Assignment 2

Due: 4:30pm Oct. 12th (Monday)

This assignment is done by a group of 2 or 3 (each group submits only 1 copy of the assignment)

1. [10 points] Consider the following two languages:
   L1: strings over {0,1} such that they contain even number of 1's
   L2: the set of all bit strings (i.e. strings over alphabet {0,1}) that are divisible by 4
   (1) Write a regular expression corresponding to L1
   (2) Write a regular expression corresponding to L2

2. [10 points] Draw an automaton that accepts the regular expression $\mathbf{b?a(c^{+}\,b)^{*}}$

3. [20 points] Question 5.8

5.8 Using the first organization of the symbol table described in the text (a single simple table), show the symbol table for the following C program at the three points indicated by the comments **(a)** using lexical scope and **(b)** using dynamic scope. What does the program print using each kind of scope rule?

```
#include <stdio.h>

int a,b;

int p(void)
{ int a, p;
  /* point 1 */
  a = 0; b = 1; p = 2;
  return p;
}

void print(void)
{  printf("%d\n%d\n",a,b);
}

void q (void)
{  int b;
   /* point 2 */
   a = 3; b = 4;
   print();
}

main()
{  /* point 3 */
   a = p();
   q();
}
```

4. [15 points] Question 5.26

5.26 Given the following C program, draw box-and-circle diagrams of the variables after each of the two assignments to **x (lines 11 and 15). Which variables are aliases of each other at each of those points? What does the program print?

```
(1)  #include <stdio.h>
(2)  main()
(3)  { int **x;
(4)    int *y;
(5)    int z;
(6)    x = (int**) malloc(sizeof(int*));
(7)    y = (int*) malloc(sizeof(int));
(8)    z = 1;
(9)    *y = 2;
(10)   *x = y;
(11)   **x = z;
(12)   printf("%d\n",*y);
(13)   z = 3;
(14)   printf("%d\n",*y);
(15)   **x = 4;
(16)   printf("%d\n",z);
(17)   return 0;
(18) }
```

5. [10 points] Consider the context-free grammar G:

S → aSbS

S → bSaS

S → ε

Show that G is ambiguous by giving two parse trees for the string bbaaba

6. [15 points] Question 8.9 Give the output of the following program using call-by-value, call-by-reference, and call-by-name.

```
int i;
int a[3];

void swap( int x, int y)
{ x = x + y;
  y = x - y
  x = x - y
}

main()
{ i = 1;
  a[0] = 2;
  a[1] = 1;
  a[2] = 0;
  swap(i,a[i]);
  printf("%d %d %d %d\n", i, a[0], a[1], a[2]);
  swap(a[i],a[i]);
  printf("%d %d %d\n", a[0], a[1], a[2]);
  return 0;
}
```

7. **[20 points] Let input.txt** be a file containing a sequence of strings. The strings are separated using new lines. Write a Perl program **match.pl** which reads a file **input.txt** and print (1) strings that contain "hi", (2) strings that contain exact one vowel characters (i.e. a, e, i, o, u), and (3) strings that contain two or more `l', and (4) strings that begin with the letter "h" and end with the letter "t". Assume that input.txt contains only characters a-z.

For example, assume that input.txt is:
day
thill
helolol
hot
hotu

Output:
day contains one vowel characters
thill contains hi
hill contains two or more l
helolol contains two or more l
hot begins with h and ends with t

Submission guideline

You need to hand in your assignment electronically using the blackboard, which contains:

- readme, which contains the name and email address of group members
- assignment2.pdf, which contains solution to the problems 1-6.
- match.pl

Please place the above files under one directory with a unique name (such as p2-[userid] for assignment 2, e.g. p2-pyang).
Tar the contents of this directory using the following command.

tar –cvf [directory_name].tar [directory_name]

E.g. tar -cvf p1-pyang.tar p1-pyang/

Use the Blackboard to upload the tared file you created above.