University of Toronto
csc228S - File Structures and Data Management, Spring 2000

Midterm Test — Afternoon Section

Friday February 25, 1999

Duration: 50 minutes

Aids allowed: None

Family Name: ____________________ Given names: ____________________

Student #: ____________________

Tutor (circle one): Sirish Pande Kiran Chaudhry Anna Evlogimenou

- There are 5 pages, including this one. The test is out of 30 marks and the value of each question is provided; please use this information to manage your time effectively.
- For questions that involve writing code, comments are not necessary. If you need to call a standard method but can't remember the correct order of arguments, just indicate the meaning of each argument.

Part A:	______ / 2
Part B:	______ / 4
Part C:	______ / 5
Part D:	______ / 4
Part E:	______ / 3
Part F:	______ / 3
Part G:	______ / 9
Total	______ / 30

Part A [2 marks in total]

Suppose we have a file of integers, in binary format. The following C++ code attempts to go to the integer that is 9 away from the beginning of the file, and then read and print that integer. But what it always prints is the very first integer in the file. Fix the bug by writing neatly directly on the code. Do not make other improvements to the code.

```
file.seekp( 9 * sizeof(int),  ios::beg );
int num;
file.read( &num, sizeof(int) );
cout << num;
```

Part B [4 marks in total]

The following function will do binary search on a file:

```
int BinarySearch(fstream & fs, Record & t){

        Record try;
        int low=0; int high;
        fs.seekg(0,ios::end);
        high=((fs.tellg()-1)/Record::recordSize);
        while(low<high){
                int middle=(high+low)/2;
                fs.seekg(Record::recordSize*middle);
                fs >> try;
                if(try.compare(t)==0)return(try);
                if(try.compare(t)<0)low=middle+1;
                else high=middle-1;
        }
        return(low);
}
```

List four assumptions it makes about class `Record`.

1.

2.

3.

4.

Part C [5 marks in total; **no marks** will be given if your variables are not defined.]

1. State how much time is required in order to merge two sorted files. Give your answer in big-oh terms and define any variables that you use.

2. State how much space is required, in memory, in order to merge two sorted files. Give your answer in big-oh terms and define any variables that you use.

Part D [4 marks in total]

Exactly how many disk accesses are required, in the worst case, to read a single block of a unix file if the file contains 2^{13} bytes? Assume that the inode for the file is already in memory, that a block holds 2^{12} bytes, and that a pointer to a file block requires 2^2 bytes. (These are the same numbers we used in class.)

ANSWER: ____________ disk accesses

ROUGH WORK:

Part E [3 marks in total]

The following program runs without crashing. State the output.

```
#include <iostream.h>
#include <malloc.h>

int main (void) {

     char * s1 = (char *) malloc(10 * sizeof(char));

     s1[0] = 'A';
     s1[1] = 'B';
     s1[2] = 'C';
     s1[3] = 0;    // end of string indicator.

     char * s2 = (char *) malloc(10 * sizeof(char));
     s2 = s1;
     s2[0] = 'D';
     s2[1] = 'E';

     char * s3;
     s3 = s2;
     s3[0] = 'X';

     // Print the 3 strings.
     cout << s1 << "\n" << s2 << "\n" << s3 << "\n";
}
```

OUTPUT:

Part F [3 marks in total]

