ASSIGNMENT #2: C++ ARRAYS

DUE DATE WITH D2L: WEDNESDAY, SEPTEMBER 23, 2015 AT 11:30PM
THE PRINTED COPY DUE AT THE BEGINNING OF THE FRIDAY LAB AT 8:30AM, SEPT. 25

THE PURPOSE OF THIS ASSIGNMENT IS

- to write a complete C++ program that uses (static) arrays
- to do a simulation and to learn to use the random number generator
- to learn to analyze a program's results

READINGS

Read §2.8, §3.9, §4.4, §4.6, §5.8, §6.14, Appendix D and chapters 7 and 8 of the textbook.

Do the Check Point exercises as needed but don't hand them in. Note that the answers to the Check Point exercises are in http://www.cs.armstrong.edu/liang/cpp3e/solution.html

PROGRAM

Write a program that estimates the probability P that if N people are in a room, at least two people in that room will have the same birthday.

By the same birthday, we don't mean the same date of birth, we mean the same day and the same month in a year that is not a leap year.

The 'birthday paradox' is described as follows: for relatively small values of N, there is a surprising high probability that two people in the same room happen to share the same birthday.

Write a program to implement the 'birthday paradox'. Your program will use simulation to approximate the value of P for the given value of N as follows:

- Your program should read in N, which is the number of people in the room, and it should read T, which is the number of trials.
- Run a trial or experiment (of determining whether at least 2 people in the room have the same birthday) T times and then count the number of those trials C where at least two people in the room do have indeed the same birthday.
- Output the value N and the value of C/T which will be an estimate for P.
- Repeat for several values of N printing their corresponding estimated value P, in fact, choose and print a reasonable range of values for N with their estimated probabilities P. (To clarify what a range means here is that you could read a starting value of N and then compute the next few (10?) values for a range from N to N + 10?)

Note: the larger the value you use for T, the more accurate C/T will be for the probability P. Make T, which is the number of trials, to be at least 3000.

Of interest in the birthday paradox is finding the smallest value of N such that P is 0.5. That is, for such a value of N there is a 50/50 chance that two people have the same birthday in the room. Before you run the experiment, guess what the value of N should be (just for fun – you don't need to include your original guess). Run your program and see. The value of N that you are looking for should be less than 30. (Thus the values for the range of N should be less than 30 and greater than some another value.)

IMPLEMENTATION DETAILS

Document your functions and your program completely. Modularize (use functions) as needed. You don't need to name the variables in your program N and T just because I used them for the problem description above. I am using those names to describe the problem using English (and a bit of Math). If you do use short variable names, explain what they are used for in you code. Do not assume that the person reading your program has read this assignment sheet, in other words, your program should have enough comments for someone to understand the code.

TO SUBMIT WITH D2L AS A SINGLE ZIP FILE:

1. The source code.
2. The results from your simulation for a range of values of N as described above and their estimated Ps. Your output could be in a file or as screen shots.
3. A brief write-up about your conclusion as to which is the smallest value of N such that P is as close as possible to 0.5. Explain using **your** results. Do not put your conclusions in the "Comments" box of the Dropbox in D2L.

TO PRINT ON PAPER AND TO HAND IN:

Print 1., 2., 3. and submit them at the beginning of the lab.

The above assignment is based on the Programming Project 8 of chapter 5 of *Absolute C++* by Walter Savitch and Kenrick Mock, 5th edition, Pearson Education, Inc., 2012.