Assigned Tu 2/13/2007, due We 2/21/2007 at 1pm.

How to Submit Homework Assignments

Email your answers, in either plain text format or as pdf, to Long Lin <llin@cs.nyu.edu>. Assignments are due on Wednesdays at 1pm. This deadline will be strictly enforced.

Reading Assignments

- For lecture on 2/13/2007: Scott 7.7.1-7.7.2 and Drexel 1-10 (http://einstein.drexel.edu/courses/CompPhys/General/C_basics/)
- For lecture on 2/20/2007: Scott 7, skip the parts on CD

Homework Assignments


2. (18 points) Consider the following C program:

   ```c
   #include <stdlib.h>
   int main(int argc, char** argv) {
   double* x = (double*)malloc(10 * sizeof(double));
   int y[25][25];
   double* a = &(x[5]);
   int b = a - x;
   int c = (int*)a - (int*)x;
   int d = (char*)a - (char*)x;
   int (*e)[25] = y + 4;
   int* f = 4 + y[3];
   return 0;
   }
   ```

Assume that this program runs on an architecture where pointers are 4 bytes large, and the sizes of char, int, and double are 1, 4, and 8 bytes, respectively. Further assume that the value of pointer variable x is the address 100, and the value of pointer variable y is the address 1,000. What are the values of variables a, b, c, d, e, and f just before the return statement?
3. a. (3 points) Describe, in one short sentence, what a memory leak is.
   b. (4 points) Write a program in C that has a fatal memory leak.
   c. (2 points) Explain how the leak from (3c) manifests itself at runtime.
   d. (3 points) Describe, in one short sentence, what a dangling reference is.
   e. (4 points) Write a program in C that has a dangling reference that affects the program output.
   f. (2 points) Explain how the leak from (4c) manifests itself at runtime.

4. (0 points: This question is optional. It will not be graded, but there will be example solutions. It is an opportunity for you to continue teaching yourself C if you don’t already know it well.)

   a. Write a small example program using I/O. Your program should read user input from stdin. You can assume that no lines are longer than 100 characters. It should write the number of characters and the number of words of each line of user input to stdout. When the user enters an empty line, your program should terminate. Here is an example interactive session:

   this is user input
   19 characters, 4 words
   hello
     6 characters, 1 words

   b. Write a small example program using types. For each line of output below, your program should first create a variable with the specified name, type, and value, and then print that variable. The output should look like this:

   name i, type int, value 42
   name c, type char, value Z
   name s, type string, value hello
   name f, type float, value 3.141
   name a, type int array, value { 1, 4, 9, 16 }

   c. Write a small example program using control flow. Your program should contain an if/else statement, a switch/break/default statement, a while loop, a for loop iterating over an array, a function definition, and a function call.

   d. Write a small example program using libraries. Your program should print the current date and time. An example output is date 01/23/2007, time 13:21.