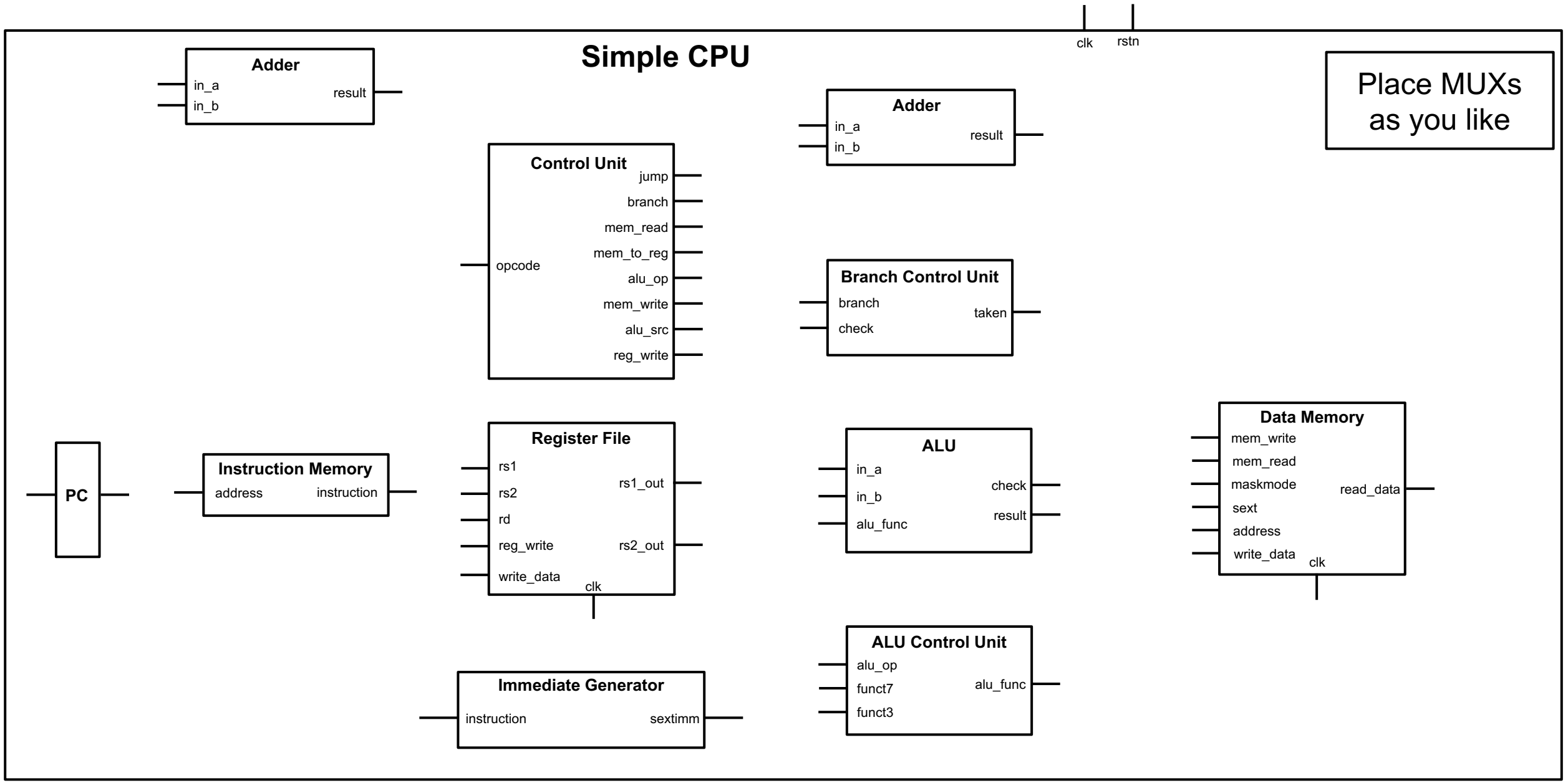
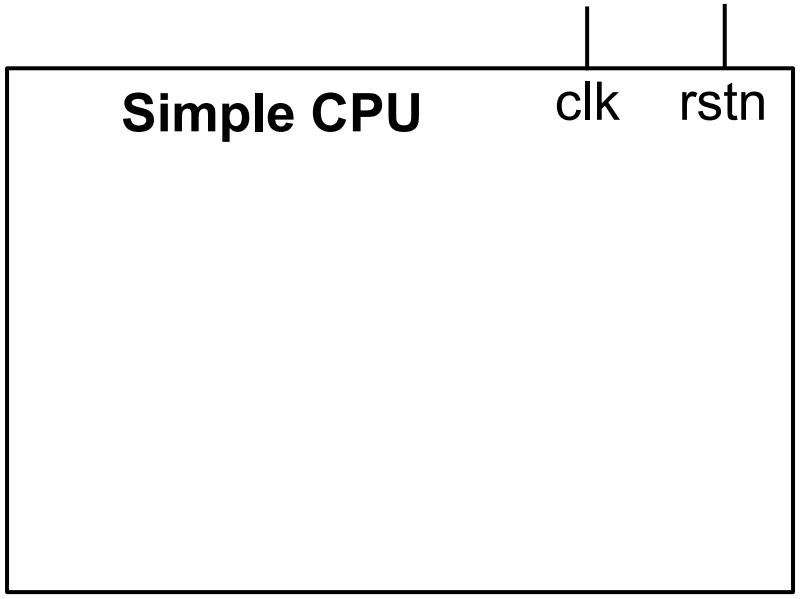



