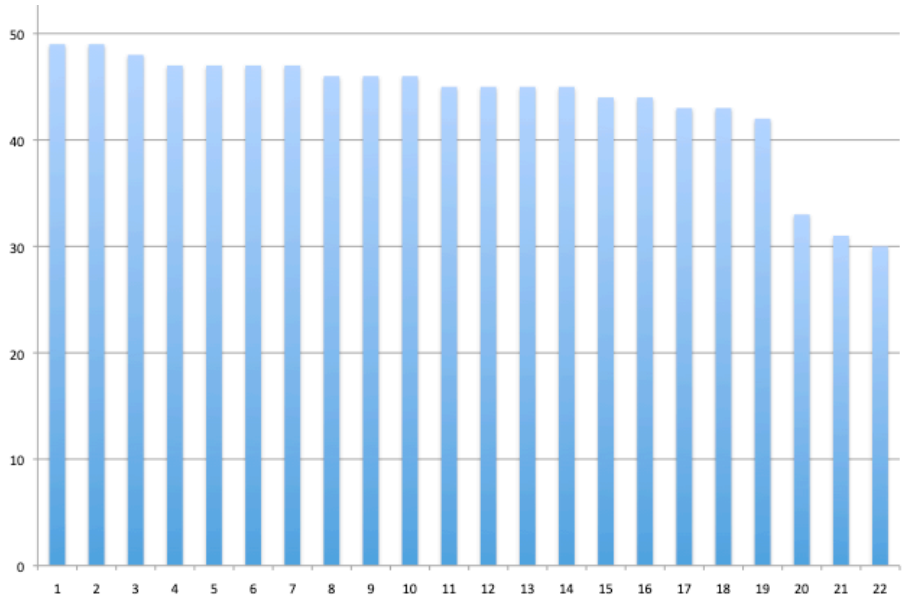
COS 109 Problem Set 5

Graded out of 49. Most people did well; the file system question was responsible for most of the errors.



Problem 1: 10 + 10

It was probably easier to just ignore the original code and rewrite from scratch using the specification. Not as well posed as it could have been.

(a) Counting down.

One of many ways to write it:

```
while n > 0:
     print(n)
     n = n – 1
print “Boom”
```

Note that this works if n <= 0; no penalty if yours didn't, but keep such things in mind if you ever write real code.

(b) Powers of 2.

```
n = 0
while n <= 10:
```

```
print(math.pow(2, n))  # or 2**n
n = n + 1
```

Problem 2: **14 pts (7 x 2)**

(a) Total number of disk blocks?

6 + 2 + 1 + 2 + 6 + 2 + 1 + 3 + 2 = 25

Each directory is a block and each file has to be rounded up to an integral number of blocks; that's really the point.

(b) Disk blocks to read D1/F1?

1 + 3 = 4

(c) Disk blocks to read D1/D2/D3/F4?

1 + 1 + 1 + 2 = 5

(d) Disk blocks to decide whetherD1/F1 and D1/F2 have the same contents?

1 (directory D1 only)

Missed by many. D1 tells you how big F1 and F2 are. They are different sizes so they are necessarily different. No need to look at the contents.

(e) Disk blocks to determine I D1/D2/D4/D6/F4 exists?

2 (D1 and D2 only; there is no D4 in D2)

(f) Which file wastes the most, and how much?

D1/D3/F5, 1023

Oddly, a fair number of people said 1013, presumably a failure of arithmetic.

(g) Which file wastes the least, and how much?

D1/F1, zero

Problem 3: **15 pts (3 each)**

(a) How many years until 10 milliwatts?

45. Going from 10 x 10^6 to 10 * 10^-3 is 10^9, which is 2^30 or 30 doublings, at 1-1/2 years each.

(b) Dimensions of square of 10,000 people?

