Assignment 2

CSE 326: Data Structures and Algorithms

Autumn Quarter, 1999, University of Washington.

Steven Tanimoto, Instructor

Due Wednesday, October 13.

The pencil-and-paper parts of the assignment are due at the beginning of class. The C++ program must be submitted via the turnin program by 5:00 PM that day.

1. Problem 1 on page 65 of Lewis and Denenberg.

2. Problem 3a.

3. Problems 4a and b.

4. Do problem 6, but with the following changes. Choose any base b between 2 and 16 (e.g., 10). Your program should perform its arithmetic in that base. Allow the integers to have any number of digits (perhaps using a #define directive in your C++ program).

   Besides comparing the running times for simply multiplying a pair of n-digit numbers as mentioned in the problem in the book, also use your multiplication procedures to compute $n!$ for $n = 3, 4, \ldots$ up through at least 8 or 9 and ideally 10 or more. Print the results of computing $n!$ in both your base b used for computing it and base 10. (If you compute in base 10, then you don't have to do any output conversion here.)

   Collect timing information of two types: (1) running time as measured using library calls in the time library (include time.h), and (2) a count of the number of iterations processed in the innermost of each of your possibly nested loops.

   Your program, when run, should begin by multiplying together pairs of numbers of increasing lengths (1-digit numbers, then 2-digit numbers, etc., up through 50-digit numbers – the numbers themselves can be random), and then it should compute 3!, 4!, etc., up through at least 8! and better up to around 15!. It should indicate the two times (elapsed and number of loop-body executions) for each output. Each output line should therefore contain: (a) a description of what is being computed, such as "1492 x 1776", (b) the answer in the special base b (if not base 10), (c) the answer in base 10, (d) the elapsed time for the grade-school algorithm, (e) the number of loop-body executions for the grade-school algorithm, (f) the elapsed time for the clever algorithm, (g) the number of loop-body executions for the clever algorithm.

5. Problem 15.

6. Problem 16.