

Models and Simulations: Problem Set 6

Recursion

Exercise 1: Generate all Subsets

On the course website, I have posted a file called “Generate_Subsets.” Your job is to complete the procedure called “subsets” contained in the file so that it lists all subsets of the positive whole numbers between 1 and some number n which is determined by the user. For example, if the user enters 4 as input, then your program ought to produce the following output:

Output:

There are 16 subsets of the integers [1 2 3 4], namely,

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[[[] [1] [2] [3] [4] [1 2] [1 3] [1 4] [2 3] [2 4] [3 4] [1 2 3] [1 2 4] [1 3 4] [2 3 4] [1 2 3 4]]]
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Use recursion. You need only write a few lines of code to finish the program; there few than ten additional lines of code in my solution.

Exercise 2: Turtles of Hanoi

On the course website, I have posted a file called “Turtles of Hanoi.” Your job is to complete the procedure called “move_turtles” contained in the file so it solves the following puzzle. The puzzle requires moving a stack of blocks from one table to another. There are three tables, and the blocks are of different sizes. There are three rules, however, that constrain how one is permitted to move the blocks. First, one can move only one block at a time. Second, when a block is moved, it must be placed either (i) on top of another stack of blocks or (ii) on one of the three tables. Finally, although one can stack blocks on top of each other, one cannot place a larger block on top of a smaller block.

This is a well-known puzzle, and there are many solutions on the internet. Please think about the problem before running a Google search to find an answer. This is an excellent exercise to gain experience writing recursive functions. You need only write a few lines of code to finish the program; there are fewer than ten additional lines of code in my solution. Before writing any code, I recommend writing pseudo-code describing how you would solve the problem.