

1806ICT Programming Fundamentals

Workshop Week 4: Functions

Please complete these exercises before your workshop.

1. Write a program to find the greatest common divisor (gcd) of two positive integers. The greatest common divisor of two integers is the largest integer value that evenly divides the two integers. Define a function that takes in the two integers and returns the gcd to the main program.

Sample Run:

Input	Output
15 10	5
48 24	24

2. The least common multiple (lcm) of two positive integers u and v is the smallest positive integer that is evenly divisible by both u and v . Thus, the lcm of 15 and 10, written as $\text{lcm}(15, 10)$, is 30 because 30 is the smallest integer divisible by both 15 and 10. Write a function $\text{lcm}()$ that takes two integer arguments, and returns their lcm.

Sample Run:

Input	Output
15 10	30
48 24	48

3. An integer is said to be a prime number if it is divisible by 1 and itself. For example, 2, 3, 5, and 7 are prime numbers, but 4, 6, 8, and 9 are not. Write a function that determines if a number is prime.
4. An integer is said to be a perfect number if its factors, including 1 (but not the number itself), sums to the number. For example, 6 is a perfect number because $6 = 1 + 2 + 3$. Write a function that prints out all perfect numbers between 1 and 1000.
5. Write a coin tossing program. The program should use a function $\text{flipCoin}()$ that returns 0 for tails and 1 for heads. Use a loop to flip the coin 1000 times, and count the number of times each side of the coin appears.

6. Write a program that plays the game “Guess a number”.
 - a. The program will initially choose an integer number (from the range 1 to 1000) to be guessed.
 - b. The program will prompt the user to enter a guess.
 - c. If the guess is correct, the program will output “Congratulations! You guessed it!”
 - d. If the guess is incorrect, the program will either output “Too low, please guess again.” or “Too high, please guess again”, depending on whether the guess is lower or higher than the correct answer.
 - e. The program will loop infinitely until the user guesses correctly.

Use functions in your program.

7. Following on from Q6, now turn the problem in Q6 around.
 - a. Ask the user to select a number, and the program will guess the number.
 - b. The program will ask the user if the guess is correct, higher or lower.
 - c. The user will enter an appropriate response accordingly (e.g. 0 for correct, 1 for higher, 2 for lower)
 - d. The program must implement a sensible guessing strategy.

Use functions in your program.

8. The Goldbach conjecture says that every even integer n that is greater than 2 has the property that it is the sum of two prime numbers. Using your solution from Q3, write a program that will prove that the conjecture is true for all even integers between two numbers that you will input into the program.

Sample Run:

Input	Output
4 10	$4 = 2 + 2$ $6 = 3 + 3$ $8 = 3 + 5$ $10 = 3 + 7$
40 50	$40 = 3 + 37$ $42 = 5 + 37$ $44 = 3 + 41$ $46 = 3 + 43$ $48 = 5 + 43$ $50 = 3 + 47$

9. A Fibonacci series is a series of numbers: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, ... where the next number is found by adding up the two numbers before it. Write a function that will find the n^{th} integer in the Fibonacci series.

Sample Run:

Input	Output
0	0
1	1
2	1
3	2
4	3
5	5
6	8

10. Write a program that will convert a decimal number to its binary equivalent. Use functions in your program.

Sample Run:

Input	Output
15	1111
27	11011