CS 208

Mon, 6 March 2023
Data representation

Here's some bits

What do they mean?

Depends on context

Here's a character; how do I store it as bits?

Same: integers
Real Numbers

Candidate #1: Fixed point

- Simple
- Easier to prove stuff about

110.011

Doesn't go very high (2^16-ish)
Small fractions only 2^-16-ish
Wasted space
John von Neumann
in favor of
fixed point
Candidate #2: Floating point
(this candidate won)
(IEEE 754 standard)

-1.0101 \times 2^{4} = -10101.0
Big example

\[ 1.1 \times 2^{254-127} = 1.1 \times 2^{127} = 110 \quad 0 \]

128 0's
Little example

\[ \begin{array}{c}
0.80000001 \\
1.1 \times 2^{-127}
\end{array} \]

\[ = 0.0\overbrace{00000001}^{125 \ 0's} \]
Recap

\[
\frac{t}{2^e} \leq 23
\]

\[
1.5 \times 2^{e-127}
\]

\[
e = 0 \rightarrow 0 \text{ or denormalized depending on } s
\]

\[
e = 255 \rightarrow \text{Inf or NaN}
\]
Double

1 11 84 52
\[ \begin{array}{cccccccc}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
\end{array} \]

\[ 0 \times 0 \rightarrow 2 \cdot 0.0000 \rightarrow 0 \]

\[ -1.01011_{\text{two}} \times 2_{\text{ten}}^{128_{\text{ten}} - 127_{\text{ten}}} \]

\[ = -10.1011_{\text{two}} = -2 + \frac{1}{2} + \frac{1}{8} + \frac{1}{16} = -2\frac{7}{16} \]
Networking

What ops can you perform on a file?

open
read
write
close

change permissions
Server

while (1) {
  open-ish ➔ wait for connection
  read ➔ read request
  write ➔ respond to request
  close ➔ close connection
}

Programming

Client

1. Open connection to server
2. Send request
3. Read response
4. Close

Use "socket" to make this happen
TCP "port"

Mantis

Apache web server
80, 443

SSHd
22

Email server
25

Client

Wants to talk to the web server

Mantis port 80

Wants to talk to the web server