**You should add wires to this diagram to complete the project**

# Ports

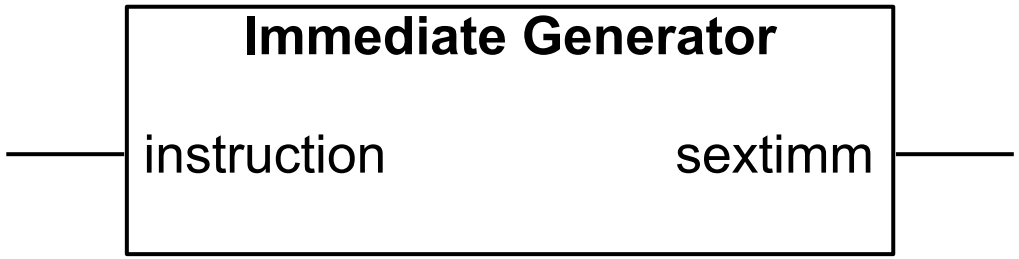



- Input
  - clk : clock input
  - rstn : for resetting the cpu

# Ports

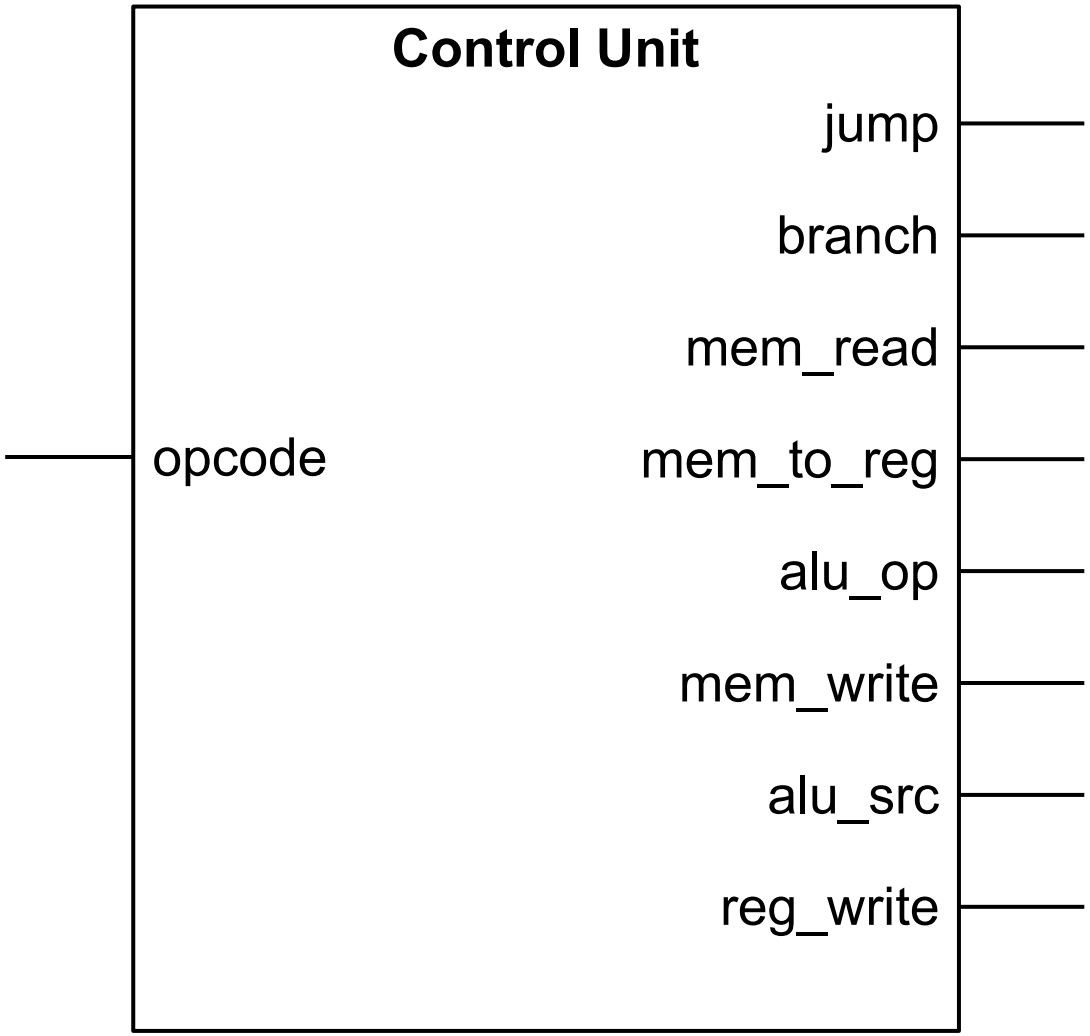

- Input
