

Registers

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CSC201 Section 002

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Types

- General-purpose vs. special-purpose
- Register length
- Register names

Operands

- Can be constants (immediates); what value?
- Can be in memory; which address?
- Can be in a register; which register?

Addressing Modes

- Where is the operand?
- If in memory, what is the *effective address* of the operand?
- How many ways can we specify the effective address?
 - load/store architectures: 3 or 4
 - Pentium: around 10
- Tradeoff
 - simple, fixed-length instructions, easy to decode and optimize
 - complex, variable-length instructions, ease of programming, fewer instructions needed

Modes (cont.)

- Specifying the addressing mode
 - implicit in the instruction type, or
 - must be explicitly indicated in the instruction
- Evaluating modes
 - how useful?
 - how many memory accesses required (in addition to reading the instruction)?
 - how many bits in the instruction needed to specify?

Immediate Addressing Mode

- The operand value is part of the instruction
- Additional memory accesses: none
- Bits in instruction: enough to store the constant value
- This is one mode allowed by SASM
- Example:

Direct Addressing Mode

- The **address** of the operand in memory is specified
 - the operand value is contained at that memory location
- Additional memory accesses: one
- Bits in instruction: enough to specify memory address
- This is the other mode used by SASM
- Example:

Register Addressing Mode

- The operand value is stored in a register
 - instruction specifies which register to use
 - register value must have previously been loaded from memory, or computed
- Additional memory accesses: none
- Bits in instruction: enough to specify which register
- Example:

Register Direct (Pentium: Register Indirect)

- A register than contains the *address* of the operand in memory is specified
 - operand value is at this memory location
 - register value (the operand address) must have previously been computed or loaded
- Additional memory accesses: one
- Bits in instruction: enough to specify which register to use
- Example:

Indexed Mode (Pentium: Based-Displacement)

- A register contains the memory *address*, AND there is a constant value that is added to that
 - register value must have previously been loaded
- Additional memory accesses: one
- Bits in instruction: register number, and constant value
- Example: