

Review of MIPS ISA and ALU

Though many simple and intuitive ideas have been covered, they collectively have a large impact, enabling modern computers to run efficiently and reliably

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Basic Representations

What is this bit sequence?

1011 1000 0100 0001 0000 0000 0000 1100

Hexadecimal

Unsigned Integer

Signed-magnitude Integer

Twos Complement Integer

Floating Point Number

Instruction

ASCII

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Terminology

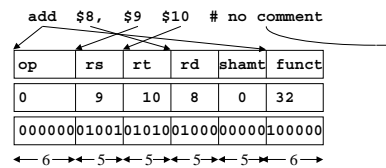
- Pseudo Instruction
- Stack Pointer
- Word Addressing
- Program Counter
- Opcode
- Significand
- Hi/Lo Registers
- "shamt"
- Overflow
- jump and link
- Bias
- PC-relative
- MUX
- Sign Extend
- Floating point register
- NaN

Are there more positive numbers or negative numbers? Why?

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ISA

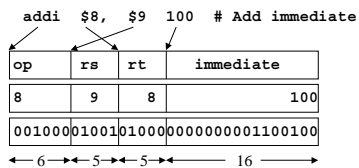
Anatomy of an R-type Instruction



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ISA

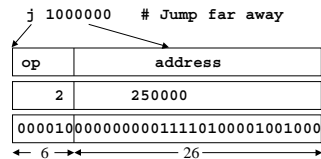
Anatomy of an I-type Instruction



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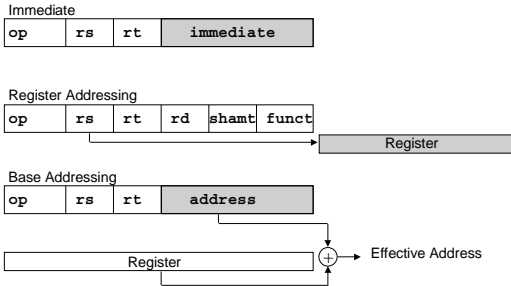
ISA

• Anatomy of a J-type Instruction



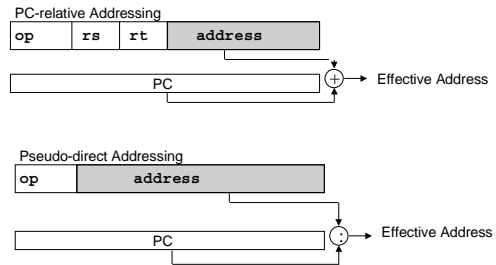
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Addressing Modes



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More Addressing Modes



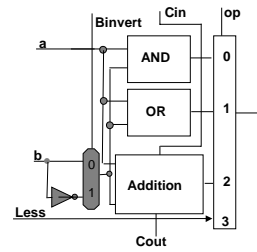
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Register Usage

| Name | Reg. No. | Usage | Preserved On Call |
|-----------|----------|-------------------|-------------------|
| \$zero | 0 | Constant value 0 | N.A. |
| | 1 | Reserved for Assm | N.A. |
| \$v0-\$v1 | 2-3 | Result registers | No |
| \$a0-\$a3 | 4-7 | Arguments | Yes |
| \$t0-\$t7 | 8-15 | Temporaries | No |
| \$s0-\$s7 | 16-23 | Saved Locals | Yes |
| \$t8-\$t9 | 24-25 | More temporaries | No |
| | 26-27 | Operating System | N.A. |
| \$gp | 28 | Global Pointer | Yes |
| \$sp | 29 | Stack Pointer | Yes |
| \$fp | 30 | Frame Pointer | Yes |
| \$ra | 31 | Return Address | Yes |

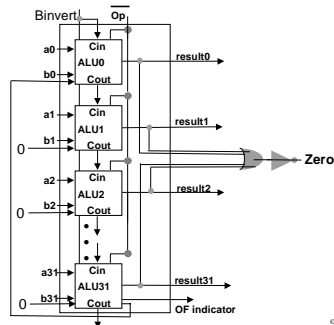
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1-Bit ALU



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Data Path Structure



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