

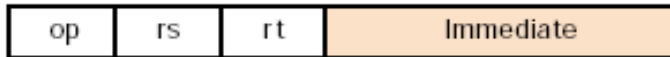
Addressing modes

MIPS has 5 ways of addressing data (see fig. 3.17)

- 1. immediate: data is in instruction itself**
- 2. register: register number in instruction tells which register contains data**
- 3. base/offset: offset value added to base register**
- 4. PC-relative: offset added to PC**
- 5. pseudodirect: offset from instruction merged with PC**

Addressing modes: immediate

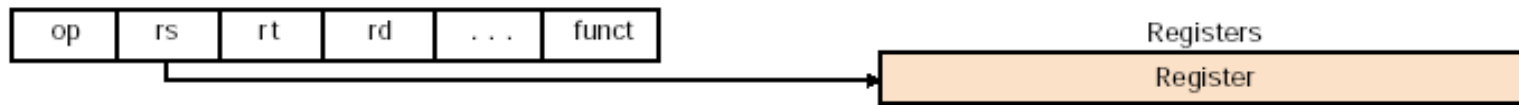
1. Immediate addressing



data is in instruction itself: I-type instruction
how many bits?
signed or unsigned?

Addressing modes: register

2. Register addressing



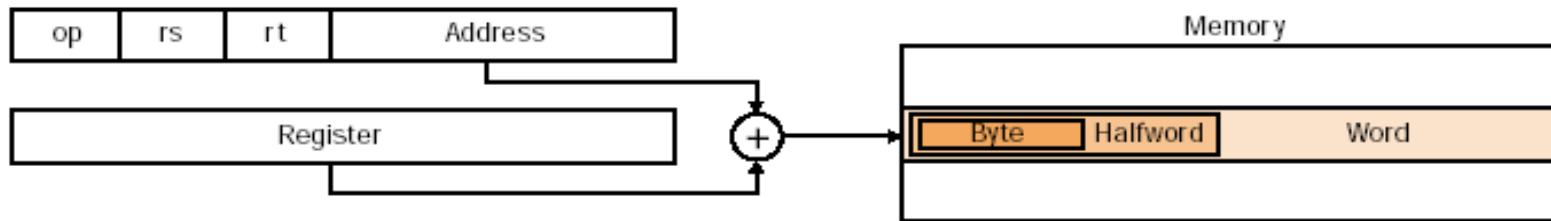
register number in instruction tells which register contains data

register may contain data (add) or address (jr)

R-type instructions

Addressing modes: base/offset

3. Base addressing



$$\text{Addr} \leftarrow R[s] + (\text{IR}_{15})^{16} :: \text{IR}_{15-0}$$

16-bit offset (immed) value in instruction is added to address value in register

sign-extend offset

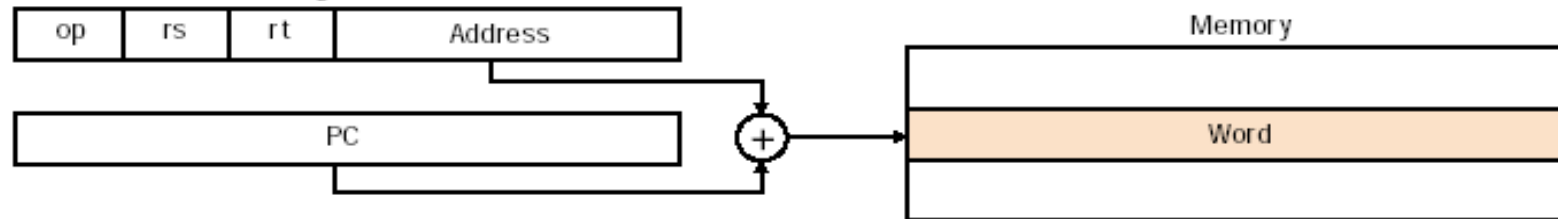
result is address in memory which contains data

data may be byte, halfword, word depending on instruction

used in load and store instructions (I-type)

Addressing modes: PC-relative

4. PC-relative addressing

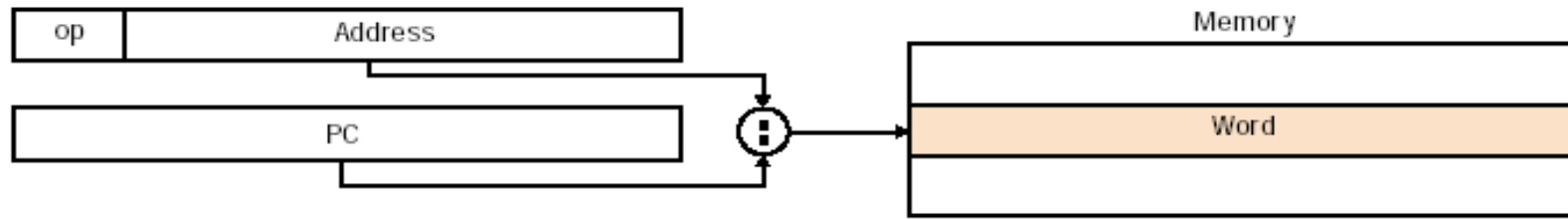


$$PC = PC + (IR_{15})^{14} :: IR_{15-0} :: 00$$

similar to base addressing, but offset is added to value of PC
extra 00 concatenated to end of offset
used for branch instructions (l-type)

Addressing modes: pseudo-direct

5. Pseudodirect addressing



$$PC \leftarrow PC_{31-28} :: IR_{25-0} :: 00$$

direct addressing: complete 32-bit address

26 bits in instruction are concatenated with PC

4 high-order PC bits

00 for low-order bits

can access 1/16 of all possible MIPS addresses

note that figure is not clear on which bits are actually used from PC

J-type instructions

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