

# COMP 3311

# DATABASE MANAGEMENT

# SYSTEMS

## LECTURE 11 EXERCISES

## STORAGE AND FILE STRUCTURE

$$bf = \lfloor \# \text{ bytes per page} / \# \text{ bytes per record} \rfloor$$
$$\# \text{ pages} = \lceil \# \text{ records} / bf_r \rceil$$

## EXERCISE 1

A Student file has 20,000 records of fixed-length. Assume the page size is 512 bytes and each record has the following fields:

name (30 bytes), studentId (8 bytes), address (40 bytes), phone (8 bytes), birthdate (8 bytes), gender (1 byte), majorDeptCode (4 bytes), minorDeptCode (4 bytes), classCode (4 bytes), and degreeProgram (3 bytes). An additional byte is used as a deletion marker.

a) What is the record size in bytes?

**record size:**  $30 + 8 + 40 + 8 + 8 + 1 + 4 + 4 + 4 + 3 + 1 = 111$  bytes

b) What is the blocking factor  $bf_{\text{Student}}$ ?

**$bf_{\text{Student}}$ :**  $\lfloor 512 \text{ bytes per page} / 111 \text{ bytes per Student record} \rfloor$   
 $= 4$  records/page

c) How many pages are needed to store the file?

**Pages needed:**  $\lceil 20,000 \text{ records} / 4 \text{ records per page} \rceil = 5000$  pages

## EXERCISE 2

How many page I/Os are needed to search for a record given its studentId value if the file of Exercise 1 is organized as

a) a heap file?

**Search cost:**  $\lceil 5,000 / 2 \rceil = \underline{2500}$  page I/Os (linear search)

b) a sequential file sorted on studentId?

**Search cost:**  $\lceil \log_2 5,000 \rceil = \underline{13}$  page I/Os (binary search)

$$bf = \lfloor \# \text{ bytes per page} / \# \text{ bytes per record} \rfloor$$
$$\# \text{ pages} = \lceil \# \text{ records} / bf_r \rceil$$

## EXERCISE 3

An Employee file has 30,000 records of fixed-length. Assume the page size is 1,000 bytes and each record has the following fields:

name (25 bytes), hkid (8 bytes), address (35 bytes), deptCode (8 bytes), phone (8 bytes), birthdate (8 bytes), gender (1 byte), jobCode (3 bytes), salary (4 bytes). An additional byte is used as a deletion marker.

a) What is the record size in bytes?

**record size:**  $25 + 8 + 35 + 8 + 8 + 8 + 1 + 3 + 4 + 1 = 101$  bytes

b) What is the blocking factor  $bf_{Employee}$ ?

**$bf_{Employee}$ :**  $\lfloor 1000 \text{ bytes per page} / 101 \text{ bytes per record} \rfloor = \lfloor 9.9 \rfloor = 9$  records/page

c) How many pages are needed to store the file?

**Pages needed:**  $\lceil 30000 \text{ records} / 9 \text{ records per page} \rceil = \lceil 3333.3 \rceil = 3334$  pages

## EXERCISE 4

For the file of Exercise 3, how many page I/Os are needed to search for

- a) a record given its hkid value if the file is organized as a sequential file sorted on hkid?

**Search cost:**  $\lceil \log_2 3334 \rceil = \lceil 11.7 \rceil = \underline{12}$  page I/Os (binary search)

- b) all the records with a given jobcode value if the file is organized as a sequential file sorted on hkid?

**Search cost:** 3334 page I/Os (linear search)

- c) a record given its hkid value if the file is organized as a hash file hashed on hkid and there are no overflow pages?

**Search cost:** 1 page I/O