  - PC (32b) : address of instruction
- Output
  - instruction (32b) : instruction for current PC

# Ports



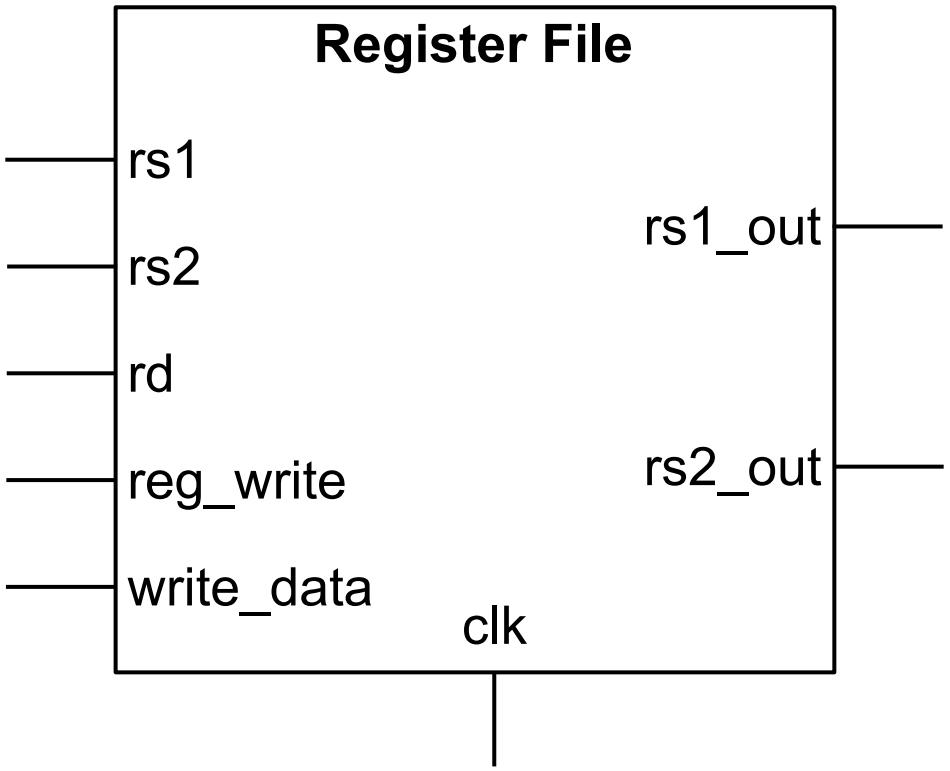

- Input
  - instruction (32b): instruction
- Output
  - sextimm (32b): sign-extended immediate

