



Experiment No. 9

Implement Non-restoring -algorithm using c- programming

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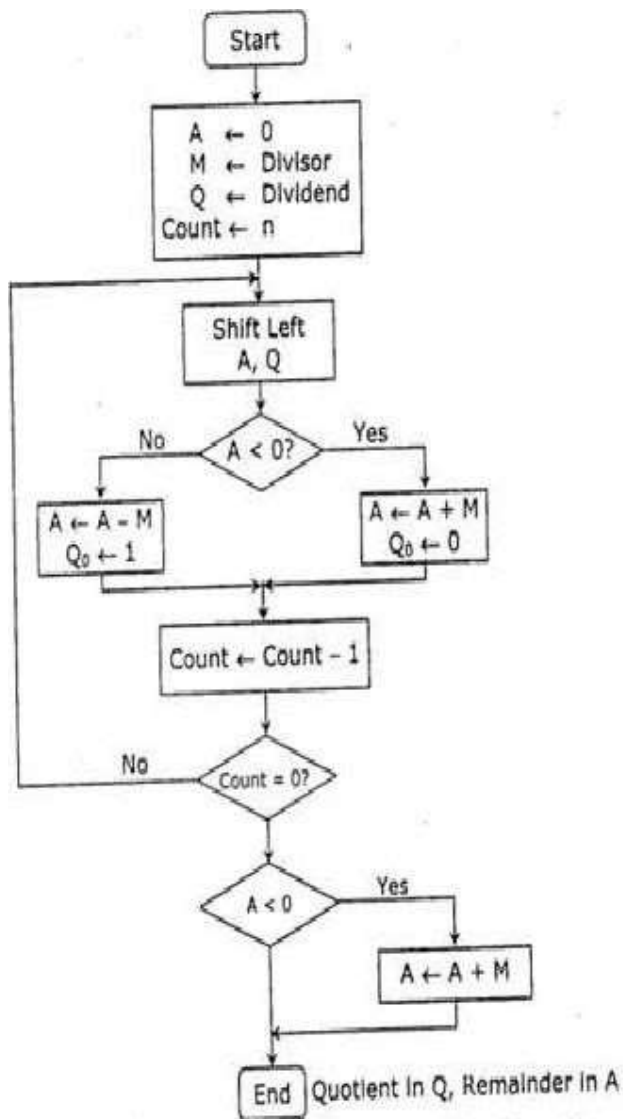
Aim - To implement Non-Restoring division algorithm using c-programming.

Objective -

1. TO understand the working Of Non-Restoring division algorithm.
2. To understand how to implement Non-Restoring division algorithm using cprogramming.

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	1 0 0 0	
Shift	0 0 0 1	0 0 0 □	
Subtract	1 1 1 0		
Set Q <sub>0</sub>	1 1 1 0	0 0 0 0	First Cycle
Shift	1 1 1 0	0 0 0 □	
Add	0 0 0 1		
Set Q <sub>0</sub>	1 1 1 1	0 0 0 0	Second Cycle
Shift	1 1 1 1	0 0 0 □	
Add	0 0 0 1		
Set Q <sub>0</sub>	0 0 0 1	0 0 0 1	Third Cycle
Shift	0 0 0 1	0 0 1 □	
Subtract	1 1 1 0		
Set Q <sub>0</sub>	1 1 1 1	0 0 1 1	Fourth Cycle
Add	1 1 1 1		
	0 0 0 1		
	0 0 0 1		
			Quotient
			Remainder

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.