

CS1028 Practical 7

Programming for Sciences and Engineering

1 November, 2019

QUESTIONS:

1. Compose a function `max3()` that takes three int or float arguments and returns the largest one.
2. Compose a function `odd()` that takes three bool arguments and returns True if an odd number of arguments are True, and False otherwise.
3. Compose a function `majority()` that takes three bool arguments and returns True if at least two of the arguments are True, and False otherwise. Do not use an if statement.
4. Compose a function `areTriangular()` that takes three numbers as arguments and returns True if they could be the sides of a triangle (none of them is greater than or equal to the sum of the other two), and False otherwise.
5. Compose a function `sigmoid()` that takes a float argument x and returns the float obtained from the formula: $1/(1 - e^{-x})$.
6. Compose function `lg()` that takes an integer n as an argument and returns the base-2 logarithm of n . You may use Python's math module.
7. Compose a function `lg()` that takes an integer n as an argument and returns the largest integer not larger than the base-2 logarithm of n . Do not use the standard Python math module.

8. Compose a function `signum()` that takes a float argument n and returns -1 if n is less than 0, 0 if n is equal to 0, and +1 if n is greater than 0.

ADVANCED QUESTIONS:

Once you have completed the questions above and feel sufficiently confident, feel free to try these harder questions.

1. Write a function that takes a positive integer as input and returns its prime decomposition as a list of numbers.

Prime decomposition: Any positive integer n can, in a unique way, be written as a product of prime numbers. This is called the prime decomposition of n . Examples:

$$12 = 2 * 2 * 3$$

$$13 = 13$$

$$14 = 2 * 7$$

$$15 = 3 * 5$$

$$16 = 2 * 2 * 2 * 2$$

$$17 = 17$$

Hint: Practical 4 had a question on counting primes. Its solution may come in handy here.

2. If you still do not feel sufficiently challenged: Euler's totient function. Euler's totient function is an important function in number theory: $\varphi(n)$ is defined as the number of positive integers less than or equal to n that are relatively prime with n (no factors in common with n other than 1). Compose a function that takes an integer argument n and returns $\varphi(n)$. Include global code that takes an integer from the command line, calls the function, and writes the result.