

Homework 1

CSC553

March 30, 2022

This assignment is on (i) disk layout, (ii) database page layout, and (iii) buffer management.

1 Disk

A 3.5 inch diameter disk has 8 platters with each platter having two data recording surfaces, each platter on disk has 4084 tracks, each track has 400 sectors and one sector can store 1 MB of data. 10 sectors in each track are reserved and no data can be stored in those sectors. The disk rotates at 10,000 rpm. The time it takes the head to move n tracks is $1 + 0.0004n$ milliseconds. Based on this specification of the disk answer the following questions:

1. What is the capacity of the disk?
2. What is the maximum seek time?
3. What is the maximum rotational latency?
4. If a block is 65,546 bytes (i.e., 64 sectors), what is the transfer time of a block?

2 Buffer Management

Consider a database D with 4Kb pages and relation R (a int, b int, c int) with 10000 tuples, each tuple with a size of 12 bytes. Each database page has a header. The header stores bit 1 if the slot is occupied and 0 if the slot is empty. Compute: (i) Compute the number of tuples per page. Note: Read Section 2.5 of Lab1. (ii) how many database pages will be allocated for storing the tuples of this relation. (iii) Compute the number of bytes occupied by the header. 43 (iv) Write the pagenum, header byte and bit position for tuple # 165 and tuple # 1065. (iv) Report the number of empty slots on the last page. 3. Assume the Java Virtual Machines are little endian. (i) List functions in HeapPage that will change due to this. (ii) Neatly rewrite on paper the code of the changed function(s).

3 Buffer Management

Let us further assume a sequence of queries sent serially to the database with the following syntax: `select * from R` where $a > N$, where N is chosen by the user. The query workload results in the following sequence of page requests: 7 0 1 2 0 3 0 4 2 3 0 3 2 1 2 0 1 7 0 1. Assume a buffer size of 3, which is initially empty. Use cache replacement policies of (i) Least recently used (LRU) to perform buffer replacement. Show your working.