

ORDRE DES INGÉNIEURS DU QUÉBEC

MAY 2014 SESSION

Open-book examination
Calculators : only authorized models
Duration : 3 hours

04-MB-0 COMPUTER SCIENCE BASICS

You have 3 hours to complete this exam. You are allowed to use a reference book and authorized non-programmable calculator. You are not allowed laptops, cell phones, notebooks, or other electronic devices. Write your answers carefully. Incomplete, unintelligible, or illegible answers will receive little or no credit. When you are asked to write a program, it is not necessary to comment your code but you are expected to indent appropriately to make your code easier to follow. There are 7 questions on 4 pages (excluding this one), for a total of 100 points on this exam.

Question 1 [11 points]

[2 points] Suppose we have a pointer `p`. Briefly explain the difference between the two `cout` statements below.

```
cout << p;           cout << *p;
```

[3 points] Write a `for` loop that prints the characters in a string `s` one at a time, separated by a space. For example, `s="APPLE"` prints: A P P L E

```
string s;  
cin >> s;
```

[3 points] Write a `while` loop that prints the numbers from an integer `N` down to zero, separated by commas. For example, `N=4` prints: 4, 3, 2, 1, 0,

```
int N;  
cin >> N;
```

[3 points] Write a single `cout` statement that prints the following text exactly as below, including the quotation marks.

```
The file is in:  
"C:\My Computer"
```

Question 2 [12 points]

Write the output of the following blocks of code.

a)

```
for (int i=1; i<=3; i++) {  
    for (int j=1; j<i; j++)  
        cout << i << " ";  
    cout << "\n";  
}
```

b)

```
vector<char> b(3);  
b[0]='r'; b[1]='a'; b[2]='c';  
b.push_back('e');  
for (int i=2; i>=0; i--)
```

```

        b.push_back(b[i]);
    for (int=0; i<b.size(); b++)
        cout << b[i];

```

c)

```

int* c = new int;
*c = 10;
int* p = c;
*p += 3;
cout << *c << *p;

```

d)

```

/**Indicate the spaces in your answer.***/
vector<string> d(3);
d[0]="Bill"; d[1]="Carmen"; d[2]="Toto";
int j = 2;
do {
    cout << setw(d[j].length()+2) << d[j];
    j--;
} while (j>0);

```

Question 3 [18 points]

Sales at a Staples store are recorded in the text file "Sales.txt". Each line of the file specifies a sale with the salesperson's last name and the dollar amount of the sale. The file is sorted alphabetically by name, so that each person's sales appear consecutively. Write a full program (starting from #include) that reads in the file "Sales.txt" and prints to the console the total sales amount for each salesperson. An example is shown below. Note the first total is shown as \$21.50, not \$21.5.

Sales.txt

```

Bob    10.50
Bob    2.00
Bob    9.00
Roger  5.20
Roger  7.20
Gary   2.65
Smith  2.40
Smith  3.40
Smith  0.20

```

Output:

```

Bob earned $21.50
Roger earned $12.40
Gary earned $2.65
Smith earned $6.00

```

Note: The strategy is to read in one name and amount at a time. If the name is the same as the previous name, add amount to the total. If the name you just read is different, output the total. Be careful to output the last person in the file (Smith in the example).

Question 4 [7 points]

A prime number is a number that is only divisible by itself and 1. Write a boolean function `isPrime` that takes an integer as input and returns true if the number is prime. You may assume the input is a positive number larger than one.

Question 5 [20 points]

Let us define the following variables:

```
const int MAX = 8;
int order[MAX] = {55, 27, 30, 14, 59, 65, 20, 81};
int disorder[MAX];
```

By using the variables defined above and by declaring any additional variables as necessary, write the instructions to place the values from the table `order`, into the table `disorder`, where the positions of the values in the table `disorder` are chosen randomly. In other words:

The first value 55 is at position 0 in the table `order`; if we obtain a random value 3 between [0, MAX], the value 55 will be placed at position 3 in table `disorder`.

The second value 27 is at position 1 in the table `order`; if we obtain a random value different to 3 and between [0, MAX], such as 1, the value 27 will be placed at position 1 in table `disorder`.

The third value 30 is at position 2 in the table `order`; if we obtain a random value different to 3 and 1, and between [0, MAX], such as 5, the value 30 will be placed at position 5 in table `disorder`.

And so on...

Reminder:

1. To generate a random number, we call only once the function `srand(time(0))`;
2. Then, we can call at multiple occasions the function `rand()` to generate a random number between [0, HighestNumber].

Question 6 [7 points]

The Euclidean norm of a n-dimensional vector \mathbf{x} is defined as:

$$\|\mathbf{x}\| = \sqrt{x_1^2 + x_2^2 + x_3^2 + \dots + x_n^2}$$

Write a function that takes an array or vector of doubles as input and returns the norm. You may assume the `<cmath>` library is available. An example is shown below:

$$a = \begin{array}{|c|c|c|c|} \hline 1 & 2 & 3 & 4 \\ \hline \end{array}$$

$$norm = \sqrt{1^2 + 2^2 + 3^2 + 4^2} = \sqrt{30} \approx 5.47722$$

Question 6 [25 points]

Write a program which asks the user to type in a word (without spaces) and finds if the words begins with vowel or consonant. Until the end of the `cin` (`cin.eof()` corresponds to ctrl+z in the keyboard), the program repeats the word entry by the user. If the word begins with a vowel, it is stored in the table `listWordsVowel`, if it begins with a consonant, it is stored in the table `listWordsConsonant`. The variables `nbVowels` and `nbConsonant` allows keeping track of the number of words beginning with a vowel or consonant. Then, the program will display the variables `nbVowels`, `listWordsVowel`, `nbConsonant` and `listWordsConsonant`. The word can begin with uppercase or lowercase. It is not necessary to verify overflow of the tables.

```
const int MAX = 100;
string listWordsVowel[MAX];
int nbVowels = 0;
string listWordsConsonant[MAX];
int nbConsonant = 0;
string word;
```

Reminder:

tolower(int argument) Converts character to lower case.

toupper(int argument) Converts character to upper case.