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1  //SHREYAS SAWANT D7A 55
2  //Implement Booth's Algorithm
3
4  #include <stdio.h>
5  #include <math.h>
6
7  int a = 0, b = 0, c = 0, a1 = 0, b1 = 0, com[5] = { 1, 0, 0, 0, 0};
8  int Q[5] = {0}, Q1[5] = {0}, M[5] = {0}, M1[5] = {0};
9  int acomp[5] = {0}, pro[5] = {0}, res[5] = {0}, k=5;
10
11 void binary()
12 {
13     a1 = fabs(a);
14     b1 = fabs(b);
15     int r, r2, i, temp;
16     for (i = 0; i < 5; i++){
17         r = a1 % 2;
18         a1 = a1 / 2;
19         r2 = b1 % 2;
20         b1 = b1 / 2;
21         Q[i] = r;
22         Q1[i] = r;
23         M[i] = r2;
24         if(r2 == 0){
25             M1[i] = 1;
26         }
27         if(r == 0){
28             acomp[i] = 1;
29         }
30     }
31
32     c = 0;
33     for (i = 0; i < 5; i++){
34         res[i] = com[i] + M1[i] + c;
35         if(res[i] >= 2)
36             {
37                 c = 1;
38             }
39         else
40             c = 0;
41         res[i] = res[i] % 2;
42     }
43     for (i = 4; i >= 0; i--){
44         M1[i] = res[i];
45     }
46
47     if (a < 0){
48         c = 0;
49         for (i = 4; i >= 0; i--){
50             res[i] = 0;
51         }
52         for (i = 0; i < 5; i++){
53             res[i] = com[i] + acomp[i] + c;
54             if (res[i] >= 2){
55                 c = 1;
56             }
57             else
58                 c = 0;
59             res[i] = res[i] % 2;
60         }
61         for (i = 4; i >= 0; i--){
62             Q[i] = res[i];
63             Q1[i] = res[i];
64         }
65     }
66
67     if(b < 0){
68         for (i = 0; i < 5; i++){
69             temp = M[i];
70             M[i] = M1[i];
71             M1[i] = temp;
72         }
73     }
74 }
75 void add(int num[]){
76     int i;
77     c = 0;
78     for (i = 0; i < 5; i++){
79         res[i] = pro[i] + num[i] + c;
80         if (res[i] >= 2){
81             c = 1;
82         }
83         else{
84             c = 0;

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85         }
86         res[i] = res[i]%2;
87     }
88     for (i = 4; i >= 0; i--){
89         pro[i] = res[i];
90     }
91 }
92
93
94 }
95 void arshift(){
96     int temp = pro[4], temp2 = pro[0], i;
97     for (i = 1; i < 5 ; i++){
98         pro[i-1] = pro[i];
99     }
100    pro[4] = temp;
101    for (i = 1; i < 5 ; i++){
102        Q1[i-1] = Q1[i];
103    }
104    Q1[4] = temp2;
105    printf("\nAfter pass %d\nA: ",k);
106    for (i = 4; i >= 0; i--){
107        printf("%d",pro[i]);
108    }
109    printf("\nQ: ");
110    for(i = 4; i >= 0; i--){
111        printf("%d", Q1[i]);
112    }
113
114    k--;
115 }
116
117 void main(){
118     int i, q = 0;
119     printf("\nEnter two numbers to multiply: ");
120
121     do{
122         printf("\nEnter Multiplier: ");
123         scanf("%d",&a);
124         printf("Enter Multiplicand: ");
125         scanf("%d", &b);
126         }while(a >=16 || b >=16);
127
128     printf("\nExpected product = %d", a * b);
129     binary();
130     printf("\n\nBinary Equivalents are: ");
131     printf("\nMultiplier = ");
132     for (i = 4; i >= 0; i--){
133         printf("%d", Q[i]);
134     }
135     printf("\nMultiplicand = ");
136     for (i = 4; i >= 0; i--){
137         printf("%d", M[i]);
138     }
139     printf("\n2's complement of Multiplicand = ");
140     for (i = 4; i >= 0; i--){
141         printf("%d", M1[i]);
142     }
143     for (i = 0; i < 5; i++){
144         if (Q[i] == q){
145             printf("\n");
146             arshift();
147             q = Q[i];
148         }
149         else if(Q[i] == 1 && q == 0)
150         {
151             printf("\n");
152             add(M1);
153             arshift();
154             q = Q[i];
155         }
156         else{
157             printf("\n");
158             add(M);
159             arshift();
160             q = Q[i];
161         }
162     }
163
164     printf("\n\nProduct is = ");
165     for (i = 4; i >= 0; i--){
166         printf("%d", pro[i]);
167     }
168     for (i = 4; i >= 0; i--){

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169         printf("%d", Q1[i]);
170     }
171     printf("\n");
172 }
173
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