RMIT University

COSC2406/2407 Database Systems
Tutorial Exercises

Note: Numbered homework exercises, and exercises marked "*", are from Ramakrishnan and Gehrke.

Disks and files: Week 3

1. Every storage device has different characteristics. Consider an enterprise SSD (Solid State Drive) with the following characteristics (based on an actual drive available in 2014):

   - read bandwidth (sequential): 0.75 GB/s
   - write bandwidth (sequential): 0.5 GB/s
   - capacity: 800 GB
   - power: 3 W
   - price $3,100

   and compare it with an enterprise HDD (Hard Disk Drive) from the same manufacturer with the following characteristics (based on actual drive available in 2014):

   - read bandwidth (sequential): 0.2 GB/s
   - write bandwidth (sequential): 0.2 GB/s
   - capacity: 600 GB
   - power: 4 W
   - price $200

   based on the following criteria:

   (a) $/GB
   (b) $/GB/s (based on sequential read bandwidth)
   (c) power usage (W/GB)
   (d) power usage (W/GB/s)

2. The *Washing Machine 999* disk drive has the following characteristics:

   - 8 platters that provide 16 surfaces
   - 32,768 tracks per surface
   - An average of 256 sectors per track
   - 4,096 bytes per sector
   - Rotation speed of 7,200 RPM
   - To start moving the head assembly takes 1 ms
   - To stop moving the head assembly takes 1 ms
   - Moving the head requires 1 ms per 800 cylinders

   (a) What is the approximate unformatted capacity of the *Washing Machine 999*?
   (b) Give examples of valid block sizes. Is 2,048 a valid block size?
   (c) What is the best-case retrieval time to read five sectors?
   (d) What is the worst-case retrieval time to read five-sectors?

(e) The disk head is currently stopped and resting at cylinder 800. Consider the following stream of requests that arrive at the following times:

Cylinder	Arrival time (ms from now)
600	0
12,000	0
400	0
300	4
500	4
13,000	12

Using the elevator algorithm, show the the order in which requests are serviced. Assume that reading requires 4 ms, including rotational latency and reading time.

(f) Repeat the last question, but assume a first-come-first-served algorithm. Which algorithm is faster? Why?

3. * When does the DBMS buffer manager write pages to disk?

4. * What does it mean to say that a page is *pinned* in the buffer pool? Who is responsible for pinning pages? Who is responsible for unpinning pages?

5. Homework: 8.1, 9.1, 9.3, 9.13, 9.14