IT 1206
Section 5.0

Addressing

Addressing Issues

- Types of data that can be addressed
- Addressing modes

Data Types

- Hardware support is needed for the data types referenced by an instruction.
- Data types that need to be supported
  - Numeric:
    - integers (signed and unsigned) with lengths short (16 bit) or long (32 bit)
    - floating point with lengths of 32, 64 and 128 bits
  - Non-numeric:
    - mainly strings

Addressing Modes (I)

- Specify how an operand is accessed
  - E.g., constant, a register, or a memory location
- Some types of addressing modes
  - Immediate
  - Base / Indexed
  - Direct
  - Register
  - PC-relative
  - Indirect

MIPS - Load and store only instructions access memory

Addressing Modes (II)

- Immediate
  - The operand contains the value of the datum.
  - Eg:

    add $r4, $r2, #5
    $r4 = Data in register $r2 + 3
- Direct (pseudo-direct for MIPS)
  - The operand contains the memory address of the datum.
  - Eg:

    add $r4, $r2, (1024)
    $r4 = Data in register $r2 + Data at memory address 1024
- Register
  - The operand contains the register designation where the datum is located.
  - Eg:

    add $r4, $r2, r3
    $r4 = Data in register $r2 + Data in register $r3

Addressing Modes (III)

- PC-relative
  - The operand contains the offset from the PC
  - Eg:

    beg $r1, $r2, 25
    If ($r1 = $r2) go to PC = PC + offset (25)
    PC – Program Counter

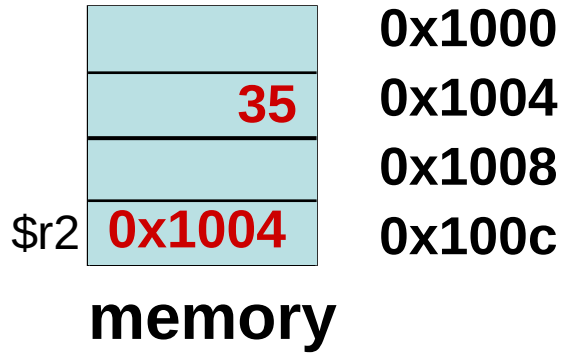
- base / Indexed
  - A register contains a base address and an operand holds a displacement from this base
    Note: the base register may be another operand or implicit
  - Eg:

    lw $r1, 100($r2)
    r1 = Memory(r2 + 100)

Addressing Modes (IV)

- Indirect
  - The operand contains the (memory) address of the datum
  - E.g:

LD $r3, ($r2)
$r3 = Contents of memory address in register $r2

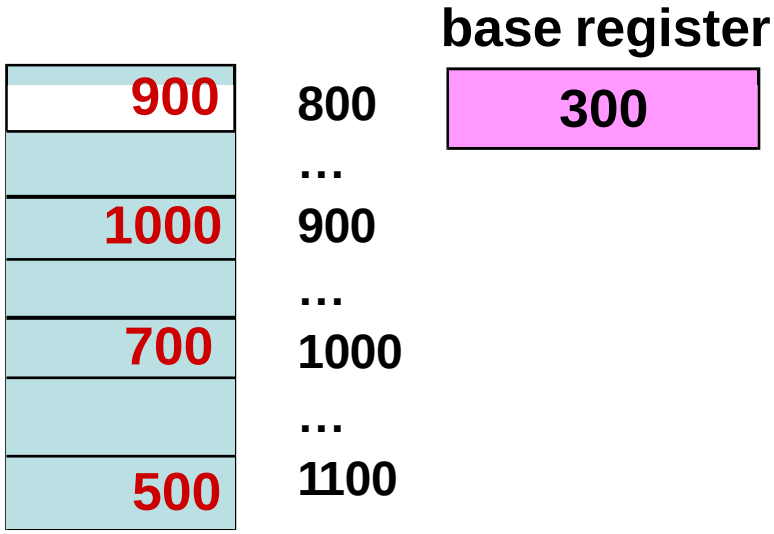


Addressing Modes – Example

Consider the instruction LOAD $R1, 800

Which value is loaded into register $R1 for each addressing mode?

- Immediate
- Direct
- Base
- Indirect



Addressing Modes – Answers

- Immediate - 800
- Direct – 900 (800 contains the intended value)
- Base - 500 (800 is added to the content of the base register = 300, which gives 1100, and the content of word 1100 is retrieved)
- Indirect– 1000 (800 has the memory address 900, and memory address 900 contains the value)