Chapter 1 Homework

Due date: Nov. 2, 2017

Program Exercises

1. There are three stacks and 64 items of different values in the the first stack. The items are placed in a decreasing order in the first stack. That is, the value of the item stored at the *top* is the smallest one among the values of 64 items. The value of the item stored at the *bottom* is the largest one among the values of 64 items. Write a recursive function to move all items from the first stack to the third stack.
   Requirements:
   a. Only one item can be moved at any time.
   b. No item can be placed on the top of an item with a smaller value. The second stack can be regarded as a temporary stack.
   c. Print out the sequence of moves needed to complete this task.
2. The Fibonacci numbers are defined as: $f_0=0$, $f_1=1$ and $f_i=f_{i-1}+f_{i+2}$ for $i>1$. Write both a recursive and an iterative C function to compute f_i. That is, the input is i and the output is f_i.

Exercises

1. Prove that if $f(n)=a_m n^m+\ldots+a_1 n+a_0$ and $a_m>0$, then $f(n)=\Omega(n^m)$
2. Prove that if $f(n)=a_m n^m+\ldots+a_1 n+a_0$ and $a_m>0$, then $f(n)=\Theta(n^m)$
3. Determine the space complexity of the iterative and recursive Fibonacci number function in the **Program Exercise** 2. (Please provide your code in **Program Exercise** 2 briefly to elaborate space complexity analysis)
4. Find the Θ function of the followings.
   a. $n^{1.001}+n\log n$
   b. $n^k+n+n^k\log n$
   c. $n^2/\log n$
   d. $\sum_{i=0}^{n} i^3$
5. Find the O function of the followings.
   a. 3^n
   b. $n!$
   c. $6n^3/(\log n+1)$
   d. $10n^3+15n^4+100n^2 2^n$