INSTRUCTION SET ARCHITECTURE

Computer Architecture Lab Course Project

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The following is the Instruction Set Architecture :

- Each instruction is 16 bits long.
- There are 8 registers available.
- There are 16 instructions in total.
- To support the proper addressing of these the op-code is 4 bit long and the register operand addressing is given a length of 3 bits.
- There are 4 types of instructions : R, I-1,I-2, J.
- The jump conditional and unconditional instructions are PC Relative. (i.e. After the instruction PC = PC + 1 + PC RELATIVE ADDRESS BIT).

R Type Instructions :

Opcode (4)	Register-1 (3)	Register-2 (3)	Register-3 (3)	Spare (3)

The following instructions are a part of this type :

Operation	opcode	Sample instruction	Machine code
Addition	ADD	ADD $R1,$R2,$R3	1100010011001000
Multiplication	MUL	MUL $R1,$R2,$R3	1101010011001000
And	AND	AND $R1,$R2,$R3	1110010011001000
Exit	EXIT	EXIT	1111111111111111

Subtraction	SUB	SUB $R1,$R2,$R3	1001010011001000

I-1Type Instructions :

Opcode (4)	Register-2 (3)	Register-1 (3)	Constant (6)

The following instructions are a part of this type :

Operation	**Opcode**	**Sample Instruction**	**Machine Code**
Shift Left	SLL	SLL $R1,$R2,#20	1000010001010100
Sub Immediate	SUBI	SUBI $R1,$R2,+20	1010010001010100
Add Immediate	ADDI	ADDI $R1,$R2,+20	0100010001010100
Mult Immediate	MULI	MULI $R1,$R2,+20	0101010001010100
Load Word	LWI	LWI $R1,$R2,+20	0110010001010100
Store Word	SWI	SWI $R1,$R2,+20	0111010001010100

I-2 Type Instructions :

Opcode (4)	Register-1 (3)	Register-2 (3)	PC Relative (6)

The following instructions are a part of this type :

Operation	**Opcode**	**Sample Instruction**	**Machine Code**
Jump Equals	JE	JE $R1,$R2,#20	0000001010010100
Jump Not Equals	JNE	JNE $R1,$R2,#20	0001001010010100
Jump Less than	JL	JL $R1,$R2,#20	0010001010010100
Jump Greater than	JG	JG $R1,$R2,#20	001100101-010100

J-Type Instruction :

Opcode (4)	Amount to be shifted relative to the next Program Counter (12)

Only the jump instruction is a part of this type.

Jump Unconditional	J	J #20	1011000000010100

Register 1 : The first register which appears in the instruction.

Register 2 : The second register which appears in the instruction.