Experiment No. 9
1mplement Non-restoring -algorithm using c- programming
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Aim - To implement Non-Restoring division algorithm using c-programming.

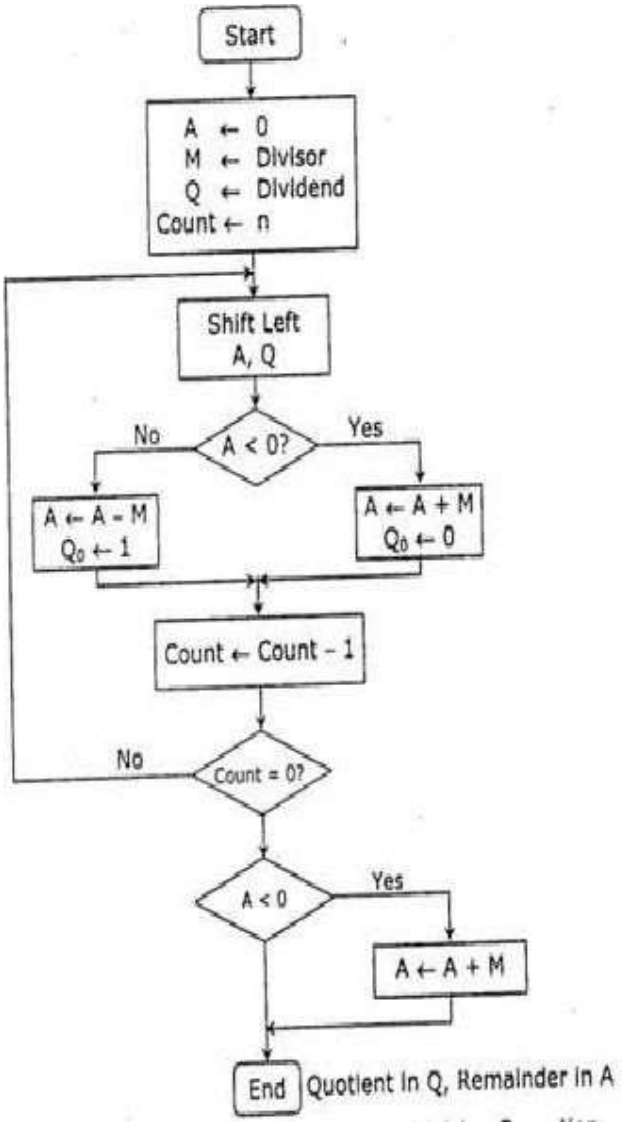
Objective -

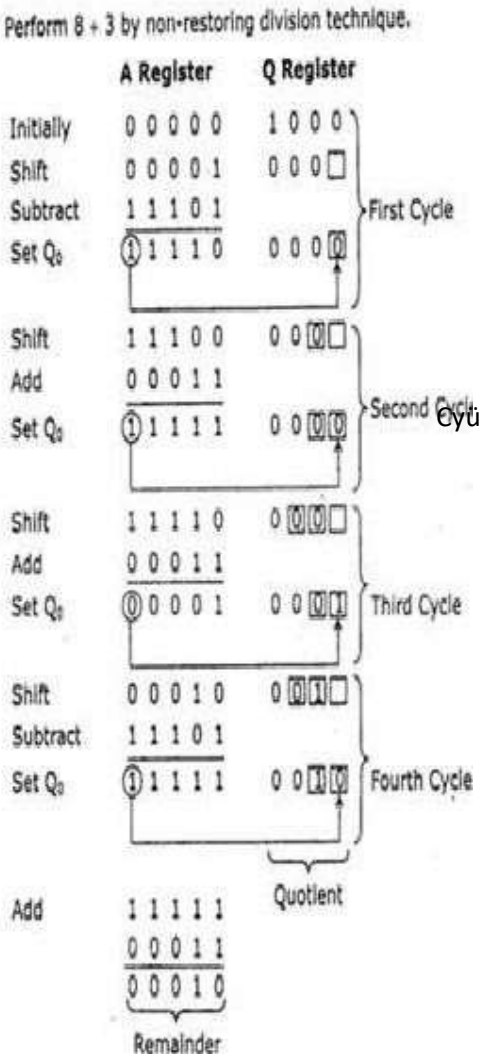
1. TO understand the working Of Non-Restoring division algorithm.

2. To understand how to implement Non-Restoring division algorithm using cprogramm1ng.

Theory:

In each cycle content of the register, A is first shifted and then the divisor is added or subtracted with the content of register A depending upon the sign of A. In this, there is no need of restoring, but if the remainder is negative then there is a need of restoring the remainder. This is the faster algorithm of division.





