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Selection of Cities

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Editorial | Selection of Cities

Prerequisites

Binomial theorem, Binomial coefficients, sum of binomial coefficients.

Explanation

Let us say that m cities are selected. For a particular value of m the number of ways for selecting the cities is nC_m . As stated any number of cities can be selected and any city can be selected. Also, at least 1 city has to be selected. So, the final answer is $\sum {}^nC_m, 1 \leq m \leq n$.

We can easily find this using the binomial theorem. Expand $(a+b)^n$ using binomial theorem. Then substitute $a=1$ and $b=1$, we will get $\sum {}^nC_m, 0 \leq m \leq n$. Therefore from this we get that $2^n = \sum {}^nC_m, 0 \leq m \leq n$. If we subtract nC_0 from both sides, we get the answer to our problem as $2^n - 1$.

$2^n \% 1000000007$ can be easily calculated using modular exponentiation by right to left binary method. The complexity of this algorithm for a particular n will be $O(\log(n))$.

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IS THIS EDITORIAL HELPFUL?



Yes, it's helpful



No, it's not helpful

2 developer(s) found this editorial helpful.

Author Solution by PRATEEK KUMAR

```

1. //O(log(n))
2. #include<stdio>

```

```
3. #define mod 1000000007
4. long long pow_mod(long long b,long long e)
5. {
6.     long long ans=1;
7.     b%=mod;
8.     while(e>0)
9.     {
10.         if(e&1)
11.             ans=(ans*b)%mod;
12.             b=(b*b)%mod;
13.             e>>=1;
14.     }
15.     return ans%mod;
16. }
17. int main()
18. {
19.     long long t,n;
20.     //FILE* f=fopen("out1.txt","w",stdout);
21.     //FILE* f1=fopen("in1.txt","r",stdin);
22.     scanf("%lld",&t);
23.     while(t--)
24.     {
25.         scanf("%lld",&n);
26.         long long ans=pow_mod(2,n)-1;
27.         printf("%lld\n",ans);
28.     }
29.     //fclose(f);
30.     //fclose(f1);
31.     return 0;
32. }
33.
34.
35. /*O(n)
36. // only 2 input files will pass this solution
37.
38. #include<stdio>
39. #define mod 1000000007
40. long long int func(long long int a)
41. {
42.     long long ans=1,i;
43.     for(i=1;i<=a;i++)
44.         ans=(ans*2)%mod;
45.     return ans;
46. }int main()
47. {
48.     long long t,n;
49.     scanf("%lld",&t);
50.     while(t--)
51.     {
52.         scanf("%lld",&n);
53.         long long ans=(func(n)-1)%mod;
54.         printf("%lld\n",ans);
55.     }return 0;
56. }
```

57.

58. */

59.

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