CMPS 351: Spring 2013 Program #5
Date assigned: Thursday, February 14, 2013 Due: Thursday, February 28, 2013

This assignment asks you to write a MIPS program to solve the Tower of Hanoi problem for a given height using a recursive function. The goal of the Tower of Hanoi is to move a series of disks of varying sizes from peg #1 to peg #3. However, there are a couple of limitations: Only one disk can be moved at a time and no disk can be placed on top of a smaller disk. To allow us to solve this problem, there is also a second peg that we can use to hold disks as we gradually move them to the third peg. Since we must always have at least one disk to move, your program should quit if the user enters a number less than one when prompted for the number of disks to move.

The recursive solution has four steps. It begins with the termination condition that if there is only one disk to move, then it can be moved directly from the origin to the destination. Failing this, we have a recursive block with three steps. To move a stack, we must first move all but on disk to a temporary holding pin, we can then move the bottom disk to the destination, finally, we can move the stack from the temporary holding pin to the destination. This can be accomplished via the pseudocode shown below.

```
Tower (int disks, int origin, int destination, int
temporary) {
      if (disks == 1) {
            move disk from origin to destination;
            return;
      }
      Tower (disks-1, origin, temp, destination);
      move disk from origin to destination;
      Tower (disks-1, temp, destination, origin);
      return;
}
```

For this program, the move pseudocode operations can be handled simply by printing the origin and destination. The focus of this assignment is on creating the Tower function so that it can recurse to an arbitrary depth and return successfully. For those who are unfamiliar with this problem, Wikipedia has an extensive article on the subject including an animation for a four disk problem.

Your program should include appropriate comments indicating what the code should be doing and which registers are being used. Please include your name and CLID in the program headers and include your CLID in the file names. Your programs should be turned in through Moodle before class starts on the due date. You should test your programs using the SPIM simulator before submitting them.

Sample output:

How many disks need to be moved? 1
1 -> 3

How many disks need to be moved? 2
1 -> 2
1 -> 3
2 -> 3

How many disks need to be moved? 3
1 -> 3
1 -> 2

3 -> 2
1 -> 3
2 -> 1
2 -> 3
1 -> 3

How many disks need to be moved? 4
1 -> 2
1 -> 3
2 -> 3
1 -> 2
3 -> 1
3 -> 2
1 -> 2
1 -> 3
2 -> 3
2 -> 1
3 -> 1
2 -> 3
1 -> 2
1 -> 3
2 -> 3

How many disks need to be moved? 0

Objectives:

1. To review writing basic functions with the MIPS assembly language.
2. To introduce and practice writing recursive functions with the MIPS assembly language.
3. To introduce and practice manipulating the stack.

Point Values:
Total. 100pts