200 feet on a side, or 40,000 sq ft? If people are 2 feet apart, which is maybe too close. Many of you appear to think that humans are very thin indeed (not my experience) and that they packed themselves exceedingly tight at cocktail parties in the good old days. No penalty but one square foot per person? Really? And there were some awfully precise values computed from very fuzzy data; again, no penalty, but do keep this in mind for the future.

(c) What fraction of the football field?

Football field is 150 x 300 = 45,000 sq ft, so about 90%. Adjust to taste.

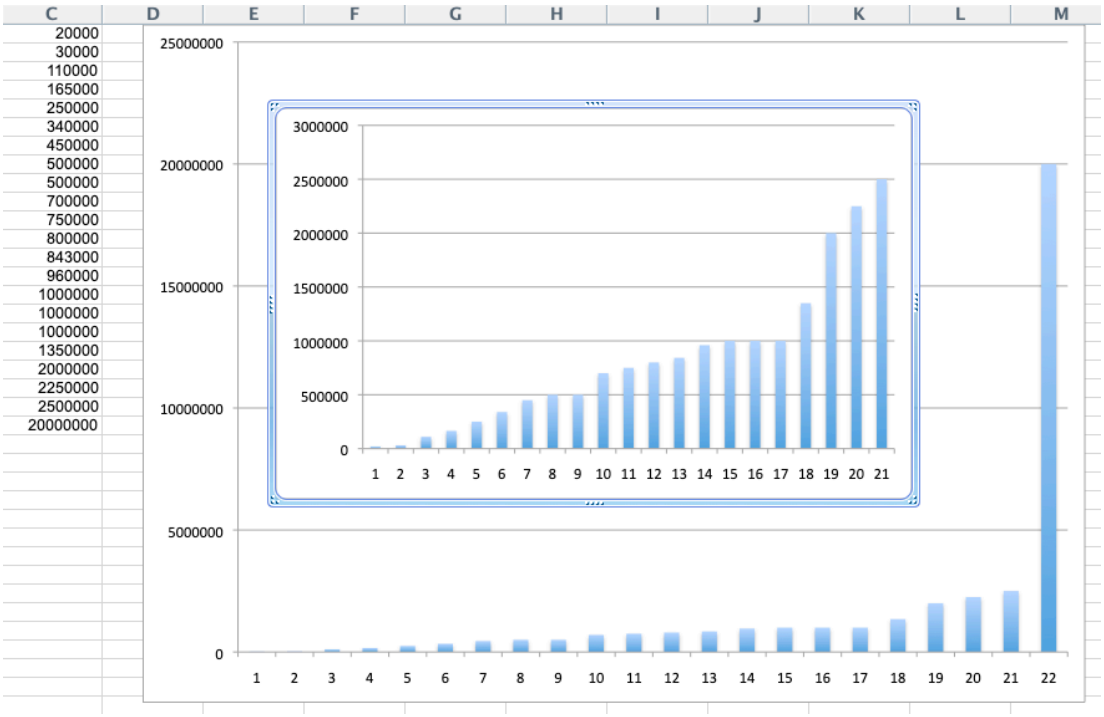
(d) Dimensions of square of 100 million people?

100M people is 10^4 x 10^4, so 2 x 10,000 = 20,000 feet on a side or 400M sq ft.

(e) Cost of Sherrerd astroturf?

The field is similar in size to a football field (see the satellite view), so call it 40,000 square feet. At $20/ft2, that's $800K. I think that's too low, since it took a crew of several people a couple of weeks and the material is specialized to Princeton (e.g., woven-in logo; it's not painted). Somewhere around $1-2M?

The numbers below are the answers you provided. Some are more precise than they should be, given the complete uncertainty about all aspects. There are two charts; the smaller one removes the $20M value, which otherwise dominates. But there was a careful explanation attached to it, based on real experience, that makes it not implausible if one includes a lot of site prep that was probably not needed locally (already done). In any case, I hope the question was interesting, thought-provoking, and if nothing else, perhaps a useful exercise. Thanks for giving it a shot.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