CS381 Homework 0 Problem 2

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1 Exercise 2.1.2

Recursive Spec The spec is CyclicHanoi(n, A, B, C) where rings are moved from A to B stacked in sorted order.

Recursive Algorithm

`CyclicHanoi(`n`, `A`, `B`, `C`)`

1. If $n > 0$
   A. CyclicHanoi($n-1$, A, C, B)
   B. Move top ring from A to B
   C. CyclicHanoi($n-1$, C, B, A)

2 Exercise 2.1.3

Recursive Spec The spec is DoubleCyclicHanoi(n, A, B, C) where rings are moved from A to C stacked in sorted order.

Recursive Algorithm

`DoubleCyclicHanoi(`n`, `A`, `B`, `C`)`

1. CyclicHanoi(n, A, B, C)
2. CyclicHanoi(n, B, C, A)

3 Exercise 2.1.4

Recursive Spec The spec is ThickHanoi($3n$, A, B, C) where all $3n$ rings are moved from A to B stacked in sorted order.

Recursive Algorithm

`ThickHanoi(`$3n$`, `A`, `B`, `C`)`

1. If $n > 0$
   A. ThickHanoi($3(n-1)$, A, C, B)

B. Move top ring from A to B
C. Move top ring from A to B
D. Move top ring from A to B
E. ThickHanoi($3(n-1)$, C, B, A)

4 Exercise 2.1.5

Recursive Spec The spec is TripleHanoi($3n$, A, B, C) where $3n$ rings are moved such that n distinct rings are on each post, one of each size, stacked in sorted order.

Recursive Algorithm

TripleHanoi($3n$, A, B, C)

1. If $n > 0$
   A. Towers-of-Hanoi($3n-1$, A, B, C)
   B. Towers-of-Hanoi($3n-2$, B, C, A)
   C. Towers-of-Hanoi($3n-3$, C, A, B)
   D. TripleHanoi($3(n-1)$, A, B, C)

5 Exercise 2.1.6

Recursive Spec The spec is AmericanHanoi(n, Red, $White$, $Blue$) where n colored rings are moved to the post with the matching color stacked in sorted order.

Recursive Algorithm

AmericanHanoi(n, Red, $White$, $Blue$)

1. If $n > 0$
   A. If bottom ring of Red is white
      1. Towers-of-Hanoi($n-1$, Red, $Blue$, $White$)
      2. Move top ring of Red to $White$
      3. Towers-of-Hanoi($n-1$, $Blue$, Red, $White$)
   B. If bottom ring of Red is blue
      1. Towers-of-Hanoi($n-1$, Red, $White$, $Blue$)
      2. Move top ring of Red to $Blue$
      3. Towers-of-Hanoi($n-1$, $White$, Red, $Blue$)
   C. AmericanHanoi($n-1$, Red, $White$, $Blue$)

6 Exercise 2.1.8

My variant is called "AustralianHanoi".

Recursive Spec The spec is AustralianHanoi(n, A, B, C) where n rings are moved from A to B in the reverse order they started in. Crikey!

Recursive Algorithm

AustralianHanoi(n, A, B, C)

1. If $n > 0$
   A. Move the top ring from A to B
   B. AustralianHanoi($n - 1$, A, B, C)