Russian Peasant Multiplication:

Russian Peasant Multiplication, also known as Ancient Egyptian Multiplication, is a multiplication algorithm that dates to ancient times. It's a way to multiply numbers using the process of halving and doubling without the use of a multiplication operator.

Formula:
Let n and m be 2 numbers to be multiplied.
Then,
if n is even
$nm = (n/2).(2m)$

if n is odd
$nm = (n-1)/2 . (2m) + m$
if $n=1$
$1.m = m$

Algorithm:

```
ALGORITHM RussianPeasantMul(n,m)


int res = 0;
while (n != 1)
if (n%2 != 0)
res= res + m;
n = n/2;
m = 2*m;

return res;
```

RISC-V Code:

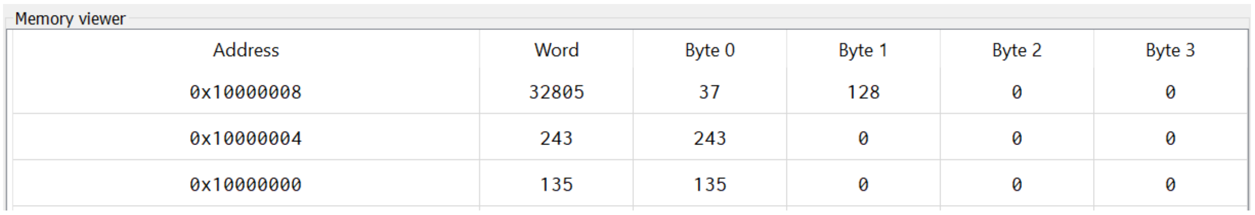
```
# Russian Peasant Multiplication in RISC-V Assembly Language


.data
    # Initialize the data section with the two numbers to be
multiplied
    num1:  .word 13
    num2:  .word 7
    result: .word 0


.text
    # Program starts at the .text section
    la x1, result
    # Load the first number into register t0
    lw t0, num1


    # Load the second number into register t1
    lw t1, num2


    # Initialize the result to 0
    li t2, 0


loop:
    # Check if the first number is odd
    andi t3, t0, 1
    beq t3, x0, skip_add


    # If the first number is odd, add the second number to the result
    add t2, t2, t1


skip_add:
    # Right-shift the first number (divide by 2)
    srli t0, t0, 1


    # Left-shift the second number (multiply by 2)
    slli t1, t1, 1
```

```
# Check if the first number is not zero, if yes, repeat the loop
bnez t0, loop


# Store the final result in the result variable
sw t2, 0(x1)

nop
```

Output:

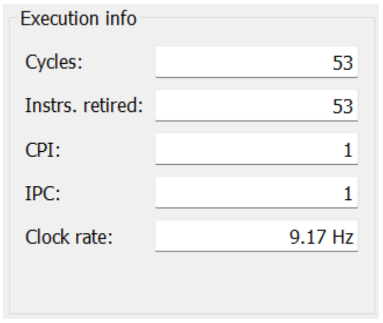
Expected results:
135*243 = 32805
135*(-897)= -121095

Obtained results:



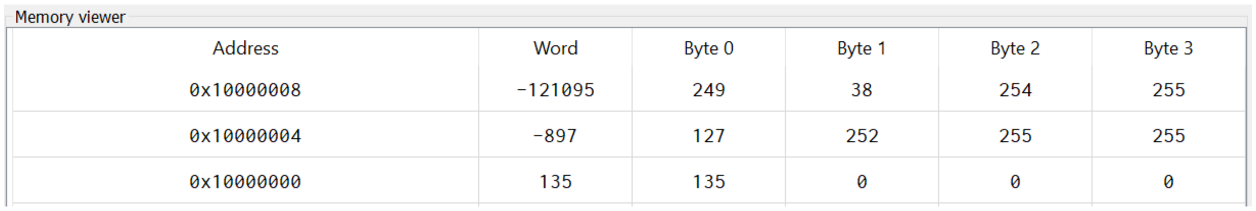
Memory viewer

Address	Word	Byte 0	Byte 1	Byte 2	Byte 3
0x10000008	32805	37	128	0	0
0x10000004	243	243	0	0	0
0x10000000	135	135	0	0	0



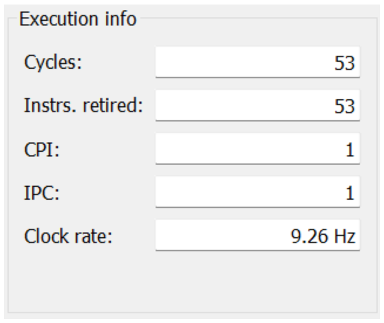
Execution info

Cycles:	53
Instrs. retired:	53
CPI:	1
IPC:	1
Clock rate:	9.17 Hz



Memory viewer

Address	Word	Byte 0	Byte 1	Byte 2	Byte 3
0x10000008	-121095	249	38	254	255
0x10000004	-897	127	252	255	255
0x10000000	135	135	0	0	0



Execution info

Cycles:	53
Instrs. retired:	53
CPI:	1
IPC:	1
Clock rate:	9.26 Hz