17.Write a program to perform Booth's multiplication of two signed numbers using any high level language.

AIM:

To perform Booth's multiplication of two signed numbers using any high level language.

ALGORITHM:

1. Start
2. Product = 0
3. Ask user to enter two decimal numbers: n1, n2
4. Convert them into binary and store them in arrays num1 and num2
5. Two's complement the numbers if they are negative
6. Two's complement num2 and store as n com
7. Create a copy of num1 as n copy
8. Set q = 0
9. If num1[i] = = q, arithmetic shift product : ncopy
10. 1Else if num1[i] == 1 and q ==0, add ncom to product and arithmetic shift product : ncopy
11. 1Else add num2 to product and arithmetic shift product : ncopy
12. 1In each step set q = num1[i] after shift operation
13. Repeat steps 9,10,11 and 12 until all bits of num1 are shifted out
14. Display final result as product : ncopy
15. End

PROGRAM:

```
#include <stdio.h>
#include <math.h>

int a = 0,b = 0, c = 0, a1 = 0, b1 = 0, com[5] = { 1, 0, 0, 0, 0};
int anum[5] = {0}, anumcp[5] = {0}, bnum[5] = {0};
int acomp[5] = {0}, bcomp[5] = {0}, pro[5] = {0}, res[5] = {0};

void binary(){
    a1 = fabs(a);
    b1 = fabs(b);
    int r, r2, i, temp;
    for (i = 0; i < 5; i++){
        r = a1 % 2;
        a1 = a1 / 2;
        r2 = b1 % 2;
        b1 = b1 / 2;
```

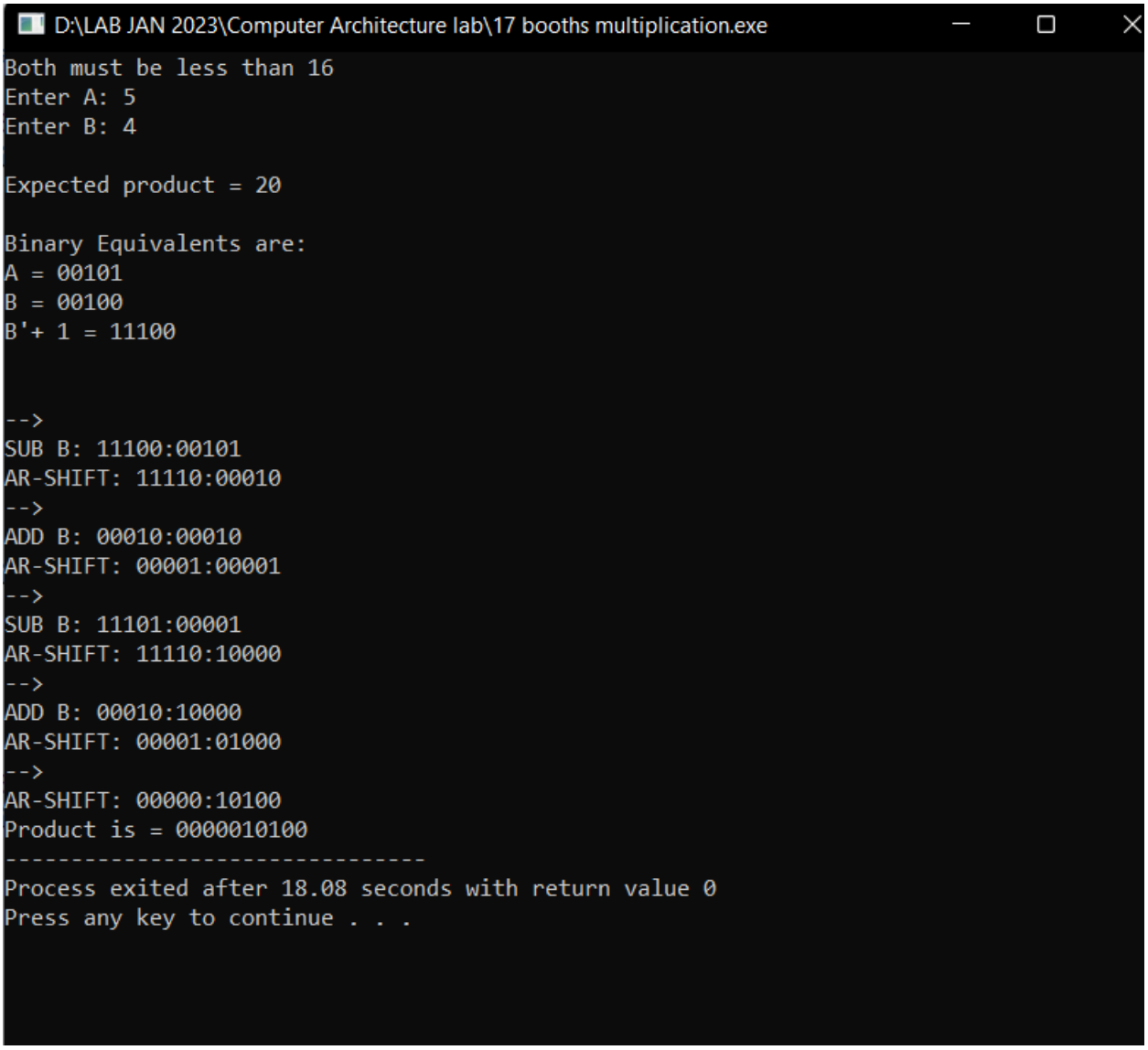
```
        anum[i] = r;
        anumcp[i] = r;
        bnum[i] = r2;
        if(r2 == 0){
            bcomp[i] = 1;
        }
        if(r == 0){
            acomp[i] =1;
        }
  }
//part for two's complementing
c = 0;
for ( i = 0; i < 5; i++){
        res[i] = com[i]+ bcomp[i] + c;
        if(res[i] >= 2){
            c = 1;
        }
        else
            c = 0;
        res[i] = res[i] % 2;
  }
for (i = 4; i >= 0; i--){
  bcomp[i] = res[i];
}
//in case of negative inputs
if (a < 0){
   c = 0;
  for (i = 4; i >= 0; i--){
        res[i] = 0;
  }
  for ( i = 0; i < 5; i++){
        res[i] = com[i] + acomp[i] + c;
        if (res[i] >= 2){
            c = 1;
        }
        else
            c = 0;
        res[i] = res[i]%2;
  }
  for (i = 4; i >= 0; i--){
        anum[i] = res[i];
        anumcp[i] = res[i];
  }
```

```
  }
  if(b < 0){
    for (i = 0; i < 5; i++){
        temp = bnum[i];
        bnum[i] = bcomp[i];
        bcomp[i] = temp;
    }
  }
}
void add(int num[]){
   int i;
   c = 0;
   for ( i = 0; i < 5; i++){
        res[i] = pro[i] + num[i] + c;
        if (res[i] >= 2){
            c = 1;
        }
        else{
            c = 0;
        }
        res[i] = res[i]%2;
    }
    for (i = 4; i >= 0; i--){
       pro[i] = res[i];
       printf("%d",pro[i]);
    }
  printf(":");
  for (i = 4; i >= 0; i--){
        printf("%d", anumcp[i]);
    }
}
void arshift(){//for arithmetic shift right
   int temp = pro[4], temp2 = pro[0], i;
   for (i = 1; i < 5  ; i++){//shift the MSB of product
      pro[i-1] = pro[i];
   }
   pro[4] = temp;
   for (i = 1; i < 5  ; i++){//shift the LSB of product
      anumcp[i-1] = anumcp[i];
   }
   anumcp[4] = temp2;
   printf("\nAR-SHIFT: ");//display together
   for (i = 4; i >= 0; i--){
      printf("%d",pro[i]);
```

```
    }
    printf(":");
    for(i = 4; i >= 0; i--){
        printf("%d", anumcp[i]);
    }
}

int main(){
   int i, q = 0;
   printf("\t\tBOOTH'S MULTIPLICATION ALGORITHM");
   printf("\nEnter two numbers to multiply: ");
   printf("\nBoth must be less than 16");
   //simulating for two numbers each below 16
   do{
       printf("\nEnter A: ");
       scanf("%d",&a);
       printf("Enter B: ");
       scanf("%d", &b);
    }while(a >=16 || b >=16);

    printf("\nExpected product = %d", a * b);
    binary();
    printf("\n\nBinary Equivalents are: ");
    printf("\nA = ");
    for (i = 4; i >= 0; i--){
        printf("%d", anum[i]);
    }
    printf("\nB = ");
    for (i = 4; i >= 0; i--){
        printf("%d", bnum[i]);
    }
    printf("\nB'+ 1 = ");
    for (i = 4; i >= 0; i--){
        printf("%d", bcomp[i]);
    }
    printf("\n\n");
    for (i = 0;i < 5; i++){
          if (anum[i] == q){//just shift for 00 or 11
              printf("\n-->");
              arshift();
              q = anum[i];
          }
          else if(anum[i] == 1 && q == 0){//subtract and shift for 10
             printf("\n-->");
```

```
            printf("\nSUB B: ");
            add(bcomp);//add two's complement to implement subtraction
            arshift();
            q = anum[i];
        }
        else{//add ans shift for 01
            printf("\n-->");
            printf("\nADD B: ");
            add(bnum);
            arshift();
            q = anum[i];
        }
    }

    printf("\nProduct is = ");
    for (i = 4; i >= 0; i--){
        printf("%d", pro[i]);
    }
    for (i = 4; i >= 0; i--){
        printf("%d", anumcp[i]);
    }
}
```

OUTPUT:



RESULT:

Thus the Program for Booth's multiplication was executed Successfully.