

COMP 10280 Programming I (Conversion)

Practical Sheet 16

Dé Máirt, 17 Deireadh Fómhair 2023

For each of the following questions, write an algorithm in pseudocode first before writing a Python program. Submit your algorithms in pseudocode as well as your Python programs.

When writing functions, use one-line or multi-line docstrings, as appropriate, to document your functions.

1. Consider the following series, defined recursively as follows:

$$f(n) = \begin{cases} 2 & n = 1 \\ 2 \times f(n-1) & n > 1 \end{cases}$$

- (a) Write a recursive function that takes as its single argument an integer ≥ 1 and prints out that number of terms from the above series.
- (b) Write a program that prompts the user for a series of integers. For each number entered the program should check that it is greater than or equal to 1. If it is, it calls the function defined in part (a). The program should stop when a zero or a negative number is entered.
- (c) In your function, include some print statements that allow you to see the operation of the recursion and its progress towards the base case.

Save this program as p16p1.py.

2. Implement the program to calculate common divisors from Lecture 16. You may use the solution on Pages 14–17 of the slides in your solution.

Save this program as p16p2.py.

3. A *perfect number* is a positive integer that is equal to the sum of its proper factors (its positive integer factors excluding the number itself). For example, 6 (with proper factors 1, 2 and 3) and 28 (with proper factors 1, 2, 4, 7 and 14) are perfect numbers.

Write a program that prompts the user for a positive integer and finds all the perfect numbers up to and including that number.

Save this program as p16p3.py.

**Please upload your work to
the Brightspace site before Wednesday
evening.**

**You should keep a copy of your programs
for your portfolio.**