COMP10120 Practical Set 2: Functions, Random Numbers and Recursion

Please read the questions carefully. Name each program based on your student number, the practical set number and question number. For this set (set 2), question 1 should be named 1234567s2q1.c where your student number replaces 1234567. All questions that you are submitting can be zipped into a single file called 1234567s2.zip, where 1234567 is your student number and s2 refers to set 2. This zipped file can be submitted via Moodle for grading.

Part 1 (Functions)

1. Write a function in C that calculates the volume of an ellipsoid when presented with all the measurements needed to calculate it. You should also provide implementation to test the function. The C program should calculate the volume of 4 ellipsoids by asking the user to specify the required measurements.

2. Write a function in C that calculates the day of the week based on a date. You should also provide implementation to test the function. For example, it should indicate that 16th April 1967 is a **Sunday**. You can test it with your birthday. The algorithm that you need to implement is Zeller's Congruence Algorithm*

*https://en.wikipedia.org/wiki/Zeller's_congruence

Part 2 (Random Numbers and Recursion)

3. Study the rules of the Thunderball lottery game from the UK National Lottery** and write a program in C that selects a random set of numbers for the Thunderball draw. The C program should give a different set of numbers each time.
*** https://www.national-lottery.co.uk/games/thunderball?icid=-:mm:-:mdg:tb:dbg:pl:co*

4. The greatest common divisor of integers x any y is the largest integer that evenly divides both x and y. Write a recursive function *gcd* that returns the greatest common divisor of x and y. The gcd of x and y is defined as follows: If y is equal to 0, then gcd (x,y) is x; otherwise gcd (x,y) is gcd (y, x%y).

Portfolio Ideas

1. Conversion of binary to decimal (base-2 to base-10) numbers and back is an important concept to understand as the binary numbering system forms the basis for all computer and digital systems. Using recursive techniques, write a C program to convert a decimal to binary. To show your understanding and reasoning of the approach, provide a demonstration of how the conversion works in comments at the start of the program.

   A sample screen would look like:
   Input a decimal number: 156
   Binary number 1 0 0 1 1 1 0 0

2. The Towers of Hanoi*** is a classic problem which can be solved using **recursion**. Write a C program which demonstrates the problem being solved by printing out the sequence of moves required to move all discs from the source tower to the destination tower.
   *** https://en.wikipedia.org/wiki/Tower_of_Hanoi