Vidyavardhini's College of Engineering and Technology
Department of Artificial Intelligence & Data Science

Experiment No. 9
Implement Non Restoring algorithm using c-programming
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Date of Performance:
Date of Submission:

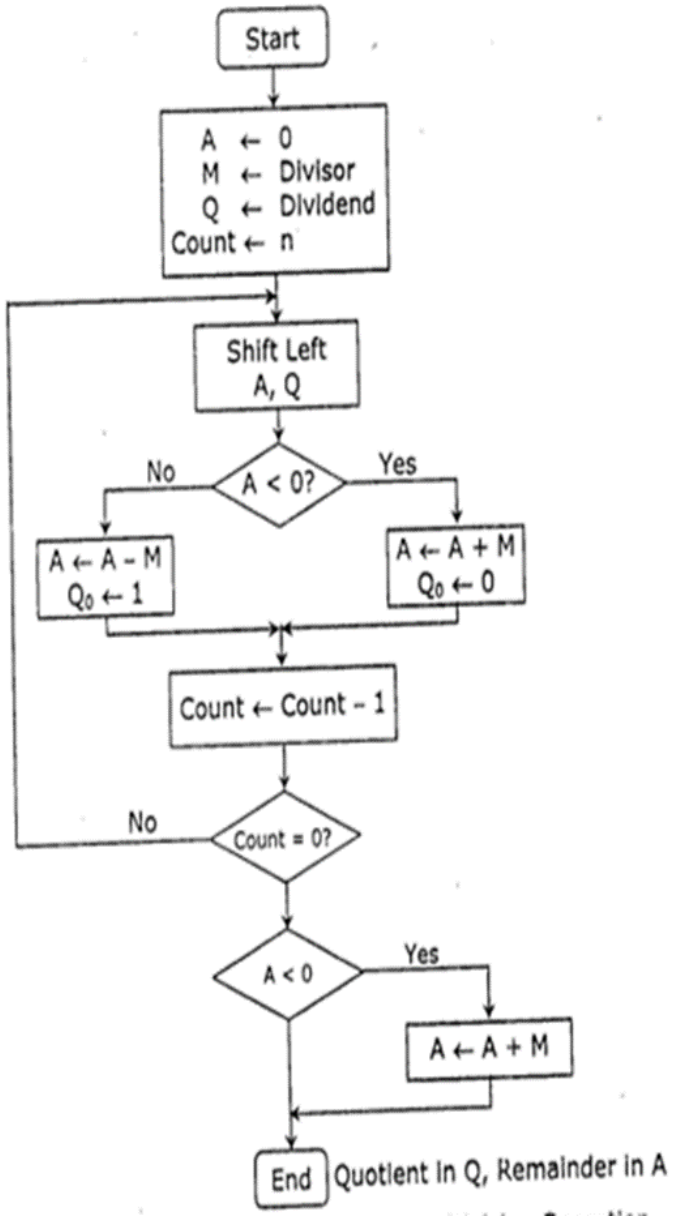
Aim - To implement Non-Restoring division algorithm using c-programming.

