ECE 205 SPRING 2026

Homework 2

Use functions for each problem using appropriate return types output the results in a neat way.

1. **(25 pts)** Write a program that calculates the gravitational attractive force between two bodies with masses m_1 and m_2 separated by a distance d as follows:

$$F = \frac{G*m_1*m_2}{d^2},$$

where $G = 6.673 \times 10^{-8}$ cm³/(g*sec²). Use the built-in pow(x,y) function from the cmath library to obtain the square of the distance. Masses will be given in units of kg (1 kg = 1000g). The use of the formula above will produce a result measured in dynes, where 1 dyne = 1 cm³/(g*sec²). Define the gravitational constant above as a constant. Design the program such that a user can repeat the code as many times as they want (this will make it necessary to get some user input to repeat or not).

2. **(25 pts)** Assume you have a file named scores.txt stored in the same folder as your main.cpp file. The file contains 5 exam scores and no other information. Write a program to compute the average and standard deviation of these scores. Standard deviation is defined as the square root of the differences of each individual squared score from the average. For more information: https://www.mathsisfun.com/data/standard-deviation.html or Wikipedia. Output the average and standard deviation (with 2 decimal digits of precision) to both the console and a file named output.txt stored in the same folder as main.cpp.

3. **(25 pts)** Write a program that asks for the user's height, weight, and age, and then computes clothing sizes according to the following formulas:

- Hat size = 2.9 multiplied by weight in pounds divided by height in inches.
- Jacket size = height multiplied by weight divided by 288. The value is then further adjusted by adding 1/8 of an inch for each 10 years over 30 years of age (only adjust for 10 full years, not a fraction thereof).
- Waist size = weight divided by 5.7. The value is then further adjusted by adding 1/10 of an inch for each 2 years over age 28 (only adjust for 2 full years, not a portion thereof).

Output the results in a neat way to the console.

4. **(25 pts)** You have 4 identical prizes to give away to a pool of 25 finalists. The finalists are assigned number from 1 to 25. Write a program to randomly select the number of the 4 finalists that will receive prizes. Make sure not to pick the same finalist more than once (e.g.: picking finalists 3, 15, 22, 24 is valid, but 3, 3, 22, 26 is not since 3 is selected more than once and also since finalist 26 does not exist.)