CS351, Fall 2009, HW1 Solutions

S1.

Storage Type	Capacity	Speed of Access	Cost
RAM	1GB – 4 GB	50ns – 60 ns	0.04 $/MB
Hard Disc	100GB – 1 TB	5.55 ms	0.09 $/GB
Floppy Disc	1.44 MB	100 ms	0.18 $/MB
CD-ROM	650 MB – 750 MB	70 ms	0.28 $/GB
DVD	4.7GB	110 ms	0.17 $/GB
Blu-Ray Optical Media	25GB	10 ms	0.18 $/GB
Magnetic Tapes	1TB	5-6 ms	1 $/GB

S2.

a) 5400 rpm

Period of Revolution $= \frac{1}{5400}$ minutes

$= \frac{1}{5400} \times 60$ seconds

$= 0{,}0\overline{1}$ seconds

$= 11.\overline{1}$ milliseconds

Average Rotational Delay $= \frac{11.\overline{1}}{2}$ milliseconds

$= 5.\overline{5}$ milliseconds

b) 7200 rpm

Period of Revolution $= \frac{1}{7200}$ minutes

$= \frac{1}{7200} \times 60$ seconds

$= 0.008\overline{3}$ seconds

$= 8.\overline{3}$ milliseconds

Average Rotational Delay $= \frac{8.\overline{3}}{2}$ milliseconds

$= 4.1\overline{6}$ milliseconds

S3.

a) Both tracks have the same amount of recording capacity because btt (block transfer time) for every track should be the same on a disk.

b) Since the recording capacities are the same and **T1** has smaller radius than **T2**, the recording density (bits/inch) of **T1** is greater than **T2**'s recording density.

c) The bits on the inner tracks are stored closer than the bits on the outer track so that the number of bits on each track is the same and the block transfer time for a given block size is the same no matter what track the block is on.

So, **T1** and **T2** have the same amount of recording capacity, but **T1**'s recording density is higher than **T2**'s recording density.

S4.

Number of blocks	**Ts (total time for sequential processing)**	**Tr (total time for random processing)**
100 blocks	$= s + r + (b \times ebt)$ $= 15m\sec + 5m\sec + (100 \times 0.84m\sec)$ $= 104m\sec$	$= b \times (s + r + btt)$ $= 100 \times (15m\sec + 5m\sec + 0.8m\sec)$ $= 2080m\sec$
1,000,000 blocks	$= s + r + (b \times ebt)$ $= 15m\sec + 5m\sec + (1{,}000{,}000 \times 0.84m\sec)$ $= 840{,}020m\sec$	$= b \times (s + r + btt)$ $= 1{,}000{,}000 \times (15m\sec + 5m\sec + 0.8m\sec)$ $= 20{,}800{,}000m\sec$
∞ blocks	$= b \times ebt$ Because we can ignore $(s + r)$	Nothing can be ignored. Because we multiply the number of blocks with $(s + r + btt)$

For very large number of blocks (=>∞);

$$\frac{Tr}{Ts} = \frac{b \times (s + r + btt)}{b \times ebt} = \frac{s + r + btt}{ebt} = \frac{15m\sec + 5m\sec + 0.8m\sec}{0.84m\sec} = 24.76$$

S5.

5.a)

Tape Reel Length = $2{,}400\, feet \times 12$
File Length = (Unit Length) x (Number of Records)
= 28,800 inches

Unit Length = (Inter Block Gap) + (Record Length)
= 0.5 inch + $\frac{800 bytes}{1600 bytes / inch}$
= 1 inch

File length = 1 inch x 36,000 records
= 36,000 inch

As 36,600 inches > 28,800 inches, we say that this many records cannot fit on a single tape reel.

5.b)

(Tape Reel Length) x (Recording Density) – (Number of Records x Record Size) = Space Available to use

(28,800 inch) x (1600 bytes/inch) – (36,000 records) x (800 bytes/record) = 17,280,000 bytes

(Space Available) / (Inter Block Gap Size) = Number of Blocks

$$\frac{17{,}280{,}000 bytes}{1600 bytes/inch \times 0.5 inch} = 21{,}600 \text{ blocks}$$

=

(Number of Records) / (Number of Blocks) = Blocking Factor

$$\frac{36{,}000}{21{,}600} = 1.6$$

Minimum Blocking Factor is $\lceil 1.6 \rceil = 2$ because it should be exact.

5.c)

File Length = $\frac{(36{,}000 records) \times (800 bytes/records)}{1600 bytes/inch}$ = 18,000 inches

Number of Blocks = $\frac{36{,}000}{10}$ = 3600

Inter Block Gap Length = $36{,}600 \times 0.5$ = 1,800 inches

Total Length = 18,000 inches + 1,800 inches = 19,800 inches

5.d)

Bkf	Total start/stop time	Tape Processing Speed	File Size	Process Time
1	= 36,000 x 10ms = 360 sec	= 1,600 byte/inch x 200 inch/sec = 32 x 10^4 bytes/sec	= 36,000 x 800 = 288 x 10^5 bytes	= $\frac{288 \times 10^5}{32 \times 10^4} + 360 \sec$ = 90 + 360 sec = 450 sec

12	= 360 sec / 12 = 30 sec	same	same	= $\frac{288\times10^5}{32\times10^4}+30\sec$ = 120 sec

S6.

Tx = Time for exhaustive reding

100,000 msec = b x ebt

70,000 msec = $\frac{b}{2}\times ebtNew$

ebtNew = $\frac{7}{5}\times ebt$

ebt = (block transfer) + (Inter Block Gap) = 5x

ebtNew = 2 x (block transfer) + (Inter Block Gap) = 7x

So; $\frac{\text{(block transfer)}}{\text{(Inter Block Gap)}}=\frac{2}{3}$ is found.

Finally, data transfer time (dtt);

$dtt=\left(\frac{2x}{2x+3x}\right)\times100=40\sec$ *OR* $dtt=\left(\frac{4x}{4x+3x}\right)\times70=40\sec$