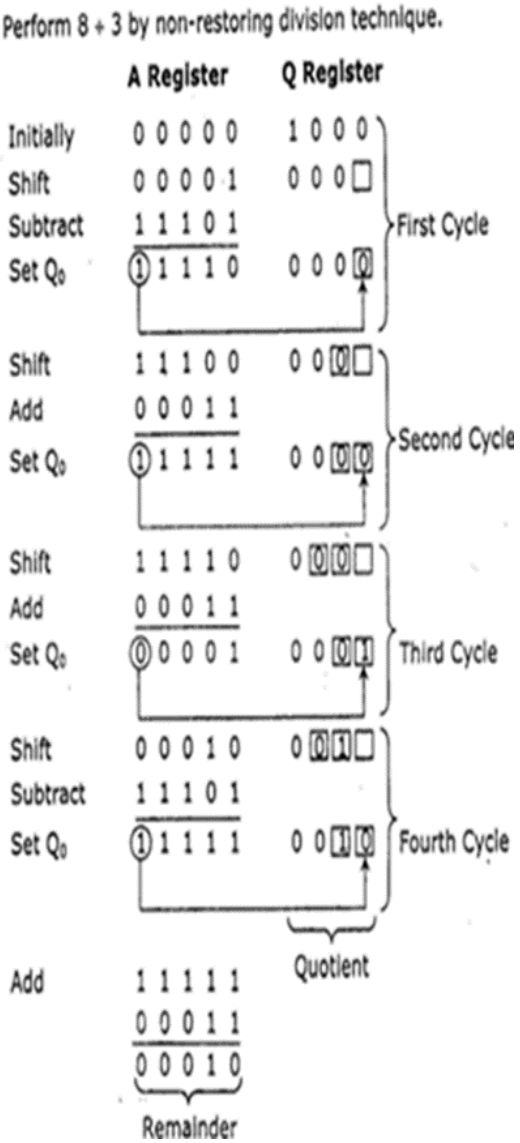
Objective -

1. To understand the working of Non-Restoring division algorithm.
2. To understand how to implement Non-Restoring division algorithm using c-programming.

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.





Program –

```
#include <math.h>

#include <stdio.h>

//NON RESTORING DIVISION

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--)//converting the 2 nos to binary
{
  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)
        {
```

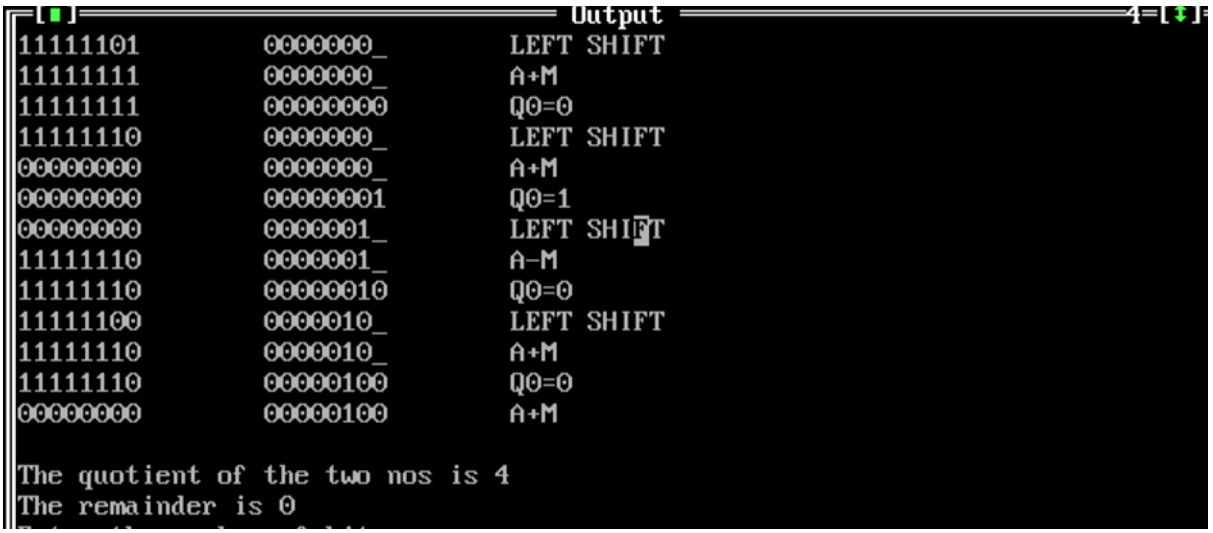
```
        if(b[j]==2)
                {
            b[j-1]+=1;
            b[j]=0;
                }
        if(b[j]==3)
                {
            b[j-1]+=1;
            b[j]=1;
                }
        }

        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");
```



Conclusion –

In this work, I am trying to improve the non-restoring algorithm to minimize the hardware cost. If dividend & divisor both are negative then proposed algorithm will not work. Though, in future I can develop this algorithm to divide two signed binary numbers.