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 bor0s

Dashboard > Algorithms > Bit Manipulation > AND Product

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## AND Product

by shaka\_shadows

Problem

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Consider two non-negative long integers,  $a$  and  $b$ , where  $a \leq b$ . The bitwise AND of all long integers in the inclusive range between  $a$  and  $b$  can be expressed as  $a \& (a+1) \& \dots \& (b-1) \& b$ , where  $\&$  is the bitwise AND operator.

Given  $n$  pairs of long integers,  $a_i$  and  $b_i$ , compute and print the bitwise AND of all natural numbers in the inclusive range between  $a_i$  and  $b_i$ .

### Input Format

The first line contains a single integer,  $n$ , denoting the number of intervals to calculate results for.  
Each line  $i$  of the  $n$  subsequent lines contains two space-separated long integers describing the respective values of  $a_i$  and  $b_i$ .

### Constraints

- $1 \leq n \leq 200$
- $0 \leq a \leq b < 2^{32}$

### Output Format

For each pair of long integers, print the bitwise AND of all numbers in the inclusive range between  $a_i$  and  $b_i$  on a new line.

### Sample Input

```
3
12 15
2 3
8 13
```

### Sample Output

```
12
2
8
```

### Explanation

There are three pairs to compute results for:

- $a = 12$  and  $b = 15$   
 $12 \& 13 \& 14 \& 15 = 12$ , so we print 12 on a new line.
- $a = 2$  and  $b = 3$   
 $2 \& 3 = 2$ , so we print 2 on a new line.
- $a = 8$  and  $b = 13$   
 $8 \& 9 \& 10 \& 11 \& 12 \& 13 = 8$ , so we print 8 on a new line.

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Submissions: 9152


Max Score: 40


Difficulty: Medium

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Current Buffer (saved locally, editable)  

C++  

```
1 #include <cmath>
2 #include <cstdio>
3 #include <vector>
4 #include <iostream>
5 #include <algorithm>
6 #include <climits>
7 using namespace std;
8
9 unsigned long int calculate(unsigned long int a, unsigned long b) {
10     unsigned long int cnt = 0, i = INT_MAX + 1L;
11
12     // 0011 (3) - 0100 (4) -> 0xxx (?)
13     // 1000 (8) - 1011 (11) -> 10xx (?)
14     // for the bits we go from left to right while they match
15     // and then print them, padded with zeroes
16     while ( (a & i) == (b & i) ) {
17         i >>= 1;
18         cnt++;
19     }
20
21     cnt = 32 - cnt;
22
23     return (a >> cnt) << cnt;
24 }
25
26 int main() {
27     /* Enter your code here. Read input from STDIN. Print output to STDOUT */
28     unsigned long int n, a, b;
29     cin >> n;
30
31     while (n) {
32         cin >> a >> b;
33
34         cout << calculate(a, b) << "\n";
35         n--;
36     }
37
38     return 0;
39 }
40
```

Line: 1 Col: 1

[Upload Code as File](#) ☐ Test against custom input

Run Code

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