CSC 134-02 Database Management Systems (Spring 2022)

Assignment 5 (100 points)

Database Normalization and Disk Structure

Due at 11:59 pm, Thursday May 5, 2022

Question 1 (10 pts): Please define 1NF, 2NF, 3NF and BCNF, respectively.

Question 2 (10 pts): Please explain what the DB normalization process is.

Question 3 (10 pts): Consider a relation *R(A, B, C, D, E)* with the following functional dependencies:

{A, B} -> {C}
{C, D} -> {E}

Identify the key and explain your answer.

Question 4 (10 pts): Compare the techniques of data stripping and data mirroring used in RAID and their respective goals.

Question 5 (10 pts): Compare the following RAID levels: Level 0, Level 1, Level 5, and Level 10.

Question 6 (50 pts): Consider a disk drive device with block size 512 bytes and data transfer rate is 512 bytes/msec. The disk drive rotates at a speed of 2400 RPM (rotations per minute). The average seek time is 30 msec.

(a) How much time does it take (on average) in msec to transfer a single block given its block address?

(b) Calculate the average time it would take to transfer 10 random blocks on disk and compare it with the time it would take to transfer 10 consecutive blocks.

(c) What is the time on average to search for a record in a file containing 100 blocks if the file blocks are stored on consecutive disk blocks? Suppose the file is unordered.

(d) What is the time to read/write an entire file containing 1000 blocks if the file blocks are stored on consecutive disk blocks?

(e) What is the time to read/write an entire file containing 1000 blocks if we distribute the file blocks evenly over 10 disks using data stripping?

Deliverables

1. A doc or pdf file containing all your answers.

Requirements on deliverables

1. Your deliverable should be ***FLastname_A5.doc*** or ***FLastname_A5.pdf*** where *F* indicates first letter, in uppercase, of your firstname and *Lastname* indicates your last name where first letter is in uppercase. Please exactly follow the naming rule described above. You will be deducted 5 points for incorrect naming.
2. On the first page, clearly state your name, ID, course title, assignment number, and due date.
3. Submit your doc or pdf file via Canvas.
4. No late submission will be accepted.
5. When grades are returned to you on Canvas, you have 7 days to meet with the instructor for grade changes. Issues and/or disagreements concerning your grade must be resolved in such 7 days window. After 7 days, the grades are written in stone and can't be changed after that point, for whatever reason.