COMP 1602 – Computing Programming II

Assignment 1

Date Due: Sunday February 3, 2019 @ 11:55 pm

Description

A set of students were polled to find out their favourite number between 1 and 100 (inclusive). The numbers are stored in a file, `numbers.txt`. The amount of students is not known beforehand but -1 terminates the data. Zero is stored in the file if a student does not wish to reveal his/her favourite number.

(a) Write a program which opens the file and reads all the numbers specified by the students.

(b) For each **distinct** number specified by the students, you must do the following if the number is valid (i.e., between 1 and 100):

(i) Determine if the number is *perfect* – a perfect number is a positive integer that is equal to the sum of its proper divisors (i.e., does not include the integer itself), e.g., 6.

(ii) Determine if the number is *prime* – a prime number is a number that is divisible only by itself and 1, e.g., 7.

(iii) Determine if the number is a *perfect square* – a number that can be expressed as the product of two equal integers, e.g., 25 which is the product of 5 and 5.

(iv) Determine if the number is *sphenic*. A sphenic number is a number which can be expressed as a product *p*q*r* where *p*, *q*, and *r* are **three** distinct prime numbers, e.g., 30 which is the product of 2, 3, and 5.

(v) Find and display the binary number equivalent of the number. For example, if the number is 62, its binary equivalent is 0111110 (using 8 bits).

The output of (b)(i) to (b)(v) should be displayed in a table as follows, where 25 and 6 are sample numbers specified by the students:

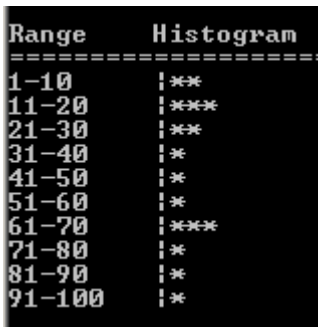
```
Number      Perfect?     Prime?    Perfect Square?     Sphenic?        Binary Equiv.
======      ========     ======    ===============     ========        =============

25          N            N         Y                   N               00011001
6           Y            N         N                   N               00000110
```

(c) **After** displaying the distinct numbers in a table, your program should display all the *invalid* numbers in the input, five per line.

(d) Next, your program should draw a histogram showing the amount of numbers that fell in the following categories:

1-10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, 81-90, 91-100.

You must display a "*" for every *five* students in each category. The diagram on the right shows the histogram for the given `numbers.txt` file.



(e) Your program should conclude by displaying the following statistical information:

(i) The amount of students who specified valid favourite numbers, the amount of students who specified invalid favourite numbers, and the amount of students who did not reveal their favourite number.

(ii) The number/s that was/were chosen the most by the students, if at least two students chose that number.

(iii) The number/s that was/were chosen the least by the students, if at least one student chose that number.

Programming Guidelines

1. You must use functions for (b)(i) to (b)(v).

2. To find out the binary equivalent of a number in (b)(v), you should repeatedly divide the number by 2 until zero is obtained. An array may be used for storing the remainders.

Submission Instructions

- Create and test the program as detailed above. The name of the program is your UWI Student Id number and the extension is **.cpp**.

- Upload *only* the **.cpp** file to myElearning no later than **3rd February 2019 at 11:55pm**.

- Absolutely no late or emailed submissions will be accepted.