ICS Homework 7

April 17, 2020

1 Organization

1.1

Suppose we have a hard disk with:

- 512 B sector size
- 200 Sectors per track in average
- 50000 tracks per surface
- 2 surfaces per platter
- 15 platters per disk

1. What is the capacity of disk in GB? Please use the unit conversion 1KB=1024B and similar conversions on MB and GB.

   ANS: 15*2*50000*200*512B = 153,600,000,000B = 143.1GB

2. If you didn't make anything wrong in the last problem, how much capacity would the manufacturer claim this disk has? Why?

   ANS: 153.6GB. Because manufactures use the unit of 1KB=1000B, and similar conversions on MB and GB.

1.2

Suppose that a 1MB file consisting of 512-byte logical blocks is stored on a disk drive with the following characteristics:

- Rotational rate: 5400 RPM
- T_{avg_seek}: 5 ms
- Platters: 2
- Surface/platter: 2
- Average # sectors/track: 1000
- Sector size: 512 B

For each case below, suppose that a program reads the logical blocks of the file sequentially, one after the other, and that the time to position the head over the first block is $T_{avg\_seek} + T_{avg\_rotation}$.

1. Best case: Assume we can read the data on the same cylinder one after the other without moving the head. Estimate the optimal time (in ms) required to read the file given the best possible mapping of logical blocks to disk sectors (i.e., sequential).

   ANS:5 + 1/2*60000/5400 + (1024*1024/512)*(1/1000) * 60000/5400 = 33.311 (ms)

2. Random case: Estimate the time (in ms) required to read the file if blocks are mapped randomly to disk sectors.

   ANS:(5 + 1/2*60000/5400 + (1/1000) * 60000/5400) * (1024*1024/512) = 21640.533 (ms)

2 System Software

If we have the following code and a file "a.txt" with the content "ABC"

```
1 int main(void) {
2     char c;
3     int fd = open("a.txt", O_RDONLY, 0);
4     if (fork() == 0)
5         read(fd, &c, 1);
6     read(fd, &c, 1);
7     printf("%c\n", c);
8     exit(0);
9 }
```

Please give all the possible output and one execution order for each. You can use line Cx or line Px to distinguish the same line of code executed by child and parent like $C5 \rightarrow P6 \rightarrow C6$.

ANS:

- A\nC\n: $P6 \rightarrow P7 \rightarrow C5 \rightarrow C6 \rightarrow C7$
- C\nA\n: $P6 \rightarrow C5 \rightarrow C6 \rightarrow C7 \rightarrow P7$
- B\nC\n: $C5 \rightarrow C6 \rightarrow C7 \rightarrow P6 \rightarrow P7$
- C\nB\n: $C5 \rightarrow P6 \rightarrow C6 \rightarrow C7 \rightarrow P7$