Algorithms In A White Box

First, solve the problem. Then, write the code.

John Johnson

By

Sergio Gabriel Sanchez Valencia

gabrielsanv97@gmail.com

searleser97

Contents

BITs Manipulation

Least Significant Set Bit

First thing we need to notice is that when we add 1 to a number N, what we are doing is just converting the first (right to left) 0-bit into a 1-bit and the 1-bits before get converted to 0-bits because $1 + 1 = 0$ with carry of 1 in binary, therefore we will be having a carry of 1-bit until we find a 0-bit.

Example:

$$00100111 + 1 = 00101000$$

Second thing we need to notice is very simple, lets start by denoting $\overline{N}$ as N with all it's bits inverted (1-bits change to 0-bit and viceversa), if we perform an AND operation between N and $\overline{N}$ we will get all bits in 0 as result.

Example:

$$N = 00100111$$

$$\overline{N} = 11011000$$

So, to achieve our main objective which is to extract the least significant bit (rightmost bit) we can just invert N and add 1 to it that will convert the first 0-bit to 1-bit so if we make an AND operation with N and $\overline{N}$ we get everything before the lsb as 0-bit and after the lsb we also get everything as 0-bit.

And we can write this as the 2's complement since what we did was just to invert bits and add one, which is just the exact definition of 2's complement.

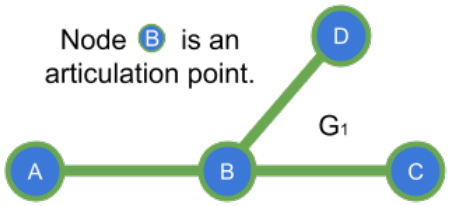
C++ Code:

```cpp
int lsb(int n) {
  return n & -n;
}
```

Graph Theory

Articulation Points And Bridges

Let's define what an *articulation point* is. We say that a vertex V in a graph G with C connected components is an *articulation point* if its removal increases the number of connected components of G. In other words, let C' be the number of connected components after removing vertex V, if $C' > C$ then V is an *articulation point*.



How to find articulation points?

•Naive approach $O(V * (V + E))$

```
for every vertex V in the graph G do
    Remove V from G
    if the number of connected components increases then V is an articulation point
    Add V back to G
```