# Ports



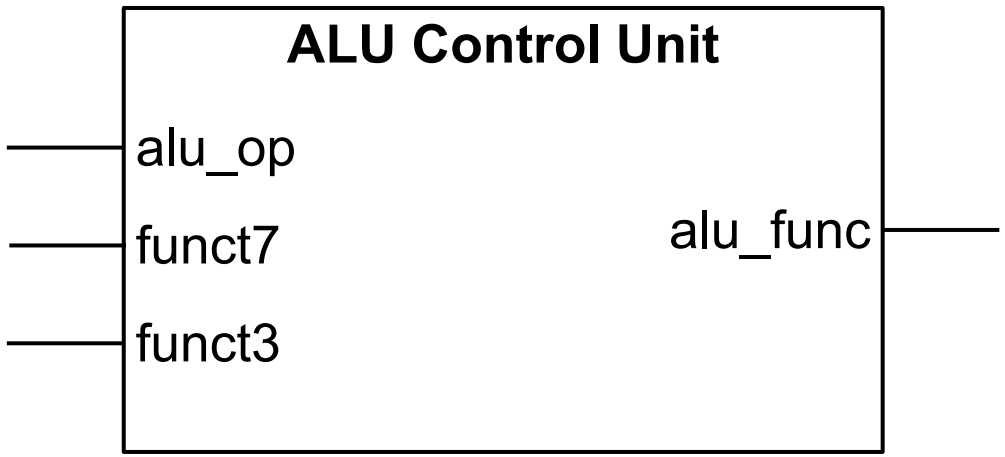

- Input
  - opcode (7b) : opcode from instruction
- Output
  - jump (2b) : indicates if this inst is “jal” or “jalr”
  - branch (1b) : indicates if this inst is a branch type
  - mem_read (1b) : indicates whether to read from memory
  - mem_to_reg (1b)
    - 0 : writeback source is from ALU
    - 1 : writeback source is from memory
  - alu_op (2b) : control signal sent to ALU control
  - mem_write (1b) : indicates whether to write to memory
  - alu_src (1b)
    - 0 : in_b of ALU is from the register file
    - 1 : in_b of ALU is from the immediate generator
  - reg_write (1b) : indicates whether to perform writeback to the register file

# Ports



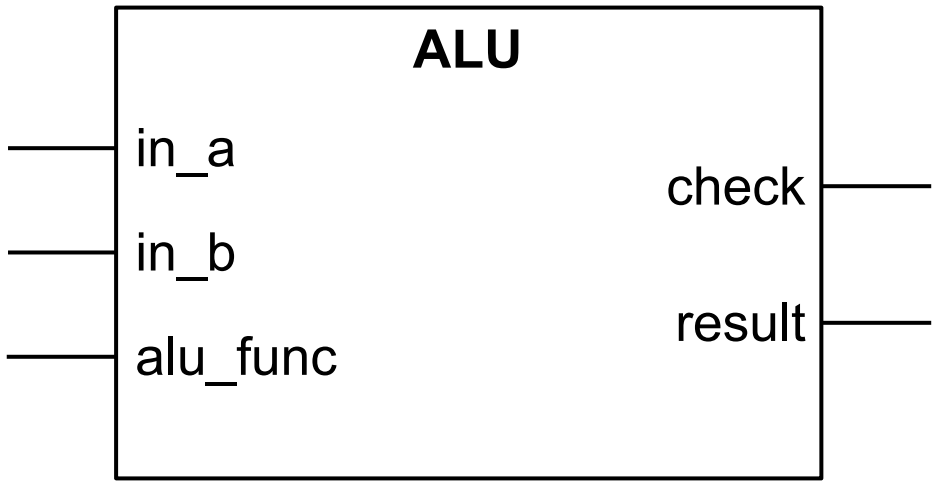

- Input
  - rs1 (5b) : source 1 register file index
  - rs2 (5b) : source 2 register file index
  - rd (5b) : destination register file index
  - reg_write (1b)
    - 0 : do not write write_data to register file
    - 1 : update rd with write_data
  - write_data (32b) : data which will be written to the register file
- Output
  - rs1_out (32b) : data from rs1
  - rs2_out (32b) : data from rs2

