MIPS Data Transfer Instructions

 Opcode rt, immed (rs)

• rt: the loaded or stored value
• immed (rs): the memory address
  • rs: base address
  • immed: signed 16-bit offset value (displacement)
• full address = base + offset
  • allows a full 32 bit address
  • can address ± 32KB from base address

Some examples:

```
lw $8, 46($10)  # $8 = memory[$10+46]
sw $8, 46($10)  # memory[$10+46] = $8

lb $9, -256($10)  # $9 =
                   sign-extended (memory[$10-256])
lbu $9, -256($10)  # $9 =
                   zero-extended (memory[$10-256])
sh $9, -256($10)  # memory[$10-256] = the least
                   significant halfword of $9
```
I-type Format

I-type format used for data transfer instructions

- **opcode** = operation
- **opcode** = data transfer instruction
- **rs** = base address
- **rt** = register value that is loaded from or stored to memory
- **immed** = address offset in bytes, $\pm 2^{15}$
  - sign-extended when used (replicate msb)

```
35  29  14  8
```

```
lw $14, 8($sp)
```