Homework 6

Introductory Programming **Allen B. Downey**
Fall 2004

Due: Thursday 21 October
The reading for this assignment is Chapter 7 of *How to think...*.

6.1 Palindromes, Lipograms and Tautonyms

You might already have a program named `filters.py`, but if not, you should create one. In it, you should write a function named `has_e` that takes a string as a parameter and that returns True if the string contains an 'e', and False otherwise.

A boolean function like this is sometimes called a "filter" because you can use it to filter out the strings that meet a particular criterion.

For each of the following filters, you should write a function that implements the specification, and then write a few lines of code that test your functions with at least one word that meets the criteria and at least one word that doesn't.

1. Read the handout regarding lipograms (attached), and then write a filter called `has_no_e` that returns `True` if the given word doesn't have the letter "e" in it.

2. Write a function named `avoids` that takes a word and a string of forbidden letters, and that returns True if the word doesn't use any of the forbidden letters.

3. Write a function named `uses_all` that takes a word and a string of required letters, and that returns `True` if the word uses all the required letters at least once.

4. Write a function named `uses_only` that takes a word and a string of letters, and that returns `True` if the word contains only letters in the list.

5. Write a function called `is_abecedarian` that returns `True` if the letters in a word appear in alphabetical order.

6. Write a function called `is_palindrome` that returns True if the given word is a palindrome (a palindrome reads the same way forward and backward, like 'otto' and 'radar').

Once you have written your filters and you are pretty sure they are correct, you can use them to search for words in the dictionary that meet various criteria. Download `word_filter.py` from the class web page:

```
wget http://wb/ip/code/word_filter.py
```

`word_filter.py` reads through the list of words in `/usr/share/dict/words` and prints only those words that meet the given criteria. By default, it uses the filter `has_e`, so if you run

```
python word_filter.py
```

it should print all the words in the "dictionary" that contain the letter 'e'. You can specify another filter on the command line, like this:

```
python word_filter.py has_no_e
```

and you should get all the words that don't have an e. And, you can specify a string of words that should be avoided (or included, etc):

```
python word_filter.py avoids qwxyz
```

Use your filters to answer the following questions. You can include your answers in comments in `filters.py`.

1. What percentage of the words in the dictionary do not contain the letter 'e'? HINT: pipe the output from your program into `wc`. If there are any print statements in `filters.py` you might want to comment them out.
2. Using `avoids`, can you find the 5 least useful letters; that is, the combination of 5 letters that you can omit and eliminate the smallest number of words? You don't have to find the best combination; just try a few and report the best one you find.
3. How many words are there that use all the vowels `aeiou`? How about `aeiouy`?
4. How many words can you spell using only the letters `acefhlo`?
5. How many abecedarian words are there?
6. How many palindromes?