# Ports



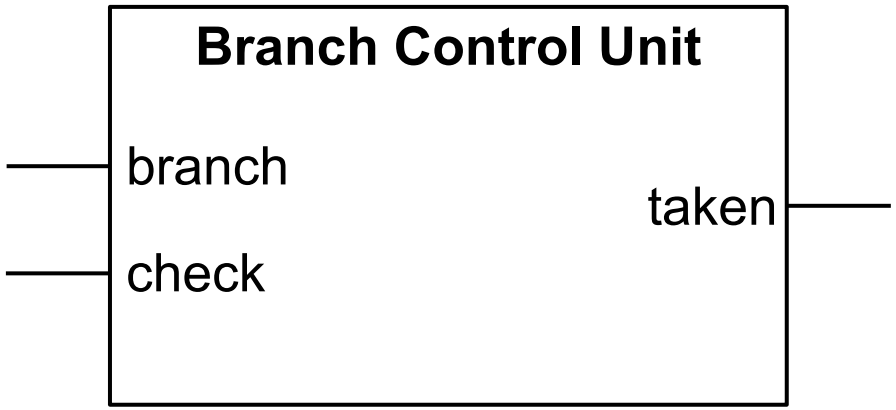

- Input
  - alu_op (2b) : from control unit
    - 00 : select operation for loads/stores
    - 01 : select operation for branches
    - 10 : select operation for R types
    - 11 : select operation for I types
  - funct7 (7b) : from instruction
  - funct3 (3b) : from instruction
- Output
  - alu_func (4b) : ALU operation control signals

# Ports



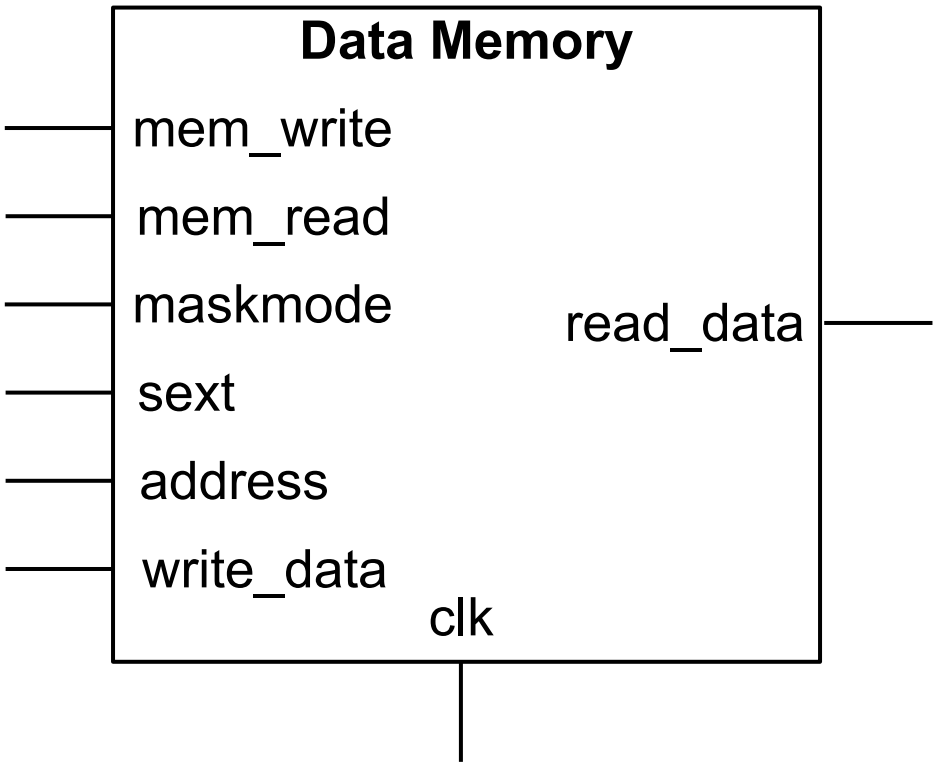

- Input
  - in_a (32b) : ALU source operand
  - in_b (32b) : ALU source operand
  - alu_func (4b) : specifies which operation the ALU should execute
- Output
  - result (32b) : ALU operation result
  - check (1b) : check flag for branches

# Ports




- Input
  - branch (1b) : instruction is a branch type or not
  - check (1b) : output from ALU
- Output
  - taken (1b) : set to 1 if branch is taken

# Ports




- Input
  - address (32b) : memory address
  - write_data (32b) : data which will be written
  - mem_read (1b) : indicates whether to read from memory
  - mem_write (1b) : indicates whether to write to memory
  - maskmode (2b)
    - 0 : byte
    - 1 : half-word
    - 2 : word
  - sext (1b)
    - 0 : output read_data as sign extend
    - 1 : output read_data as unsigned (zero extend)
- Output
  - read_data (32b) : data read from the memory