Assignment MIPS 3

Due Date: April 24

Purpose

In this assignment, you will try out MIPS subroutines, in the form of recursion. To do this properly, you must store local variables in the stack. This forces you to take care of the $sp and $fp pointers. *Follow the in-class and text examples carefully!*

Problem

Elon wants to go to Mars and other planets. He wants to know how many ways he could visit k planets out of N. For example, if $k = 2$ and $N = 4$ (say, A, B, C, and D), then he could visit AB, AC, AD, BC, BD, or CD = 6 ways. A function to calculate this is as follows:

```
int numWays (int n, int k) {
   if ((n == k) or (k == 0))
      return 1;
   else
      return numWays (n-1, k-1) + numWays (n-1, k);
}
```

Note for you mathematicians: There is a formula to find $\binom{N}{k}$*, but you are to write the above recursive solution in MIPS for this assignment!*

Input

The program should prompt for N and k, both integers. No error checking of the input is necessary.

Output

The output should simply be the number of ways k out of N planets can be visited. The output should also include the original values of k and N:

```
There are 6 ways that 2 planets can be visited out of 4.
```

Specifics

- You **must** do this recursively; no loops are allowed. In order for this to work properly, you must store local values in the stack before each new recursive call. Follow the sample program done in class. Note that it doesn't hurt to allocate a little more storage than you actually need.
- **Do not treat any registers as global variables!** We are attempting to simulate how a good recursive function written in a high-level language gets translated to assembly.
- Your recursive solution must follow the above function definition, even though there may be an easier way to compute this.
- Your `main` function should prompt the user for the input, call the recursive procedure, and display the results.
- For your own sanity, use good commenting style.

Notes

- You should follow the conventions shown in class and in the text. Following these will make coding easier. This will also be included as part of your grade.
- As usual, turn in your source code to me via Canvas, as usual, using the same naming convention as in: `mgousieMIPS3.s` or `mgousieMIPS3.asm`. Turn in a printed copy in class on April 25th.
- Note that the Crazy Model Expo is the following week and we have one more homework set. Schedule your time accordingly!

Recursion is when a function calls itself until it doesn't.
– Mattias Petter Johansson