

C++ Programming Workshop

By

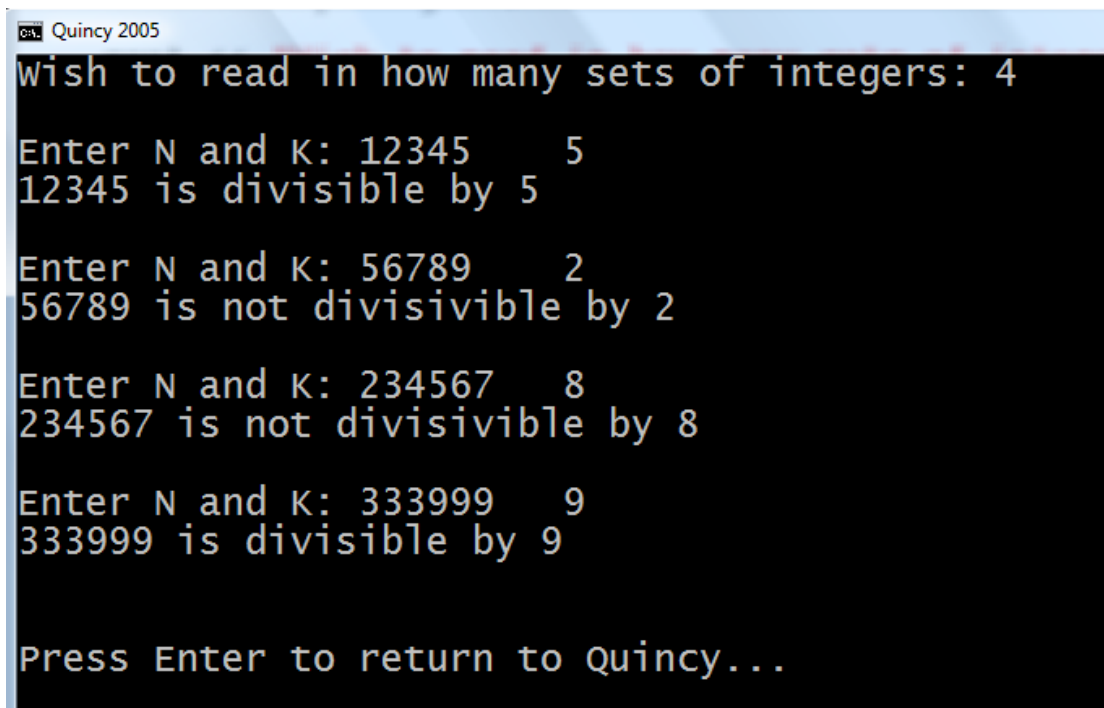
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Workshop 1 – Basic C++ features

A positive integer N is divisible by K if and only if the sum of digits is divisible by K .

For example, if $N = 12345$ and $K = 5$, the sum of digits of N is $1 + 2 + 3 + 4 + 5 = 15$, and $15 \% 5 = 0$; therefore 12345 is divisible by 5.

