ECE 175 Homework Assignment 1

Due Date: by 11.59 pm on Tuesday September 7, 2021

Submission Instructions: Submit only .c flies in the designated Assignment Dropbox on D2L.

Conventions: Name your C programs as *hw**x**p**y**.c*
where ***x*** corresponds to the homework number and ***y*** corresponds to the problem number.
For example, the C program for homework 1, problem 1 should be named as *hw**1**p**1**.c*

Write comments in your programs. Programs with no comments will receive PARTIAL credits. For each program that you turn in, at least the following information should be included at the top of the C file:
Author:
Date created:
Brief description of the program:
input(s):
output(s):
an algorithm (steps to solve a given problem)

Problem 1 (35 points): digit swaps and average
Write a C program that
- reads one 4-digit positive integer
- generate two new numbers by
  - reversing every digit position (e.g., given 1234, a new number is 4321)
  - finding a product of each digit (e.g., given 1234, a new number is 1*2*3*4 = 24)
- find average from an entered number and two new numbers
- display the output as shown in the sample code execution below

Note: a) The number entered by the user is guaranteed to be a 4-digit number and its thousandth digit will never be 0.
b) if your program uses 4 int variables (instead of 1 int variable) to accept a 4-digit number from a user, 25 points will be deducted.

Sample code execution 1: **bold** entered by a user
Enter a 4-digit number: **1357**
average of 1357, 7531, 105 is 2997.67

Sample code execution 2: **bold** entered by a user
Enter a 4-digit number: **1004**
average of 1004, 4001, 0 is 1668.33

More test cases that you can use to test your program:

input	
1754	average of 1754, 4571, 140 is 2155.00
9876	average of 9876, 6789, 3024 is 6563.00

1139 average of 1139, 9311, 27 is 3492.33
1414 average of 1414, 4141, 16 is 1857.00

Problem 2 (35 points) Projectile calculation

Projectile motion is a form of motion experienced by an object that is projected near the Earth's surface and moves along a curved path under the action of only gravity (source: https://en.wikipedia.org/wiki/Projectile_motion)

Given that a projectile be launched with an initial velocity v and at angle α, neglecting air resistance, The maximum height of projectile can be calculated as

$$h = \frac{v^2 sin^2 \alpha}{2g}$$

the maximum horizontal distance of projectile can be calculated as

$$x = \frac{v^2 \sin 2\alpha}{g}$$

g is a universal gravitational acceleration constant = 9.80665 m/s^2. Also, you may need a value for π. Use $\pi = 3.14159265$.

Write a C program that asks a user for a maximum height and an initial velocity and then finds and displays the firing angle in degrees that we should fire the ball and the maximum horizontal distance that the ball can travel.

Note: a function asin( ) in math.h can be used.

Sample program execution 1: **bold** entered by a user

Enter a maximum height (in m): **41.815**
Enter an initial velocity (in m/s): **40.5**
We should fire the ball at the angle of 45.00 degrees
The maximum horizontal distance is 167.2590 m

Sample program execution 2: **bold** entered by a user

Enter a maximum height (in m): **82.795**
Enter an initial velocity (in m/s): **75**
We should fire the ball at the angle of 32.50 degrees
The maximum horizontal distance is 519.8491 m

More test cases that you can use to test your program:

- If maximum height is 77.435 m and velocity is 45, the angle we should fire the ball is 60 degrees and the horizontal distance is 178.8271 m.
- If maximum height is 3.277 m and velocity is 30, the angle we should fire the ball is 15.5 degrees and the horizontal distance is 47.2667 m

Lab 1 Assignment (30 points) You will complete the lab 1 assignment when you attend your lab session after the homework 1 assignment is due.