Assignment No. :

Problem Statement:

Program in C to multiply two numbers by Russian Peasant Multiplication.

Theory:

In mathematics The Russian peasant method one of two multiplication methods used by scribes, was a systematic method for multiplying two numbers that does not require the multiplication table, only the ability to multiply and divide by 2, and to add.

It decomposes one of the multiplicands (preferably the smaller) into a sum of powers of two and creates a table of doublings of the second multiplicand. This method maybe called mediation and duplation, where mediation means halving one number and duplation means doubling the other number. It is still used in some areas.

In actual figures, the multiplication of 26 and 278 is given below. When the number in the left column is even the entire row is crossed off (marked as '✘'). Except these rows, the numbers from the right columns of the other rows are selected for addition for the result of the multiplication.

✘	<u>26</u>	<u>278</u>
✔	13	556
✘	6	1112
✔	3	2224
✔	1	4448

Now, the result of the multiplication is : 556+2224+4448=7228

Algorithm:

Input specification: The numbers which needs to be multiplied, say a and b.

Output specification: Multiplication result of the numbers a and b.

Steps:

Step 1　Set p=x

Step 2　Set q=y

Step 3　Print p, q

Step 4　If (p%2!=0) Then

    i.　Set s=q

    ii.　Set a[0]=q

    iii.　i=i+1

Step 5　Else

    i.　Print "X(STRUCK OFF)"

    [End of If-else structure]

Step 6   Repeat through Step i to Step x For p=x to p>1

Step 7   Set p=p/2

Step 8   Set q=q*2

Step 9   Print p, q

Step 10   If (p%2!=0)

Step 11   Set s=s+q

Step 12   Set a[i]=q

Step 13   i=i+1

Step 14   count=count+1

Step 15   Else

Step 16   Print "X(STRUCK OFF)"
          [End of For loop]

Step 17   If (x%2=0)

      i. a[count]=0
          [End of If]

Step 18   Print a[0]

Step 19   Repeat step 9 For i=1 to count

Step 20   Print "+" a[i]

Step 21   i=i+1
          [End of For loop]

Step 22   Print s

Source Code:

```
#include<stdio.h>

#include<conio.h>

int main()

{

    int x,y,p,q,s,a[50],i,count; char ch;
```

```c
do{
    i=0;
    s=0; //initialization of the sum
    count=0;
    printf("Enter the numbers:");
    scanf("%d %d",&x,&y); //scanning of the numbers
    printf("\nThe multiplication method of %d & %d\nusing Russian
            Peasant Method is as follows:\n\n",x,y);
    p=x; //setting the values of the inputs to two temporary variables
    q=y;
    printf("%d\t\t%d",p,q);
    if(p%2!=0) //checking if the variable in the left column is odd or not
    {
        s=q; //setting sum to q when left column has odd number
        a[0]=q;
        i++;
    }
    else
        printf("X(STRUCK OFF)"); //when left column has even number
    while(p>1) //until left column has not reached 1
    {
        p=p/2; //dividing the left column by 2
```

```c
            q=q*2; //multiplying the right column by 2

            printf("\n%d\t\t%d",p,q);

            if(p%2!=0)

            {

                    s=s+q; //adding q to s when left column is odd

                    a[i]=q; //taking the values of q for printing

                    i++;

                    count++;

            }

            else

                    printf("X(STRUCK OFF)");

        }

        count--; /*decrementing count to avoid unnecessary garbage value

                storing*/

        printf("\n\nThe answer is:\n");

        for(i=0;i<=count;i++)

        {

                printf("%d+",a[i]); //printing the values of qs

        }

        printf("\b=%d",s);

        printf("\n\nWhich satisfies the statement %d*%d=%d",x,y,x*y);
loop:   printf("\nDo you want to continue?(Y/N)");
```

```c
        scanf(" %c",&ch);

        if(ch=='n'||ch=='N')

        return 0;

    }while(ch=='y'||ch=='Y');

    if(ch!='y'||ch!='Y')

    {

        printf("Wrong choice given");

        goto loop; //shifting the control to the continuity part

    }

    getch();

    return 0;

}
```

Input & Output:

Set 1:

```
Enter the numbers:15 16

The multiplication method of 15 & 16
using Russian Peasant Method is as follows:

15                16
7                 32
3                 64
1                 128

The answer is:
16+32+64+128=240

Which satisfies the statement 15*16=240
Do you want to continue?(Y/N)
```

Set 2:

```
Enter the numbers:67 18

The multiplication method of 67 & 18
using Russian Peasant Method is as follows:

67                   18
33                   36
16                   72X(STRUCK OFF)
8                    144X(STRUCK OFF)
4                    288X(STRUCK OFF)
2                    576X(STRUCK OFF)
1                    1152

The answer is:
18+36+1152=1206

Which satisfies the statement 67*18=1206
Do you want to continue?(Y/N)
```

Discussion:

1. This method is useful as it does not require to remember the multiplication tables except for 2.
2. But for negative numbers and floating point numbers this method will not work.
3. Also this program uses iterative approach to fulfill its purpose. Hence it can be problematic for larger numbers. Again, when multiplying with 0, if we set the 0 to the right column and a larger number to the left column then a repetitious 0 will come on the right column.