University of Toronto
csc228S—Introduction to Computing, Spring 1996

Midterm Test

Duration: 50 minutes

Aids allowed: None

Make sure that your examination booklet has 6 pages (including this one).
Write your answers in the spaces provided. You will be rewarded for concise, well-thought-out answers, rather than long rambling ones. Write legibly.

Surname: ________________ First name: ________________

Student #: ________________ Tutor: ________________

1.	________	/ 10
2.	________	/ 4
3.	________	/ 6
4.	________	/ 4
5.	________	/ 6
Bonus[1]	________	/ 1
Total	________	/ 30

[1] Bonus mark for spelling your Tutor's full name properly

Question 1
[10 marks]

Assume that the following code has been executed:

```
typedef struct nodetyp {
   int data;
   struct nodetyp *next;
} Node;
```

Write a C function that takes an unsorted linked list and an integer, and deletes the first occurrence (if there is one) of the integer from the linked list.

Question 2

[4 marks in total]

(a)

Below is an excerpt from the general master file update algorithm presented in class:

```
if masterRec.key > transRec.key then
      process transRec
      read: transFile, transRec
else ...
```

Considering only the requirements of your program for assignment 2, is it legal for masterRec.key to be greater than transRec.key, or does it represent an error? Circle the appropriate response.

LEGAL ERROR

If it is legal, briefly describe an example transaction for which it is legal; if it is an error, explain why it is an error.

(b)

For assignment 2, you will probably use the fwrite function in C to revise file position indicators when you insert new elements into your linked calls file.

Does fwrite write over top of existing bytes in the file, or shift them down to make room for what it is writing? Circle the appropriate answer.

OVERWRITE SHIFT

Question 3

[6 marks in total]

In this question, we will discuss the merging phase of a sort-merge program, and its efficiency.

(a)

Assume that, in order to merge two sorted files containing a records and b records respectively, a total of $(a+b)$ file writing operations are executed (where each file writing operation writes out one whole record).

Consider 2-way merging, as used in assignment 1. Say you begin with 64 partition files, each containing exactly r records. Over the duration of the merging process, how many times will a file writing operation be executed?

Answer:

Show your rough work here:

(b)

Now consider 4-way merging, *i.e.*, merging 4 files at once rather than just 2. Assume that, in order to merge four sorted files containing a, b, c and d records respectively, a total of $(a+b+c+d)$ file writing operations are executed.

Again, say you begin with 64 partition files, each containing exactly r records. Over the duration of the merging process, with 4-way merging how many times will a file writing operation be executed?

Answer:

Show your rough work here:

Question 4

[4 marks in total]

With some file structures, we *compute* a record's location in a file from its key. There are many methods for doing this. With **direct mapping**, we simply use the key itself as the record's location. With **directory lookup**, we use the key as a location within a directory file. At that location, we store the location of the record itself.

(a)
How does directory lookup save space compared to direct mapping?

(b)
How does directory lookup *lose* space compared to direct mapping?

Question 5

[6 marks in total]

Imagine that the university is working on a system for storing student information. 9-digit student numbers will be the key field.

(a)

Would direct mapping be a good storage scheme? Circle the appropriate answer.

YES NO

Explain your answer:

(b)

Assume hashing were to be used, and that we have decided to use 100 buckets. Would a hash function that returns the last 3 digits of the student number be appropriate?

YES NO

Explain your answer:

(c)

Again assume hashing were to be used, and that we have decided to use 100 buckets. Would a hash function that returns the first 2 digits of the student number be appropriate?

YES NO

Explain your answer:

END OF EXAM; TOTAL PAGES = 6