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: