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47
DLCOA / Experiment 8

Aim:

To write a C program for implementation of Restoring Division

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Software:

Turbo C IDE

Theory:

In restoring division algorithm, the dividend is restored after each subtraction operation.

Algorithm:-

- Shift A and Q left by 1 position
- Perform A←A – B
- If sign bit of A = 1 then,

Restore A as: A← A +B

$Q_0 = 0$

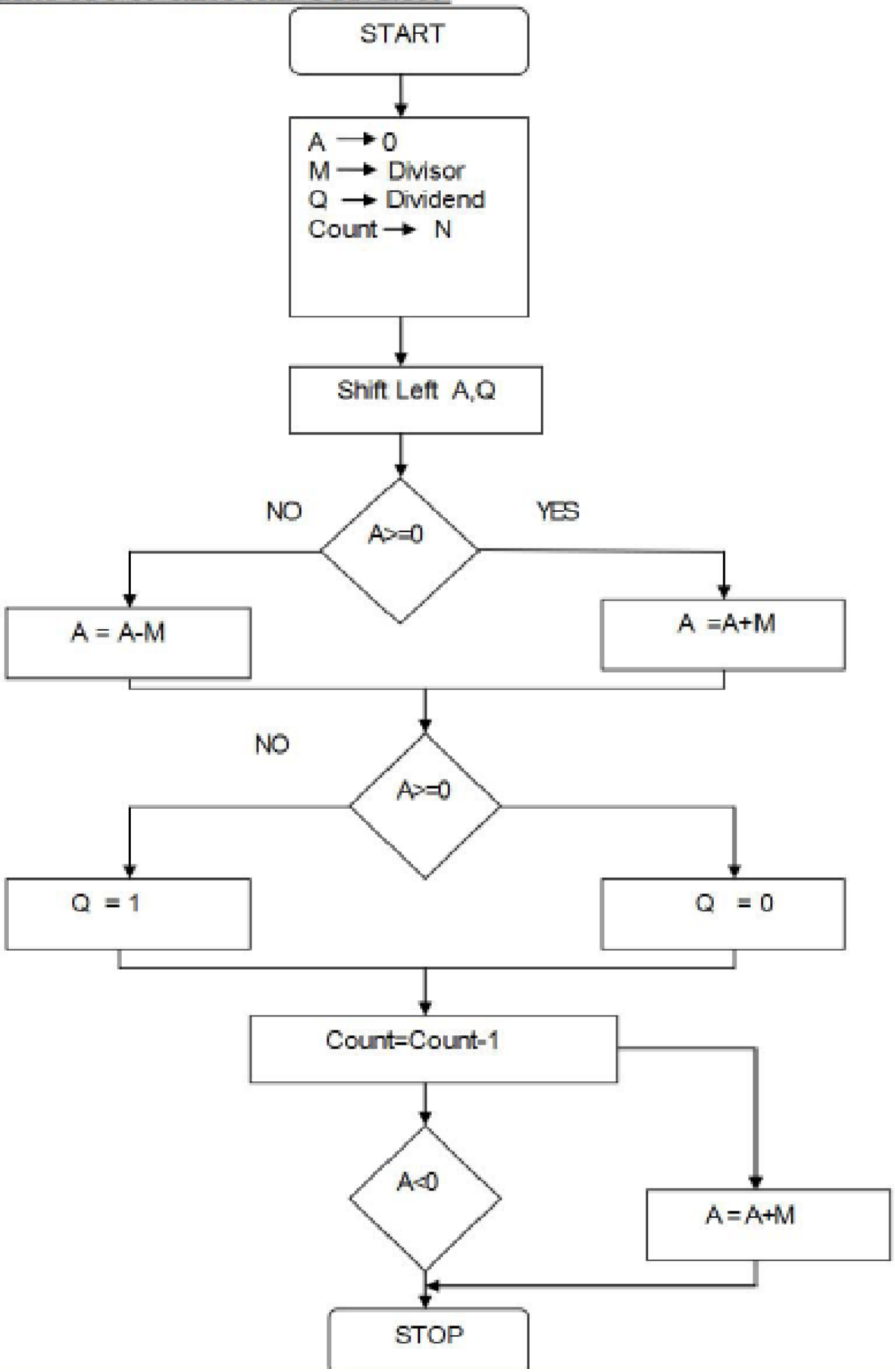
- If sign bit of A = 0 then

$Q_0 = 1$

- Repeat above steps till all the bits of the dividend are used.

FLOWCHART

FLOWCHART OF NON RESTORING DIVISION



Program:

```
#include <stdio.h>
#include <conio.h>
#include <math.h>
int getsize(int x) {
  int c;
  if (x <= 1)
    c = 2;
  else if (x < 4)
    c = 2;
  else if (x < 8)
    c = 3;
  else if (x < 16)
    c = 4;
  else if (x < 32)
    c = 5;
  else if (x < 64)
    c = 6;
  else if (x < 128)
    c = 7;
  else if (x < 256)
    c = 8;
  else if (x < 512)
    c = 9;
  return c;
}
int max(int x, int y) {
  if (x < y)
    return (y);
  else
```

```
    return (x);
}
void main() {
  int B, Q, Z, M, c, c1, e, f, g, h, i, j, x, y, ch, in , S, G, P;
  int a[24], b[12], b1[12], q[12], carry = 0, count = 0;
  long num;
  printf("\n\nENTER DIVIDEND\t: ");
  scanf("%d", & Q);
  y = getsize(Q);
  printf("ENTER DIVISOR\t: ");
  scanf("%d", & M);
  x = getsize(M);
  Z = max(x, y);
  printf("\n\tTOTAL BITS CONSIDERED FOR RESULT => %d", 2 * Z + 1);
  printf("\n\tINITiALLY A IS RESET TO ZERO:");
  for (i = 0; i <= Z; i++)
    printf("%d ", a[i] = 0);
  for (i = Z; i >= 0; i--) {
    b1[i] = b[i] = M % 2;
    M = M / 2;
    b1[i] = 1 - b1[i];
  }
  carry = 1;
  for (i = Z; i >= 0; i--) {
    c1 = b1[i] ^ carry;
    carry = b1[i] && carry;
    b1[i] = c1;
  }
  for (i = 2 * Z; i > Z; i--) {
```

```
  a[i] = Q % 2;
  Q = Q / 2;
 }
 printf("\n\n\tDivisor\t\t(M)\t: ");
 for (i = 0; i <= Z; i++)
  printf("%d ", b[i]);
 printf("\n\t2'C Divisor\t(M)\t: ");
 for (i = 0; i <= Z; i++)
  printf("%d ", b1[i]);
 printf("\n\tDividend\t(Q)\t: ");
 for (i = Z + 1; i <= 2 * Z; i++)
  printf("%d ", a[i]);
 printf("\n\n\tBITS CONSIDERED:[ A ] [ M ]");
 printf("\n\t\t\t");
 for (i = 0; i <= Z; i++)
  printf("%d ", a[i]);
 printf(" ");
 for (i = Z + 1; i <= 2 * Z; i++)
  printf("%d ", a[i]);
 count = Z;
 do {
  for (i = 0; i < 2 * Z; i++)
    a[i] = a[i + 1];
  printf("\n\nLeft Shift\t\t");
  for (i = 0; i <= Z; i++)
    printf("%d ", a[i]);
  printf(" ");
  for (i = Z + 1; i < 2 * Z; i++)
    printf("%d ", a[i]);
```

```
carry = 0;
for (i = Z; i >= 0; i--) {
  S = a[i] ^ (b1[i] ^ carry);
  G = a[i] && b1[i];
  P = a[i] ^ b1[i];
  carry = G || (P && carry);
  a[i] = S;
}
printf("\nA< -A-M \t\t");
for (i = 0; i <= Z; i++)
  printf("%d ", a[i]);
printf(" ");
for (i = Z + 1; i < 2 * Z; i++)
  printf("%d ", a[i]);
ch = a[0];
printf("\nBIT Q:%d", ch);
switch (ch) {
case 0:
  a[2 * Z] = 1;
  printf(" Q0< -1\t\t");
  for (i = 0; i <= Z; i++)
    printf("%d ", a[i]);
  printf(" ");
  for (i = Z + 1; i <= 2 * Z; i++)
    printf("%d ", a[i]);
  break;
case 1:
  a[2 * Z] = 0;
  printf(" Q0< -0\t\t");
```

```
    for (i = 0; i <= Z; i++)
      printf("%d ", a[i]);
    printf(" ");
    for (i = Z + 1; i < 2 * Z; i++)
      printf("%d ", a[i]);
    carry = 0;
    for (i = Z; i >= 0; i--) {
      S = a[i] ^ (b[i] ^ carry);
      G = a[i] && b[i];
      P = a[i] ^ b[i];
      carry = G || (P && carry);
      a[i] = S;
    }
    printf("\nA< -A+M");
    printf("\t\t\t");
    for (i = 0; i <= Z; i++)
      printf("%d ", a[i]);
    printf(" ");
    for (i = Z + 1; i <= 2 * Z; i++)
      printf("%d ", a[i]);
    break;
  }
  count--;
} while (count != 0);
num = 0;
printf("\n\t\t< < QUOTIENT IN BITS>> :");
for (i = Z + 1; i <= 2 * Z; i++) {
  printf("%d ", a[i]);
  num = num + pow(2, 2 * Z - i) * a[i];
```

```
  }
  printf("\n\t\tOUOTIENT IN DECIMAL :%d", num);
  num = 0;
  printf("\n\t\t< < REMAINDER IN BITS>>:");
  for (i = 0; i <= Z; i++) {
    printf("%d ", a[i]);
    num = num + pow(2, Z - i) * a[i];
  }
  printf("\n\t\tREMAINDER IN DECIMAL :%d", num);
}
```

Conclusion:

We learnt about restoring division algorithm and implemented it using C program.

Output:

```
ENTER DIVIDEND  : 5
ENTER DIVISOR   : 3

        TOTAL BITS CONSIDERED FOR RESULT => 7
        INITiALLY A IS RESET TO ZERO:0 0 0 0

        Divisor          (M)      : 0 0 1 1
        2'C Divisor      (M)      : 1 1 0 1
        Dividend         (Q)      : 1 0 1

        BITS CONSIDERED:[ A ] [ M ]
                        0 0 0 0  1 0 1

Left Shift              0 0 0 1  0 1
A< -A-M                 1 1 1 0  0 1
BIT Q:1 Q0< -0          1 1 1 0  0 1
A< -A+M                 0 0 0 1  0 1 0

Left Shift              0 0 1 0  1 0
A< -A-M                 1 1 1 1  1 0
BIT Q:1 Q0< -0          1 1 1 1  1 0
A< -A+M                 0 0 1 0  1 0 0

Left Shift              0 1 0 1  0 0
A< -A-M                 0 0 1 0  0 0
BIT Q:0 Q0< -1          0 0 1 0  0 0 1
                < < QUOTIENT IN BITS>> :0 0 1
                OUOTIENT IN DECIMAL :1
                < < REMAINDER IN BITS>>:0 0 1 0
                REMAINDER IN DECIMAL :2
```
