Three Sample Programs Using Tries (from Past Foundation Exams)

1) It's often useful to know how many words start with a particular prefix. Given a trie that stores a dictionary of valid words (**lowercase letters only**) as well as a prefix string, write a **non-recursive** function that calculates the number of words that begin with that prefix. To aid you in your solution, the struct that stores a trie node will not only store whether or not that node represents a word or not, but it will **also** store the total number of words stored within that subtree of the trie in a variable called numwords. You may assume that the TrieNode pointer passed to the function represents the root of the whole trie storing the dictionary of words. You may assume that root is NOT NULL and prefix has at least one lowercase letter in it.

```
#include <string.h>

typedef struct TrieNode {
    struct TrieNode *children[26];
    int flag; // 1 if the string is in the trie, 0 otherwise
    int numwords; // the total # of words stored in this sub-trie.
} TrieNode;

int numWordsWithPrefix(TrieNode* root, char* prefix);
```

The solution to this problem is contained in the file, countwords.c.

2) In many word games, the player is given some tiles with letters and must form a word with those tiles. Given a trie that stores a dictionary of valid words and a frequency array storing information of the tiles a player has, determine the number of unique words she can form with those tiles. Complete the function shown below to solve the given problem. Note: the entry in freq[i] represents the number of tiles with the letter 'a' + i. **(Hint: recursing down the trie is exactly like placing a tile down, which means updating the freq array. When you have finished "trying a tile" you have to put it back into your pool, which means editing the freq array again.)**

```
typedef struct TrieNode {
    struct TrieNode *children[26];
    int flag; // 1 if the string is in the trie, 0 otherwise
} TrieNode;

int countWords(TrieNode* root, int freq[]);
```

The solution to this problem is contained in the file, countprefixes.c.

3) The word "intention" is such that four of its prefixes, "i", "in", "intent" and "intention" are words themselves. Write a function that takes in a pointer to the root of a trie storing a dictionary of words and returns the maximum number of words that are prefixes of a single word. Use the struct definition and function prototype given below.

```
typedef struct TrieNode {
    struct TrieNode *children[26];
    int flag; // 1 if the string is in the trie, 0 otherwise
} TrieNode;

int maxNumPrefixWords(TrieNode* root);
```

The solution to this problem is contained in the file, maxprefix.c.