Assignment 2

Due: 11:59 Feb. 26th (Monday)

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

1. [10 points] Let L be a language over the alphabet ∑= {a,b} that contains strings over {a,b} such that **each string has at least one a** and every a is immediately followed by **odd number (1, 3, 5, …) of** bs. E.g. bab, bbab, bbbab, ab, abab, abbb, ababbb, abbbab,… Give a regular expression that describes L.

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

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. [16 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. [14 points] Question 8.9 Give the output of the following program using 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;
}
```

6. [30 points] Let input.txt be a file containing a sequence of strings. Each string is in a separate line. Write a Perl program **match.pl** which reads a file **input.txt** and prints (1) strings that contain the text "or", (2) strings that contain at least two vowel characters (i.e. a, e, i, o, u), (3) strings that do not start with "h", (4) strings that have "e" as the second symbol, and end with the letter "y", and (5) strings that contain both letters and digits. Assume that input.txt contains only letters a-z and digits 0-9.

E.g. input.txt:
today
lord
tomorrow
helloy
helloa
abc34

Output:
today contains at least two vowel letters
today does not start with h
lord contains or
lord does not start with h
tomorrow contains or
tomorrow contains at least two vowel letters
tomorrow does not start with h
helloy contains at least two vowel letters
helloy has e as the second symbol and ends with y

helloa contains at least two vowel letters
abc34 does not start with h
abc34 contains both letters and digits

We will store the testcases in file input.txt and use command "perl match.pl" to test your program.

Submission guideline

You need to hand in your assignment electronically using the blackboard, which contains:
- readme, which contains the name and the email address of group members
- assignment2.pdf, which contains solution to the problems 1-5.
- match.pl, which contains code for problem 6.

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 p2-[userid].tar p2-[userid]

E.g. tar -cvf p2-pyang.tar p2-pyang/

Upload the tared file you created above to mycourses.