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

Experiment No. 9
Implement Non Restoring algorithm using c-programming
Name:Dhruv Gharat
Roll Number: 11
Date of Performance:
Date of Submission:

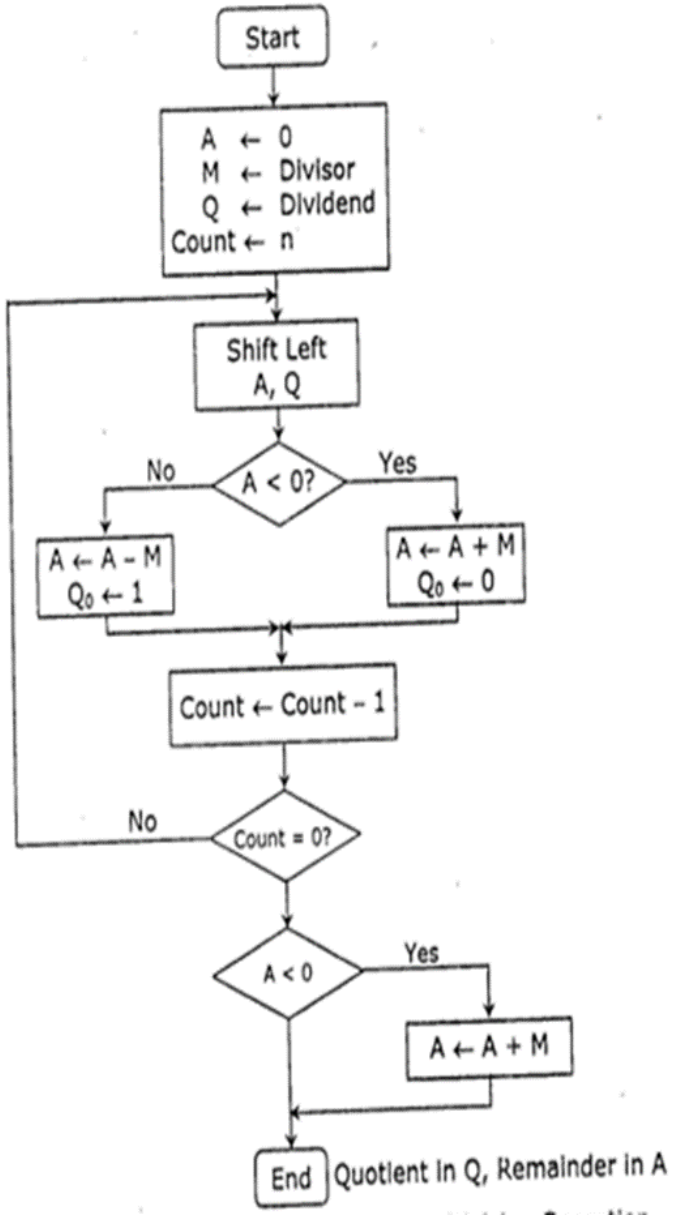
Aim - To implement Non-Restoring division algorithm using c-programming.

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.



Perform 8 ÷ 3 by non-restoring division technique.

	A Register	Q Register	
Initially	0 0 0 0 0	1 0 0 0	
Shift	0 0 0 0 1	0 0 0 □	
Subtract	1 1 1 0 1		First Cycle
Set Q_0	① 1 1 1 0	0 0 0 0	
Shift	1 1 1 0 0	0 0 0 □	
Add	0 0 0 1 1		
Set Q_0	① 1 1 1 1	0 0 0 0	Second Cycle
Shift	1 1 1 1 0	0 0 0 □	
Add	0 0 0 1 1		
Set Q_0	⓪ 0 0 0 1	0 0 0 1	Third Cycle
Shift	0 0 0 1 0	0 0 1 □	
Subtract	1 1 1 0 1		
Set Q_0	① 1 1 1 1	0 0 1 0	Fourth Cycle
			Quotient
Add	1 1 1 1 1		
	0 0 0 1 1		
	0 0 0 1 0		
	Remainder		

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");
  return 0;
}
```

Output:

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.