CS241

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1. Binary and Hexadecimal numbers

(1) bit – binary digits 1 and 0 (all computer understands)
(2) byte – 8 bits
(3) word
   (a) machine specific grouping of bits
   (b) assume 32-bit architecture
   (c) 1 word = 32 bits= 4 bytes
(4) nibble – 4 bits half a byte

1.1. **Given a byte(or word) in memory what does it mean?** Could mean many things.

(1) A number (which number?)

1.2. **How can we represent negative numbers?** Simply use a sign bit with 0 for + and 1 for - (Sign-Magnitude representation) but then you have two -1's and arithmetic is tricky

1.2.1. *Two's Complement notation.* Interpret the n-bit number as a an unsigned int. If first bit is 0 done else subtract 2^n

n bits- represent $-2^{n-1} \dots 2^{n-1}$ with left bit still giving sign. arithmetic is clean, just mod 2^n

We cant tell if a number is signed unsigned or two's complement and we have to remember.

We don't even know if what it means:a number, a character, An instruction (or part of one), Garbage

1.3. **Hexadecimal notation.**

(1) base 16 0-9, A-F
(2) more compact than binary
(3) each hex digit = 4 bits (1 nibble)
(4) e.g. 1100 1001 = C9
(5) NOTATION: 0xC9

1.4. **Mapping from binary to characters.**

1.4.1. *ASCII.* Uses 7 bits

IBM implemented extended ascii to use all 8-bits, but they add some weird characters i.e. frame like characters.Compatibility issues because no one standard.

11001001 is not 7 bit ascii, 01001001 decimal 73 is ASCII for I

other standards like EBCDIC

2. Machine Language

Computer programs operate on data and are data(occupy same space as data)

2.1. **Von Neumann architecture.**

Programs reside in the same memory as data.

Programs can operate on other programs i.e OS

2.2. **Central Processing Unit.**

see physical notes for diagram

1. Control Unit
   - (a) decodes instructions
   - (b) dispatches to other parts of the computer to carry out instructions
2. Arithmetic logic unit: Does Math

2.3. **Memory–Many Kinds (Ranked in speed order).**

1. **CPU
2. cache
3. **main memory RAM
4. disk memory
5. network memory

On the CPU, small amout of very fast memory called registers

MIPS 32 General purpose registers $0 to $31

1. each holds 32 bits
2. can only operate on data that is in regs.