Benchmark: "Multiplication Using Addition"

Author: Abdalrahman Alshannaq   *Reviewed by: "Abdullah Matar"*

Description & Notes

- Perform Multiplication Using Addition (A*B = A+A+A… B times)
- Complexity of the Benchmark depend on equation order (time for A*B not same as B*A)
- E.g. the operation "2*4" (4 iterations) takes more time than "4*2" (two iterations)
- Can perform multiplication between any two integer numbers by changing registers defined below
- A Function named Mul_Fun is used, which can be used in any other benchmark
- The Benchmark does not require access to Data Memory.

Algorithm (Pseudo or C)

```
num1 ← 5  // can be changed
num2 ← 3  // can be changed
Mul_Fun(num1, num2)

function Mul_Fun(num1, num2)
    out ← 0
    for i ← num2 - 1 down to 0 do
        out ← out + num1
    end for
end function
```

Registers and memory used in implementation

t8($24): num1

t9($25): num2

s7($23): output from Mul_Fun

s6($22): counter in Mul_Fun

Code (.data and .text)

```
.text

XORI $24, $0, 0x5            # num1 = 5
XORI $25, $0, 0x3            # num2 = 3

JAL Mul_Fun
J Finish

###########
Mul_Fun :
        ANDI $23, $0, 0      # mulOut = 0 (initilize)
        ADDI $22, $25, -1    # i = num2-1 (initilize by value of num2-1)

Mul_Loop :
        ADD  $23, $23, $24   # mulOut += num1
        ADDI $22, $22, -1    # i--
        BGEZ $22, Mul_Loop
        JR $31
##########

Finish : NOP
```

Expected Output

s7 ($23) = 0xf

Additional Note

- Try to change inputs, and note changing in execution time and results.