Project Title: Design a 12-bit Custom RISC-V Microprocessor

(Part 1.1: ISA Design)

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Introduction: Our task was to design a 12-bit Custom RISC-V Microprocessor.

Objectives: Our objective was to create a 12-bit ISA (Instruction Set Architecture) which can solve particular problems, i.e., Arithmetic operations, branching, etc.

1. ***How many types of instructions?***

- Three types of instructions.
    - R-Type
    - I-Type
    - J-Type

2. ***Describe each of the formats***

- **R-Type:** R instructions are used when all the data values used by the instruction are located in the registers.

  In our case, the total number of bits is 12. There are four fields in total, namely - Opcode, RS, RT, and RD.

Opcode	RS	RT	RD
3 bits	3 bits	3 bits	3 bits

- **I-Type:** I instructions comprise of an opcode, a source register, a destination register, and an immediate value.

Opcode	RS	RT	Immediate
3 bits	3 bits	3 bits	3 bits

- **J-type:** J instruction comprises of an opcode and a jump target.

Opcode	Jump Target
3 bits	9 bits

3. How many operands?

- **R-type:** 3 operands (RS, RT, and RD).
- **I-type:** 2 operands (RS, and RT).
- **J-type:** No operands.

4. How many operations?

- 8-operations. Those are
    - ADD - R-type
    - SUB - R-type
    - MULi - I-type

- DIVi - I-type
- LW - I-type
- SW - I-type
- BEQ - I-type
- J - J-type

5. Types of operations?

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- ADD - Arithmetic
- SUB - Arithmetic
- MULi - Arithmetic
- DIVi - Arithmetic
- LW - Memory
- SW - Memory
- BEQ - Branch
- J - Jump