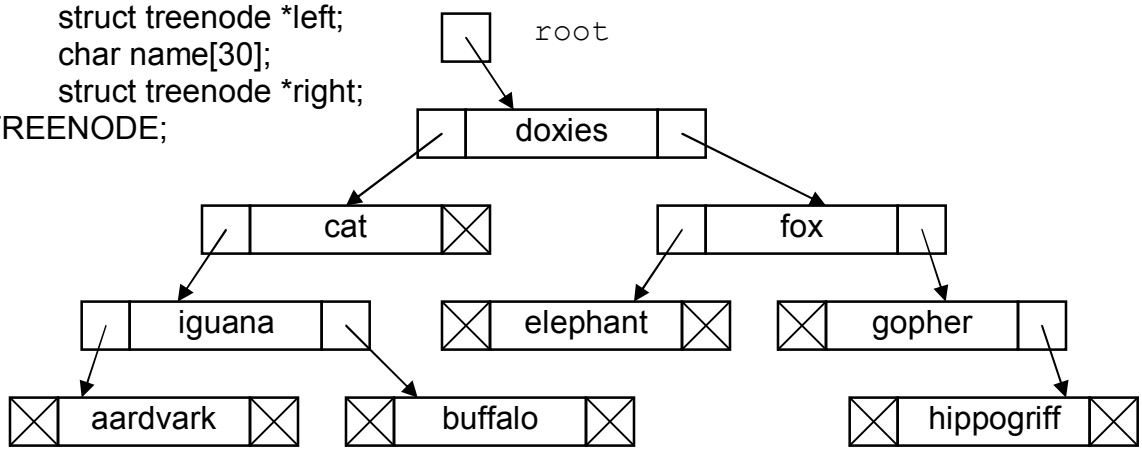
University of Massachusetts Dartmouth
Department of Electrical and Computer Engineering

ECE 161 Name: tree.cpp
Project 9 Due: see http://ece161.viall.org

Attached is a program which creates and prints the tree below. It also reads and writes this tree structure from or to a file.

```
typedef struct treenode
{
        struct treenode *left;
        char name[30];
        struct treenode *right;
} TREENODE;
```



Write a program which processes the following commands:

Print (or P) – prints the tree

addLeft (or L) – prompt the user for an existing_animal and a new_animal. The new_animal is added to the left node of the existing_animal. If the existing_animal doesn't exist, or the left node of the existing_animal is not null, then the tree is unchanged, and an error message is displayed.

addriGht (or G) – same as "addleft", except adds to the right node.

Search (or S) – prompt the user for an animal; program will search tree and inform user that the the animal does or does not exits.

Read (or R) –reads the tree from "mytree.txt"

Write (or W) – writes the tree to "mytree.txt"

Note: For debugging purposes, save a copy of "mytree.txt" under a different name. That way if your program writes garbage to the file, you can easily fix it.

```
// ECE 161 - Example of reading/writing tree structure to file
// P. Viall  Spring 2013
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

typedef struct treenode
{
     char name[20];
     struct treenode *left;
     struct treenode *right;
} TREENODE;

TREENODE * CreateNode(char n[]);
void AddLeft(TREENODE *p,char n[]);
void AddRight(TREENODE *p,char n[]);
void PrintTree(TREENODE *r,int numspace);
void WriteFileDetail(TREENODE *r,FILE *f);
void WriteFile(TREENODE *p);
void ReadFileDetail(TREENODE *r, FILE *f);
void ReadFile(TREENODE **p);

void main(void)
{
     TREENODE *tmp;
     TREENODE *root;
     char line[20];
     printf("Type \"init\" to initialize the tree, else hit ENTER");
     gets(line);

     if (!strcmp("init",line))
     {
          root = CreateNode("doxies");
          tmp = root;            AddLeft(root,"cat");       AddRight(root,"fox");
          tmp = root->left;      AddLeft(tmp,"iguana");
          tmp = root->right;     AddLeft(tmp,"elephant");   AddRight(tmp,"gopher");
          tmp=root->left->left;  AddLeft(tmp,"aardvark");   AddRight(tmp,"buffalo");
          tmp=root->right->right;AddRight(tmp,"hippogriff");
          PrintTree(root,0);
          WriteFile(root);
     }
     ReadFile(&root);
     PrintTree(root,0);
}

TREENODE * CreateNode(char n[])
{
     TREENODE *p;
     p = (TREENODE *) malloc(sizeof(TREENODE));
     strcpy(p->name,n);
     p->left = p->right = NULL;
     return p;
}

void AddLeft(TREENODE *p,char n[])
{
     p->left = CreateNode(n);
}

void AddRight(TREENODE *p,char n[])
{
     p->right = CreateNode(n);
}
```

```
void PrintTree(TREENODE *r,int numspace)
{
     int i;
     if (r)
     {
          for (i=0; i<numspace; i++) printf(" ");
          printf("%s\n",r->name);
          PrintTree(r->left,numspace+4);
          PrintTree(r->right,numspace+4);
     }
}

void WriteFileDetail(TREENODE *r,FILE *f)
{
     if (r)
     {
          fprintf(f,"%c%c%s\n",(r->left)?'+':'-',r->right?'+':'-',r->name);
          WriteFileDetail(r->left,f);
          WriteFileDetail(r->right,f);
     }
}

void WriteFile(TREENODE *p)
{
     FILE *outfile;
     outfile = fopen("myfile.txt","wt");
     if (!outfile){ printf("Error opening file\nExitig...");exit(0); }
     WriteFileDetail(p,outfile);
     fclose(outfile);
}

void ReadFileDetail(TREENODE *r, FILE *f)
{
     char line[200];
     fgets(line,sizeof(line),f);
     line[strlen(line)-1]='\0'; // eat newline
     strcpy(r->name,line+2);
     if (line[0]=='+')
     {
          r->left = CreateNode("");
          ReadFileDetail(r->left,f);
     }

     if (line[1]=='+')
     {
          r->right = CreateNode("");
          ReadFileDetail(r->right,f);
     }
}

void ReadFile(TREENODE **p)
{
     FILE *infile;
     infile = fopen("myfile.txt","rt");
     if (!infile) { printf("Error opening file\nExitig...");exit(0); }
     *p=CreateNode("");
     ReadFileDetail(*p,infile);
     fclose(infile);
}
```