



Quick Notes

Things to Remember

- 1 byte = 8 bits
- In general machines can perform 10^8 operations per second, so we can write our code accordingly to avoid TLE error.
- The range where our answer lies is called search space.

```
#include <bits/stdc++.h>
using namespace std;

int main()
{
    ios_base::sync_with_stdio(false);
    cin.tie(NULL);
    return 0;
}
```

- Unlike `&`, `&&` guarantees left-to-right evaluation: the second operand is not evaluated if the first operand is false . Unlike `|`, `||` guarantees left-to-right evaluation; moreover, the second operand is not evaluated if the first operand evaluates to true

- A macro is a piece of code in a program that is replaced by the value of the macro. Macro is defined by **#define** directive. Whenever a macro name is encountered by the compiler, it replaces the name with the definition of the macro. Macro definitions need not be terminated by a semi-colon(;) .

Arrays

- If array is allocated with fewer values than its size then the rest of the locations are by default initialized with zero
- In C++, to set them all to -1, you can use something like std::fill_n (from <algorithm>): std::fill_n(array, 100, -1);
- arrays are always passed by reference
- XOR is useful because of four key properties: XOR has an identity element. XOR is self-inverting. XOR is associative.

Sorting

- Selection sort has worst and best case complexity as $O(n^2)$
- Selection sort is good for small values
- A sorting algorithm is said to be stable if two objects with equal or same keys appear in the same order in sorted output as they appear in the input array to be sorted.
- Selection sort is not stable
- Bubble sort best case complexity is $O(n)$ and worst case is $O(n^2)$
- Bubble sort use case is that it gives nth largest element in nth round
- An in-place algorithm is an algorithm that does not need an extra space and produces an output in the same memory that contains the data by transforming the input 'in-place'. However, a small constant extra space used for variables is allowed.
- Bubble sort is in-place
- Insertion Sort is adaptive, that means it reduces its total number of steps if given a partially sorted list, hence it increases its efficiency. Its space complexity is less. Insertion sort requires a single additional memory space.

- Insertion sort best case complexity is $O(n)$ and worst case is $O(n^2)$
- Merge Sort Time complexity is $O(n\log n)$ and inplace merge sort is $O(n^2\log n)$
- Merge Sort algorithm is used in Inversion Count problem
- Quick Sort T.C. : Average and Best Case is $O(n\log n)$, worst case is $O(n^2)$
- Quick Sort S.C. : $O(n)$
- Quick Sort is not stable
- Quick Sort is preferred over MergeSort for sorting Arrays
- MergeSort is preferred over QuickSort for Linked Lists

OOP

- The size of the object of an empty class is 1 byte.
- Structure padding is a concept in C that adds one or more empty bytes between the memory addresses to align the data in memory.