

PON - Prime or Not

Given the number, you are to answer the question: "Is it prime or not?"

Given number t test cases follows. [$t \leq 500$]. Each line contains one integer: N [$2 \leq N \leq 2^{63}-1$].

For each test case output string "YES" if given number is prime and "NO" otherwise.

Solution:

```
#define i64 unsigned long long
i64 mulmod(i64 a, i64 b, i64 c)
{
    i64 x = 0, y = a%c;

    while(b>0)
    {
        if(b%2==1) x = (x+y)%c;
        y = (y*2)%c;
        b /= 2;
    }
    return x;
}
i64 modulo(i64 a, i64 b, i64 c)
{
    i64 x = 1, y = a%c;

    while(b>0)
    {
        if(b%2==1) x = mulmod(x,y,c);
        y = mulmod(y,y,c);
        b /= 2;
    }
    return x;
}
bool miller(i64 p, int iter)
{
    if(p<2) return false;
    if(p==2) return true;
    if(p%2==0) return false; // if p is even

    i64 s = p-1;

    while(s%2==0) s /= 2; //until s become odd
```

```

for(int i=0; i<iter; i++)
{
    i64 a = rand()%(p-1)+1;
    i64 temp = s;
    i64 mod = modulo(a, temp, p);

    while(temp!=p-1 && mod!=1 && mod!=p-1)
    {
        mod = mulmod(mod, mod, p);
        temp *= 2;
    }
    if(mod!=p-1 && temp%2==0) return false;
}
return true;
}

int main()
{
    int t; scanf("%d", &t);
    while(t--)
    {
        i64 n; scanf("%llu", &n);

        bool ans = miller(n,1);
        //bool ans = miller(n,9);

        if(ans) printf("YES\n");
        else printf("NO\n");
    }
    return 0;
}

```