Assignment 01

**Task:** imple ment the tower of hannoi

|  |
| --- |
| .data |
|  | Author: |
|  | .ascii "Towers of Hanoi\n" |
|  | .asciiz "Author: Austin Corso\n" |
|  | Prompt: |
|  | .asciiz "\nEnter the number of disks: " |
|  | Move: |
|  | .asciiz "\nMove disk from " |
|  | To: |
|  | .ascii " to " |
|  | .globl main |
|  | .text |
|  |  |
|  | main: |
|  | li $v0, 4 #Print author and program info |
|  | la $a0, Author |
|  | syscall |
|  |  |
|  | li $v0, 4 #Print prompt |
|  | la $a0, Prompt |
|  | syscall |
|  |  |
|  | li $v0, 5 |
|  | syscall |
|  | add $a0, $v0, $zero #$a0 = num of disks |
|  |  |
|  | addi $a1, $zero, 1 #$a1 = start peg |
|  | addi $a2, $zero, 3 #$a2 = end peg |
|  | addi $a3, $zero, 2 #$a3 = extra peg |
|  | jal hanoi\_towers |
|  |  |
|  | li $v0, 10 # Return control to OS |
|  | syscall |
|  |  |
|  | hanoi\_towers: |
|  | # if (num\_of\_disks == 1) |
|  | # move disk to end\_peg |
|  | # else |
|  | # hanoi\_towers(num\_of\_disks-1, start\_peg, extra\_peg, end\_peg) |
|  | # move disk from start\_peg to end\_peg |
|  | # hanoi\_towers(num\_of\_disks-1, extra\_peg, end\_peg, start\_peg) |
|  |  |
|  |  |
|  | # if (num\_of\_disks == 1) |
|  | addi $t0, $a0, 0 # temp save $a0 |
|  | addi $t1, $zero, 1 |
|  | bne $a0, $t1, else |
|  | li $v0, 4 # print move |
|  | la $a0, Move |
|  | syscall |
|  | li $v0, 1 # print start\_peg |
|  | move $a0, $a1 |
|  | syscall |
|  | li $v0, 4 # print to |
|  | la $a0, To |
|  | syscall |
|  | li $v0, 1 # print end\_peg |
|  | move $a0, $a2 |
|  | syscall |
|  | addi $a0, $t0, 0 # restore $a0 |
|  | jr $ra |
|  |  |
|  | else: |
|  | #expand stack |
|  | addi $sp, $sp, -20 |
|  |  |
|  | #save to stack |
|  | sw $ra, 16($sp) |
|  | sw $a3, 12($sp) #store a3(extra\_peg) |
|  | sw $a2, 8($sp) #store a2(end\_peg) |
|  | sw $a1, 4($sp) #store a1(start\_peg) |
|  | sw $a0, 0($sp) #store a0(num\_of\_disks) |
|  |  |
|  | #hanoi\_towers(num\_of\_disks-1, start\_peg, extra\_peg, end\_peg) |
|  | #set args for subsequent recursive call |
|  | addi $t3, $a3, 0 #copy var into temp |
|  | addi $a3, $a2, 0 #extra\_peg = end\_peg |
|  | addi $a2, $t3, 0 #end\_peg = extra\_peg |
|  | addi $a0, $a0, -1 #num of disk-- |
|  | #recursive call |
|  | jal hanoi\_towers |
|  |  |
|  | #load off stack |
|  | lw $ra, 16($sp) |
|  | lw $a3, 12($sp) #load a3(extra\_peg) |
|  | lw $a2, 8($sp) #load a2(end\_peg) |
|  | lw $a1, 4($sp) #load a1(start\_peg) |
|  | lw $a0, 0($sp) #load a0(num\_of\_disks) |
|  |  |
|  | #move a disk from start\_peg to end\_peg |
|  | addi $t0, $a0, 0 # temp save $a0 |
|  | addi $t1, $zero, 1 |
|  | li $v0, 4 # print move |
|  | la $a0, Move |
|  | syscall |
|  | li $v0, 1 # print start\_peg |
|  | move $a0, $a1 |
|  | syscall |
|  | li $v0, 4 # print to |
|  | la $a0, To |
|  | syscall |
|  | li $v0, 1 # print end\_peg |
|  | move $a0, $a2 |
|  | syscall |
|  | addi $a0, $t0, 0 # restore $a0 |
|  |  |
|  | #hanoi\_towers(num\_of\_disks-1, extra\_peg, end\_peg, start\_peg) |
|  | #set args for subsequent recursive call |
|  | addi $t3, $a3, 0 #copy var into temp |
|  | addi $a3, $a1, 0 #extra\_peg = start\_peg |
|  | addi $a1, $t3, 0 #start\_peg = extra\_peg |
|  | addi $a0, $a0, -1 #num of disk-- |
|  | #recursive call |
|  | jal hanoi\_towers |
|  | #load params off stack |
|  | lw $ra, 16($sp) |
|  |  |
|  | #clear stack |
|  | addi $sp, $sp, 20 |
|  |  |
|  | #return |
|  | add $v0, $zero, $t5 |