

CPS 104 Homework-3:

Due: Monday October 7, 11:59pm.

(100 pts.)

Write a **MIPS** assembly program that reads four integers: **n, a, b, c**, $0 < n < 20$, and computes the value of **K(n, a, b)**;

The recursive function **K(n, a, b, c)** is defined as follows:

$$\mathbf{K(n, a, b, c) = H(n-1, c-1, a-1, b) + G(n, c+1, a, b-1)}$$

Where:

$$\mathbf{H(n, a, b, c) = \text{if}(n > 0) \{K(n-1, c-1, b-1, a) + G(n-2, c-1, a-1, b) + n\} \\ \text{else } \{3*a + 2*b + n - c + 1\}}$$

and

$$\mathbf{G(n, a, b, c) = \text{if}(n > 0) \{H(n-1, c-1, b+1, a) + K(n-2, b-1, c, a-1)\} \\ \text{else } \{a*b + c - 1\}}$$

Your program should read in four integers: **n, a, b, c**, check that the value of **n** is within the specified bounds, print out the input parameters, print out the function value, and print out a count of how many function calls were made in order to evaluate **K(, , ,)**.

Submit your program to the directory (folder) HW3.

Included here is the assignment-program written in **Java**. Your assembler program should have an *identical behavior* to the **Java** program. Please note that a short document on how to go about writing and debugging recursive functions is posted together with the assignment. You are also given an online version of the **Java** program.

```

import java.io.BufferedReader;
import java.io.IOException;
import java.io.InputStreamReader;
public class Kfun {
    /**
     * @param args
     * @throws IOException
     */
    static int count = 0;
    public static void main(String[] args) throws IOException {
        int n;
        int a;
        int b;
        int c;
        int kvalue;
        String m;
        BufferedReader in = new BufferedReader(new
        InputStreamReader(System.in));
        while (true) {
            System.out.print("Please enter n: ");
            m = in.readLine();
            System.out.println();
            n = Integer.parseInt(m);
            if (n > 16 || n < 1)
                System.out.println("wrong input, try again");
            else {
                System.out.print("Please enter a: ");
                m = in.readLine();
                System.out.println();
                a = Integer.parseInt(m);
                System.out.print("Please enter b: ");
                m = in.readLine();
                System.out.println();
                b = Integer.parseInt(m);
                System.out.print("Please enter c: ");
                m = in.readLine();
                System.out.println();
                c = Integer.parseInt(m);

                break;
            }
        }
        kvalue = kfun(n, a, b, c);
        System.out.println("The function value is: " + kvalue);
        System.out.println("The number of function calls is: " + count);
    }
}

```

```
public static int kfun(int n, int a, int b, int c) {
    count++;
    return (hfun(n - 1, c - 1, a - 1, b) + gfun(n, c + 1, a, b - 1));
}

public static int hfun(int n, int a, int b, int c) {
    count++;
    if (n > 0)
        return (kfun(n - 1, c - 1, b - 1, a) +
                gfun(n - 2, c - 1, a - 1, b) + n);
    else
        return (3 * a + 2 * b + n - c + 1);
}

public static int gfun(int n, int a, int b, int c) {
    count++;
    if (n > 0)
        return (hfun(n - 1, c - 1, b + 1, a) +
                kfun(n - 2, b - 1, c, a - 1));
    else
        return (a * b + c - 1);
}
}
```