Programming Assignment 2
Due: Friday, September 21, 11:55PM

Objective: To implement a class that converts between postal zip codes and bar codes. This project reviews the use of arrays as class attributes and function parameters. It also reviews input and output file streams.

The assignment is adapted from an exercise in chapter 7 of *Absolute C++ 4th edition*, by Walter Savitch, Pearson, 2010.

Description:

The United States Postal Service (USPS) uses machine readable bar codes to label packages and envelopes. This exercise is based on the format called POSTNET, as it was used for five digit zip codes prior to 2009.

The bar code consists of 27 long and short bars, which looks like the following:

We will represent these bar codes with binary strings, where 0 is a short bar and 1 is a long bar. The bar code shown above will be represented by the string:

    110100101000101010001110011

The first and last bars are always 1, and therefore contain no information. The remaining bars are split into groups of five bars, where each group encodes one digit from the zip code. For the example bar code, this gives us the following information:

    10100   10100   01010   00011   01001
    digit 1   digit 2   digit 3   digit 4   digit 5

The bits are not interpreted in the usual 2^n manner for binary numbers, in order to allow machines to check for read errors. This is done by using an encoding such that each group always has exactly two 1's. The individual bits, when set to 1, have the following values:
- The first (left-most) bit has value 7
- The second bit has value 4
- The third bit has value 2
- The fourth bit has value 1
- The last bit (right-most) has value 0

To convert a group of five bits to a zip code digit, multiply each bit by its value and sum the results. Applying this rule to our example gives us

10100	1*7 + 0*4 + 1*2 + 0*1 + 0*0	9
10100	1*7 + 0*4 + 1*2 + 0*1 + 0*0	9
01010	0*7 + 1*4 + 0*2 + 1*1 + 0*0	5
00011	0*7 + 0*4 + 0*2 + 1*1 + 1*0	1
01001	0*7 + 1*4 + 0*2 + 0*1 + 1*0	4

Thus our example bar code represents the zip code 99514.

There is one special case. The zip code digit 0 cannot be represented due to the requirement that each group of five bits must have two 1's. For this reason, 0 is represented by the five bit group 11000 that sums up to 11.

Your Task:

Develop a class that can convert between POSTNET bar codes and zip codes. Instances of your class should accept both bar codes and zip codes and store some representation of the code internally. Your class should also include access methods to return the code in either format.

Also develop a program that
1. reads zip codes and bar codes from a text file,
2. stores the resulting zip code objects in an array,
3. sorts the zip code objects in ascending order, and
4. prints the ordered zip codes to a second text file.

Format of the input file:

You will be supplied with a text file containing the input data. Each line of the input file will start with a character with the following meaning:
- 'b': line contains a bar code in positions 3 through 29.
- 'z': line contains a zip code in positions 3 though 7.
- 'e': end of file.

Note: You should not read the bar codes or zip codes as integers. Read them as strings of characters.

Format of the output file:

Each line of the output file should contain a zip code (5 characters), followed by a space, followed by a bar code (27 characters). The zip codes should appear in ascending order.