Memory Hierarchy

CISC 221 – Assignment 5
Due: March 31, 2022, 11:59pm
120h – Grace Period

1. (2 marks; note: 1MB = 1024×1024B)

6.24 ◆◆

Suppose that a 2 MB file consisting of 512-byte logical blocks is stored on a disk drive with the following characteristics:

Parameter	Value
Rotational rate	18,000 RPM
$T_{\text{avg seek}}$	8 ms
Average number of sectors/track	2,000
Surfaces	4
Sector size	512 bytes

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 $T_{\text{avg seek}} + T_{\text{avg rotation}}$.

A. *Best case:* 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).

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

2. (4 marks)

6.25 ◆

The following table gives the parameters for a number of different caches. For each cache, fill in the missing fields in the table. Recall that m is the number of physical address bits, C is the cache size (number of data bytes), B is the block size in bytes, E is the associativity, S is the number of cache sets, t is the number of tag bits, s is the number of set index bits, and b is the number of block offset bits.

Cache	m	C	B	E	S	t	s	b
1.	32	1,024	4	4	_____	_____	_____	_____
2.	32	1,024	4	256	_____	_____	_____	_____
3.	32	1,024	8	1	_____	_____	_____	_____
4.	32	1,024	8	128	_____	_____	_____	_____
5.	32	1,024	32	1	_____	_____	_____	_____
6.	32	1,024	32	4	_____	_____	_____	_____

3. (2 marks)

6.27 ◆

This problem concerns the cache in Practice Problem 6.12.

A. List all of the hex memory addresses that will hit in set 1.

B. List all of the hex memory addresses that will hit in set 6.

Deliverables

To OnQ:

1. Single PDF file for all questions.