Design a C++ program, read in a few positive integers N and a few K , and check if each integer read is divisible by the K read. The following shows one of the possible interactions and displays:



```
Quincy 2005
Wish to read in how many sets of integers: 4

Enter N and K: 12345    5
12345 is divisible by 5

Enter N and K: 56789    2
56789 is not divisivible by 2

Enter N and K: 234567    8
234567 is not divisivible by 8

Enter N and K: 333999    9
333999 is divisible by 9

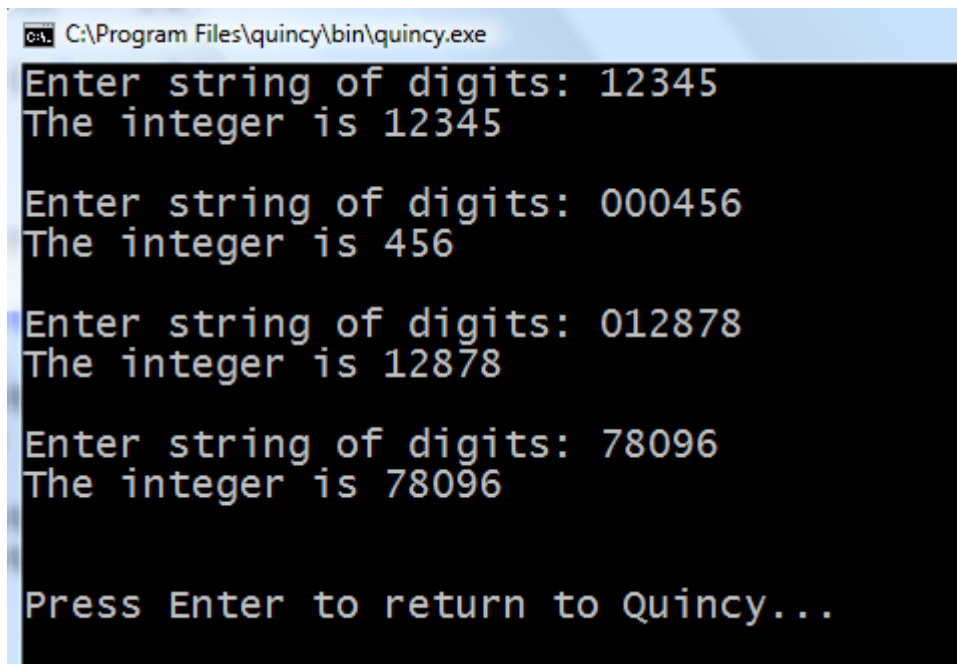
Press Enter to return to Quincy...
```

Workshop 2 – User defined functions

Convert program written in Workshop 1 using user defined functions, and explore the concepts of functions passing by value and by reference.

Workshop 3 – Array and C-string

In Java, there is function to convert a string of digits to its integer equivalent. Write a C++ program to read a few strings of digits and to display their corresponding integers' equivalent. The following shows one of the possible interactions:



```
C:\Program Files\quincy\bin\quincy.exe
Enter string of digits: 12345
The integer is 12345

Enter string of digits: 000456
The integer is 456

Enter string of digits: 012878
The integer is 12878

Enter string of digits: 78096
The integer is 78096

Press Enter to return to Quincy...
```

Think of doing the string manipulation rather than looking for some available functions in C language.

Workshop 4 – User defined data types

Generate some sets of three integers, we wish to see the status of the third integer and see if this third integer is the biggest, smallest or in between the first two integers.

Explore the use of three enumeration constants, for example, **Biggest**, **Smallest** and **Between** in your design and display them.

The following shows some of the generations and analysis:

```
31945    8695    4924
==> Smallest
15090    14196    29807
==> Biggest
15784    23151    28656
==> Biggest
11358    32501    13182
==> Between
1316     9692     6249
==> Between
16792    1718     27596
==> Biggest
31722    14171     984
==> Smallest
7010     12657     7727
==> Between
15461    8419      12475
==> Between
6441     26668     12716
==> Between
```

