Name: _____ USC ID: _____

INF 551 – Fall 2017 (Afternoon section)

Quiz 1: Hard Drives (10 points)

15 minutes

Consider a Seagate hard drive with the following characteristics (note each block contains only one sector):

Number of cylinders	256
Number of heads	8
Number of sectors per track	128
Size of sector	4 KB
Number of sectors per block	1
(Maximum) bandwidth	100 MB/s
Platter speed	**7,200 RPM**
Maximum seek time	15 ms

1. [2 points] What is the **capacity** of the hard drive?

   Capacity=#cylinders* #heads *#sector/track *size of sector

   = 256* 8* 128*4KB = $2^8 * 2^3 * 2^7 * 2^2 * 2^{10}B = 1GB$

2. [2 points] What is its average seek time?

   Average seek time = 1/3 *maximum seek time = 1/3 * 15ms = 5ms

3. [2 points] What is its average rotational latency?

   Time of full rotation is $\mathrm{T_{rotation}} = \frac{60{,}000\mathrm{ms}}{7200\ \mathrm{rotations}} = 8.33\mathrm{ms/rotation}$

   Average rotation latency = ½ s $T_{rotation}$ = ½ *8.33 ms = 4.17ms

4. [4 points] How long does it take (i.e., completion time which includes seek and rotational latency) to access 100 **random** blocks of data?

   Time to transfer a block of data:

   $$T_{transfer} = \frac{4KB}{100MB/s} = \frac{4KB * 1000ms}{100 * 1000KB} = 0.04ms$$

   Because of random access, it needs seek time and rotation time to access each block.

   So $\mathrm{T_{completion}} = \#\mathrm{blocks} * (\mathrm{T_{seek}} + \mathrm{T_{rotation}} + \mathrm{T_{transfer}}) = 100 * (5 + 4.17 + 0.04)ms = 921ms$