COMP 10280
Programming I (Conversion)
Practical Sheet 15
Thursday, 14 November 2017

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:

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

   (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 `p15p1.py`.

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

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

   (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 `p15p2.py`.

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

$$f(n) = \begin{cases} 13 & n = 0 \\ 8 & n = 1 \\ f(n-2) + 13 \times f(n-1) & n > 1 \end{cases}$$

   (a) Write a recursive function that takes as its single argument an integer ≥ 0 and prints out that number of terms from the above series (Assume that the 0th term is the first term).

   (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 0. If it is, it calls the function defined in part (a). The program should stop when 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 cases.

   Save this program as `p15p3.py`.

Please upload your work to the Moodle site before Wednesday evening.

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