

Algorithmic Problem Solving

17ECSE309

Russian Peasant Multiplication

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The Problem

- Russian Peasant Multiplication is an alternative to the age old method of multiplication of two numbers.
- Previous method :
 - If we want to multiply two numbers, say 56 and 45, we first multiply 56 by 5 and then multiple 56 by 40 and then add both the results.
 - Highly time consuming when a lot of multiplication is to be carried out.

The Solution

- Russian Peasant offers an easier method for multiplication.
- Rules :
 - Write each number at the head of a column.
 - Double the number in the first column, and halve the number in the second column.
If the number in the second column is odd, divide it by two and drop the remainder.
 - If the number in the second column is even, cross out that entire row.
 - Keep doubling, halving, and crossing out until the number in the second column is 1.
 - Add up the remaining numbers in the first column. The total is the product of your original numbers.

Example

Write each number at the head of a column.

57	86
----	----

Double the number in the first column, and halve the number in the second column.

57	86
----	----

114	43
-----	----

If the number in the second column is even, cross out that entire row.

57	86
---------------	---------------

114	43
-----	----

Keep doubling, halving, and crossing out until the number in the second column is 1.

57	86
114	43
228	21
456	10
912	5
1824	2
3648	1

Add up the remaining numbers in the first column.

57	86
114	43
228	21
456	10
912	5
1824	2
<u>+ 3648</u>	1
4902	

Russian Peasant Function (Code)

```
unsigned int russianPeasant(unsigned int a, unsigned int b)
{
    int res = 0; // initialize result

    // While second number doesn't become 1
    while (b > 0)
    {
        // If second number becomes odd, add the first number to result
        if (b & 1)
            res = res + a;

        // Double the first number and halve the second number
        a = a << 1;
        b = b >> 1;
    }
    return res;
}
```

Applications

- Any application involving multiplication of two numbers is where this method can be applied.

References

- <https://www.geeksforgeeks.org/russian-peasant-multiply-two-numbers-using-bitwise-operators/>
- <http://mathforum.org/dr.math/faq/faq.peasant.html>