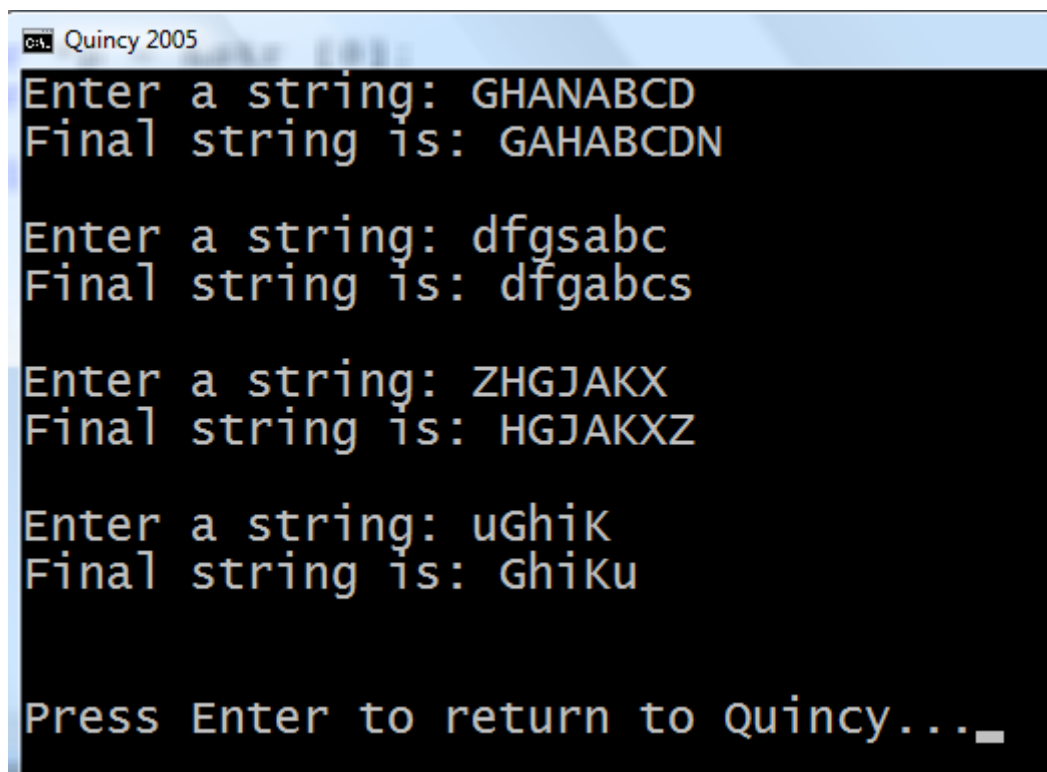
Workshop 5 – File processing

A text file consists of an English essay. Design a C++ program to convert the text file to a binary file; and from the binary file to a text file again. Make sure that the final text file and the original text file is the same.

Workshop 6 – Pointers

Let `str` be a C-string. Write a C++ program to move the largest character towards the end, i.e. the last character is the largest character. Explore the use of pointer arithmetic for the move.

Some possible interactions and displays:



```
C:\> Quincy 2005
Enter a string: GHANABCD
Final string is: GAHABCDN

Enter a string: dfgsabc
Final string is: dfgabcs

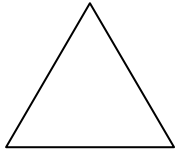
Enter a string: ZHGJAKX
Final string is: HGJAKXZ

Enter a string: ughik
Final string is: GhiKu

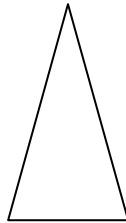
Press Enter to return to Quincy..._
```

Workshop 7 – Classes and Objects

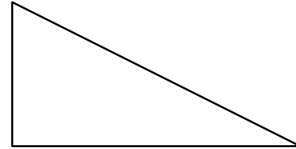
Three types of triangles



Equilateral



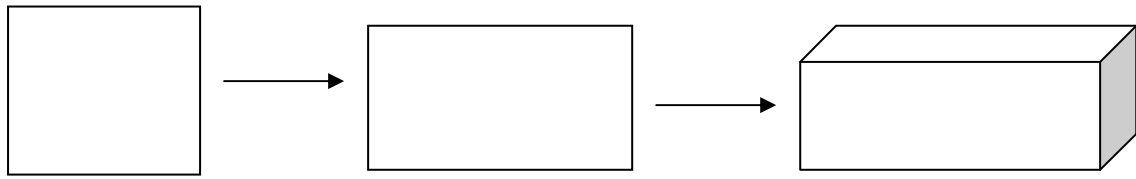
Isosceles



Scalene

Suggest a class to describe these three triangles. In your suggestions, try to put in as much as possible everything you know in classes and objects.

Workshop 8 - Inheritance



An extension of a square is a rectangle; an extension of a rectangle is a rectangular box.

Suggest a few classes to link them together.

Workshop 9 – template classes + STL

Queue has two operations:

Enqueue - Queue up from the back

Dequeue – Remove from the front

A queue can be implemented using vector. Suggest a template class to represent a queue and implement it.

Workshop 10 – All features

An extension of a real number is a complex number that both real and imaginary parts are real numbers. In computing, we have explore the assignment operators, for example, +=, -=, *= or /=.

For this workshop, design two classes, Number class and the Complex Number class which is an extension of Number class. In each of the classes, you should some assignment operators; for example, only += and -=.

Final Case Study – See lecture notes Module_10