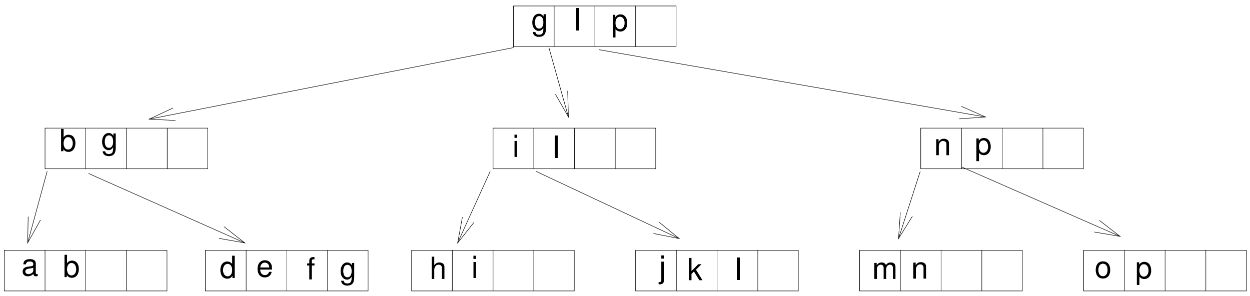
1. Suppose you have a list of UofT student numbers (9 digits long) to write to a file. Which of the following statements is true? Circle one.
   (a) The file will take less disk space if written in binary format.
   (b) The file will take less disk space if written in text format.
   (c) The file will take the same amount of space regardless.
   (d) There is not enough information here to determine which file format will take less space.
2. Fill in the line of code below so that it writes integer `num` to file stream `fs` in binary format:

```
fs.write(                                          );
```

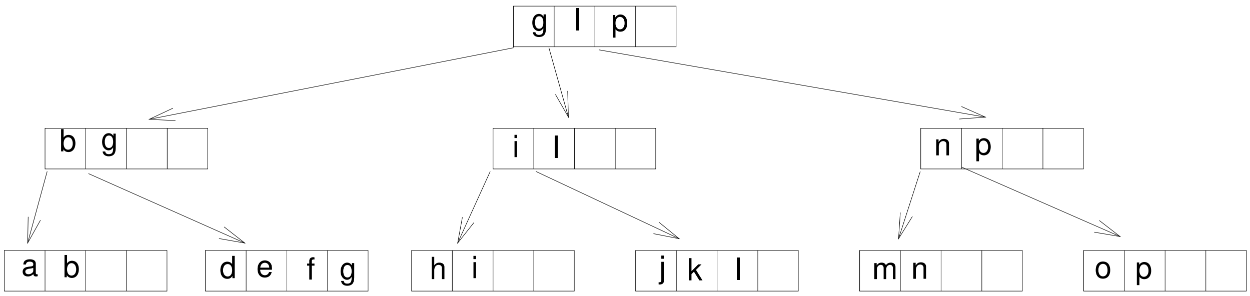
Part G [9 marks in total]

Suppose we have a B-tree with order 4 (*i.e.*, $M = 4$).

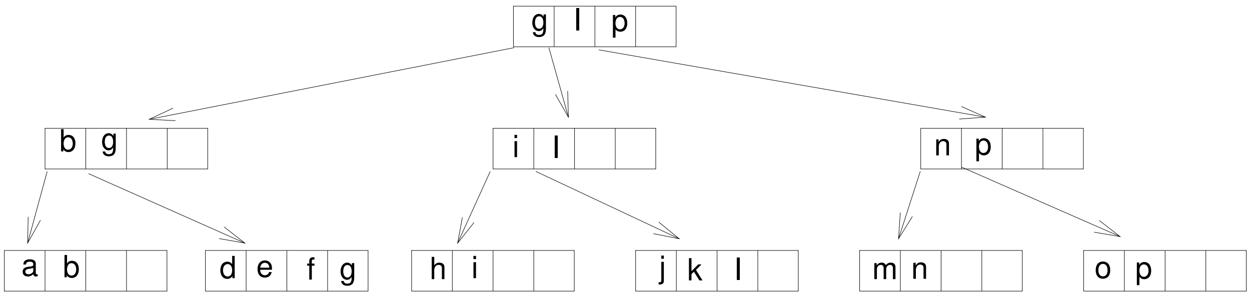
1. Write on the B-tree below to show what would happen if you inserted the key `c`.



2. On this second copy of the same tree, show what would happen if you deleted `m`.



3. On this third copy, show what would happen if you deleted `a`.



End of Examination