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# ICOM 6005 – Database Management Systems
# Final Exam
# Due: December 18, 2001, 11:59 PM

Name: _____

Student Number: _____

Instructions:

1. This exam is worth 200 points. I will grade it as a regular 100 points exam, and then multiply your score by 2.
2. Write your name on all pages of this exam.
3. Answer this exam, and send it via e-mail as a Word or PDF document.
4. The Web page contains extra slides with the topics discussed in class.
5. There are five problems and a bonus in this exam.
6. Read each question carefully, and show all the work you used to generate your answer.
7. To receive partial credit, you **MUST SHOW** all the work you used to generate your answer.

GOOD LUCK!

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# Score

| | |
|---|---|
| 1 | /20 |
| 2 | /20 |
| 3 | /20 |
| 4 | /20 |
| 5 | /20 |
| Bonus | /10 |
| Sub-Total | /100 |
| Total | /200 |

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**Problem 1. (20 points) General Knowledge about Database Concepts**

Answer each of the following statements as true or false. For those that are false, you must explain why.

a) Queries in relational algebra and in SQL **always** produce the same results.

b) An index can be used for a dual role: stores all the data in a relation and also provides fast access to the records based on one or more attributes.

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**Problem 1 (Continuation)**

c) The Buffer Manager will rely on the Disk Space Manager to access space on disk. The only exception to this rule is during a Page-at-a-time Nested Loops join operation, where the Buffer Manager directly accesses the disk to make the join run faster.

d) The order in which joins are evaluated in a DBMS is only important when the relations to be joined do not have an index defined on them. Otherwise, the relations can be joined in any order and the cost of the join is the same.

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**Problem 2. (20 points) General Knowledge about Database Terminology**

Explain each of the following terms:

a) Data Entry in a index

b) Schema of a relation

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**Problem 2 (Continuation)**

c) RAID

d) Heap File

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**Problem 3. (20 pts) Heap File formats (See Chapter 7 of the textbook, Chapter 3 old one)**

There are two principal formats used to implement a Heap File. These are:

1. **Linked List of Pages** – The data pages in a heap file are organized in two linked lists: one for the pages that are full, and the other for the pages that have some free space.

2. **Directory of Pages –** A linked list stores directory pages, where each page has information and a pointer to a group of data pages.

Explain the advantages and disadvantages of each one, in terms of the cost for finding a data page with enough room to insert a variable-length record.

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**Problem 3 (Continuation)**

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**Problem 4 (20 points) Indexing (see Chapter 8 of textbook, chapter 4 old one)**

When building an index on a relation R based on an attribute A, we have three possible options:

a) Store the full record in the index. In this case, the data entry in the index is also the data record.

b) For each data record in R, store a data entry in the index as a pair <*k, rid*>, where *rid* is the record id of a data record with a value *k* for attribute A (*k* is the search key for the index).

c) For each data record in R, store a data entry in the index as a pair <*k, rid-list*>, where *rid-list* is a linked list with record ids of data records with search key value *k*.

Compare each of these organizations in terms of space utilization, flexibility, and complexity of implementation.

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**Problem 4 (Continuation)**

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**Problem 5. (20 points) Disk Organization (see chapter 7 of textbook, 3 of old one)**

Consider a hard disk with the following properties:

- ?? Sector size of 512 bytes.
- ?? 3000 tracks per surface.
- ?? 50 sectors per track
- ?? 8 sectors per block
- ?? 10 double-sided platters

Using this information, answer each of the following questions (justify your answer):

a) What is the capacity of the disk?

b) How many cylinders does the disk have?

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**Problem 5. (20 points) Disk Organization (see chapter 7 of textbook, 3 of old one)**

c) How many blocks are required to store a 2 MB file?

d) How many records of 64 bytes can be stored in a track?

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**Bonus (10 points) Class assessment**

a) What aspect of the class you liked the most? Explain

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**Bonus (Continuation)**

b) What aspect of the class you disliked the most? Explain