Problem set 7

Problem 1: Potpourri

(a) Bookshelf length high, low, or about right, and why?

I think it's too low by about 10x but opinions could differ. My reasoning: 1 book is 1 MB and is one inch thick. 150 mi * 5280 feet * 12 in = 9.5 x 10^6 books so 9.5 x 10^12 bytes

Was pretty generous here, most people were within the right order of magnitude. Someone used Python (Lab6 code) to count the number of characters in a sample book to base an estimate off of, which I thought was fun

(b) Distance to Salt Lake City?

About 2000 miles. 11M pages / 1 foot/page is 11M feet or about 2K miles

(c) Height of Fine Hall?

If paper is 0.1mm thick, the stack would be 1100 meters. 1100 / 17 is 65 meters or 210 feet.

(d) Number of five-year periods to shrink the GPGP?

20 periods. Dividing by 2 20 times takes it from 1.6 * 10^6 sq km to 1.6 sq km, which is less than 2.4 sq km. The problem was carefully worded so as to make 20 really the right answer: “how many five-year periods ... to fit comfortably”.

Problem 2: Some Bits and Bytes

(a) How many bytes so everyone has their own IP address?

5 bytes. Only one more bit but no fractional bytes.

A bit disappointing that there were quite a few incorrect answers. A few people did not seem to remember how bytes worked and gave answers like 2^33 bytes

(b) How many Ethernet addresses per person?

2^48 / 2^33

Took points off for people who did not express as power of 2 and directly calculated with 8 billion
(c) How many IPv6 addresses per person?

\[ 2^{128} / 2^{33} \]

Took points off for people who did not express as power of 2 and directly calculated with 8 billion

(d) What's the largest “time” that it can display?

15:63

Accepted 16:03. Did not accept 15:59

(e) How many more digits to enable 24-hour times?

Just 1

Problem 3: Be Fruitful, and Multiply

(a) Function to multiply by repeated addition

Lots of ways

(b) How to handle negative inputs?

Remember sign of \( m \times n \) somehow
Multiple absolute values
Return sign * result
Or any variation

Tried to be generous with those that only gave written descriptions, but a few were too vague.

(c) How to run as fast as possible?

The loop should be controlled by the smaller number, while adding instances of the larger number.