# Examples



## ① Memory:

→ use [ ] for memory

→ # of cells = $2^n$ ; n = # of add. bits

→ # of add bits = $\log_2 n$.

**Ex:** operand → 10 bits


↳ # cells = $2^{10}$ = 1K cells

↳ if each cell = 8 bits (1B) → size of M = $2^{10} \times 8$ = 1KB.

**Ex:** Memory size = 256 MB, Cell = 16 bits → find Length operand ?

↳ # of cells = $\frac{256\,M \times 8}{16} = 128\,M = 2^7 \cdot 2^{20}$

↳ # of add bits = $\log_2 2^{27} = 27$ bits.

## ② Registers:

# reg depends on # of reg. bits (operands).

**Ex.** how many bits needs to represent 48-reg.

$48 = 2^6 \Rightarrow 48 < 64 \rightarrow n = 6$ bits.

## ③ Constant

Add $R_0, 5$ ; $R_0 = R_0 + 5$

→ assume Add 10101

R → Five bits

**Ex.** binary: 10101 00000 00101 → last Length = 15

(5) (5) (5)

**Range**

→ Signed numbers $-2^{n-1} \longrightarrow +2^{n-1} - 1$

→ unsigned numbers $0 \longrightarrow 2^n - 1$

} Constant value

**Ex.** how many bits need to represent −512 → +511

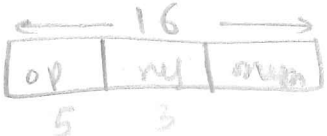
$-512 = -2^9 \rightarrow 9 = n - 1 \rightarrow \boxed{n = 10}$ bits

STUDENTS-HUB.com Uploaded By: anonymous

→ to diffe. reg, num, imm. → in inst. there is bits ≤

---

**Q1** machine supports 18 ope., has 8 Rg.

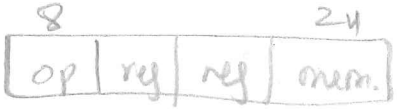



1. (memg length) → 16 - 5 - 3 = 8 bits

2. max. memory space Cas access = $2^8$ cells.

**Q2** Machine access 64 MB, Cell = 32 bits, supports 130 oper. has 96 reg. Find the # bits for each field.

→ 64 MB, Cell = 32 bits = 4B




$\#\text{cells} = \frac{64\,MB}{4B} = 16\,M\text{ cells} = 2^4 \cdot 2^{20} = 2^{24}$

↳ # bits memory = 24 bits.

→ 130 Op. → $130 < 2^8 = 256$ → 8 bits.

→ 96 reg. → $96 < 2^7 = 128$ → 7 bits

STUDENTS-HUB.com Uploaded By: anonymous

**Note**: # diff. inst. ≡ # operations.

length of inst. = total length of op-code + operands -