Programming Homework 1: Zip Code Holder

Due March 16th at 11:00 p.m.

Task Description

The U.S. Postal Service prints a bar code on every envelope that represents a five (or more) digit zip code using a format called POSTNET (this format is being deprecated in favor of a new system, OneCode, in 2009). The bar code consists of long and short bars as shown:

For this program, we will represent the bar code as a string of digits. The digit 1 represents a long bar, and the digit 0 represents a short bar. Therefore, the bar code would be represented in our program as:

11010010100010101011000010011

The first and last digits of the bar code are always 1. Removing these leave 25 digits. If these 25 digits are split into groups of five digits each, we have:

10100 10100 01010 11000 01001

Next, consider each group of five digits. There will always be exactly two 1's in each group of digits. Each digit stands for a number. From left to right, the digits encode the values 7, 4, 2, 1, and 0. Multiply the corresponding value with the digit and compute the sum to get the final encoded digit for the zip code. The table below shows the encoding for 10100.

Bar Code Digit	1	0	1	0	0
Value	7	4	2	1	0
Product of Digit * Value	7	0	2	0	0

Zip Code Digit = 7 + 0 + 2 + 0 + 0 = 9

Repeat this for each group of five digits and concatenate to get the complete zip code. There is one special value. If the sum of a group of five digits is 11, then this represents the digit 0 (this is necessary because with two digits per group it is not possible to represent zero). The zip code for the sample bar code decodes to 99504. While the POSTNET scheme may seem unnecessarily complex, its design allows machines to detect if errors have been made in scanning the zip code.

Create a class called ZipCode that encodes and decodes five-digit bar codes used by the U.S. Postal Service on envelopes. The class should have two constructors. The first constructor should input the zip code as an integer, and the second constructor should input the zip code as a bar code string consisting of 0's and 1's, as described above. Although you have two ways to input the zip code, internally, the class should

only store the zip code using one format (you may choose to store it as a bar code string or as a zip code number.) The class should also have at least two public member functions, one to return the zip code as an integer, and the other to return the zip code in bar code format as a string. All helper functions should be declared private. Your program should print an error message if an invalid bar code is passed to the constructor. Write a Makefile to compile your program.

Deliverables

You need to electronically submit your entire homework as a .zip file (with file name <*school number*>*_hw1.zip*) to the course webpage on Moodle. Be sure to include your **Makefile** and **report**, which explains your design (along with **UML diagram**), **environment of execution**, and why you believe your program to be correct and robust.