# E. Add Modulo 10

**time limit per test :** 2 seconds
**memory limit per test :** 256 megabytes
**input :** standard input
**output :** standard output

## Solution

```
#include <bits/stdc++.h>

using namespace std;

#define Precizne ios_base::sync_with_stdio(0); cin.tie(0);
#define int long long
#define INF 0x3f3f3f3f
#define MOD 1000000007
#define endl "\n"

void zero() {
        int n;
        cin >> n;
        int a[n];
        int count = 0;
        for(int i = 0; i < n; i++) {
            cin >> a[i];
            if(a[i] % 10 == 0) {
                count++;
                continue;
            }
            else if(a[i] % 10 == 5) {
                count++;
                a[i] += 5;
            }
            else {
                while(a[i] % 10 != 6) {
                            a[i] += a[i] % 10;
                }
                }
        }
        if(count == 0) {
                for(int i = 0; i < n - 1; i++) {
```

```
                if(abs(a[i] / 10 - a[i + 1] / 10) & 1) {
                    cout << "NO" << endl;
                        return;
                    }
                }
            cout << "YES" << endl;
        }
        else if(count == n) {
            for(int i = 0; i < n - 1; i++) {
                if(a[i] / 10 != a[i + 1] / 10) {
                        cout << "NO" << endl;
                        return;
                }
                }
            cout << "YES" << endl;
        }
        else {
            cout << "NO" << endl;
        }
}

int32_t main() {
        Precizne

        #ifndef ONLINE_JUDGE
            freopen("input.txt", "r", stdin);
            freopen("output.txt", "w", stdout);
        #endif

        int t = 1;
        cin >> t;
        for(int i = 1; i <= t; i++) {
            //cout << "Case #" << i << ": ";
            zero();
        }

        return 0;
}
```

## Explanation

> Before moving on with the Brute Force, we need to have the following mathematical observation
>
> All `odd` numbers once converted to `even` stay `even` (consider only units place)

1 + 1 -> 2
3 + 3 -> 6
5 + 5 -> 0
7 + 7 -> 4
9 + 9 -> 8

In `even` numbers 2 -> 4 -> 8 -> 6 form a chain and 0 -> 0 forms a chain

In 2 -> 4 -> 8 -> 6 chain, we try to converge every number to units place 6 by doing a `a[i] = a[i] + (a[i] % 10)` till `a[i] % 10 == 6`

If a collection of both 0 and anything from {0, 2, 8, 6} exists, then it is a **NO** as both chains can't coexist

If it is only a 0 -> 0 chain, then we need to check that all non-units place values should be same that is

$$\frac{a[i]}{10} = \frac{a[i+1]}{10}$$

for all `i`

If it is only a 2 -> 4 -> 8 -> 6 chain, then we need to check that difference of non-units place of any two numbers must be `even` that is

$$\left|\frac{a[i]}{10} - \frac{a[i+1]}{10}\right| mod[2] = 0$$

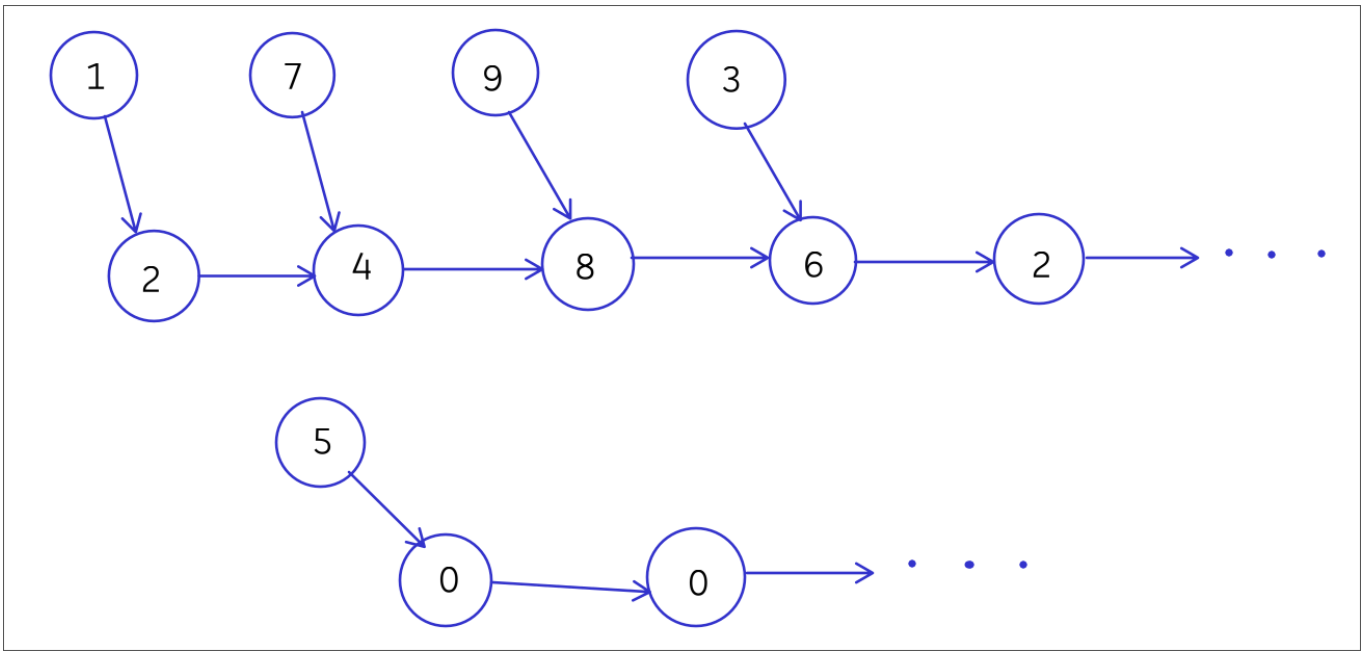
for all `i`

This is because, for example in **6** -> 1**2** -> 1**4** -> 1**8** -> 2**6**, 6 repeats in the units place when there is a difference in multiple of 2 in non-units place

If either of above is satisfied, then it is a **YES** else it is a **NO**

**Assume Division by 10 results in a floor**

## Chain Diagram


1
7
9
3
2
4
8
6
2
5
0
0