

Question 3

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The goal is to find the skipped number from 1 to 2^n-1 , so if we don't consider missing numbers, there are 2^n numbers from 1 to 2^n-1 .

Solution is use binary search to find the skipped number, for the every binary search we have the check the value we hit is equals to it index or not ,for example we hit $2^{n-1}/2$, then we check the number at index $(2^{n-1})/2$ is equals to $(2^{n-1})/2$ or not, if equal then the skipped number will be the right side and do the next binary search ,otherwise the skipped number will on the left side.

We keeping do that until we narrow it down to 3 numbers a ,b ,c then its easy to get the skipped number.(e.g. if $a+1 \neq b$ return b else return $b+1$)

The complexity of this model is to binary search a 2^n list which is

$$O(\log 2^n) = O(n)(\log \text{ base } 2)$$