Perform 8 ÷ 3 by non-restoring division technique,

Program - #include <math.h>

#include <stdio.h>

int main() { int a[50],a1[50],b[50],d=0,i,j;

int n1,n2, c, k1,k2,n,k,quo=0,rem=0;

printf("Enter the number of bits\n");

```
scanf("%d",&n);    printf("Enter the divisor
and    dividend\n");          scanf("%d    %d",
&n1,&n2);


  for (c = n-1; c >= 0; c--)
  {     k1 = n1
>> c;


    if (k1 & 1)
a[n-1-c]=1;// M
else      a[n-1-c]=0;


     k2 = n2 >> c;


    if (k2 & 1)
b[2*n-1-c]=1;// Q
else      b[2*n-1-c]=0;


  }
```

```
 for(i=0;i<n;i++)//making complement
 {
if(a[i]==0)
a1[i]=1;
else
a1[i]=0;
 }

 a1[n-1]+=1;//twos complement ie -M   if(a1[n-1]==2)
 {          for(i=n-
1;i>0;i--)
    {
if(a1[i]==2)
        {
a1[i-1]+=1;
a1[i]=0;
        }
    }
```

```
  }
  if(a1[0]==2)
a1[0]=0;

  for( i=0;i<n;i++)// putting A in the same array as Q
  {
b[i]=0;

  }
printf("A\tQ\tPROCESS\n");

  for(i=0;i<2*n;i++)
{     if(i==n)
printf("\t");

    printf("%d",b[i]);
} printf("\n");

  for(k=0;k<n;k++)//n iterations
```

```
 {      for(j=0;j<2*n-1;j++)//left
shift
       {
b[j]=b[j+1];


       }


       for(i=0;i<2*n -1;i++)
       {            if(i==n)
printf("\t");
printf("%d",b[i]);
       }printf("_");


       printf("\tLEFT SHIFT\n");


          if(b[0]==0)
          {
                    for(i=n-1;i>=0;i--)//A=A-M
                    {
b[i]+=a1[i];
```

```
                    if(i!=0)
{                    if(b[i]==2)
{                           b[i-
1]+=1;
b[i]=0;
                            }
if(b[i]==3)                         {
b[i-1]+=1;
b[i]=1;
                            }
                           // printf("%d",b[i]);
                }
}
if(b[0]==2)
b[0]=0;

if(b[0]==3)
b[0]=1;
```

```
                for(i=0;i<2*n -1;i++)
                {
if(i==n)
printf("\t");
printf("%d",b[i]);
                }printf("_");

                printf("\tA-M\n");
        }
else
        {
                for(j=n-1;j>=0;j--)//A=A+M
                   {
b[j]+=a[j];
                        if(j!=0)
{                        if(b[j]==2)
{                                b[j-
1]+=1;
b[j]=0;
```

```
                    }
if(b[j]==3)                    {
b[j-1]+=1;
b[j]=1;
                    }
                }

if(b[0]==2)
b[0]=0;

if(b[0]==3)
b[0]=1;
                }

                for(i=0;i<2*n -1;i++)
              {
if(i==n)
printf("\t");
printf("%d",b[i]);
```

```
                }printf("_");

                printf("\tA+M\n");

        }


            if(b[0]==0)//A==0?
            {                   b[2*n-
1]=1;
for(i=0;i<2*n ;i++)
                {
if(i==n)
printf("\t");
printf("%d",b[i]);

                }

                printf("\tQ0=1\n");
```

```
        }



        if(b[0]==1)//A==1?
        {               b[2*n-
1]=0;
for(i=0;i<2*n ;i++)
                {
if(i==n)
printf("\t");


                   printf("%d",b[i]);
                }                   printf("\tQ0=0\n");


        }


 }
```

```
if(b[0]==1) {                   for(j=n-
1;j>=0;j--)//A=A+M
                        {
b[j]+=a[j];
                              if(j!=0)
{                              if(b[j]==2)
{                                     b[j-
1]+=1;
b[j]=0;
                                    }
                              if(b[j]==3)
{                                     b[j-
1]+=1;
b[j]=1;
                                    }
                        }

if(b[0]==2)
b[0]=0;
```

```
if(b[0]==3)
b[0]=1;
                        }

                        for(i=0;i<2*n;i++)
                    {
if(i==n)
printf("\t");
printf("%d",b[i]);

                    }

                    printf("\tA+M\n");
} printf("\n");
for(i=n;i<2*n;i++)
{    quo+= b[i]*pow(2,2*n-1-
i);
} for(i=0;i<n;i++)
```

```
{     rem+= b[i]*pow(2,n-1-
i);
} printf("The quotient of the two nos is %d\nThe remainder is
%d",quo,rem);


printf("\n");
return 0;
}
```

Output:

```
5
4
A   Q   PROCESS
0000    0100
0000    100_    LEFT SHIFT
1011    100_    A-M
1011    1000    Q0=0
0111    000_    LEFT SHIFT
0010    000_    A-M
0010    0001    Q0=1
0100    001_    LEFT SHIFT
1111    001_    A-M
1111    0010    Q0=0
1110    010_    LEFT SHIFT
0011    010_    A+M
0011    0101    Q0=1

The quotient of the two nos is 5
The remainder is 3
```

Conclusion - The aim of the experiment is to implement the Non-Restoring division algorithm in C programming, a technique for efficient division that avoids restoring partial remainders, aiming to streamline the division process and achieve precise results through a systematic approach.