

2020/05/02-2020/05/08周报

团队训练

本周无团队训练

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专题

没有专题

比赛

没有比赛

题目

TJOI2019 唱、跳、rap、篮球

分类：生成函数、FFT

一句话题意：有四类人排队，每类人分别喜欢唱、跳、rap、篮球，分别有 a, b, c, d 个人，队伍长度 n 。如果任意 $k, k+1, k+2, k+3$ 四个位置上的人依次喜欢唱、跳、rap、篮球，则不合法，求合法的排列方法数 mod 998244353。 $n, a, b, c, d \leq 1e3$

解法：注意任意两个四人组不可能有交，分别求至少包含 $1, 2, \dots$ 个四人组不合法，求法使用指数型生成函数，最后容斥

```
#include <bits/stdc++.h>
using namespace std;
const int N = 4040;
long long a[N], b[N], nn = 1, rev[N], w1[N], w2[N];
const int mod = 998244353;

inline int power(int di, int ci) {
    int ret = 1;
    while (ci) {
        if (ci & 1)
            ret = (long long)ret * di % mod;
        di = (long long)di * di % mod;
        ci >>= 1;
    }
}
```

```
    }  
    return ret;  
}  
  
inline long long inv(int x) {  
    return power(x,mod-2);  
}  
  
inline void NTT(long long *x,int I) {  
    int i,j;  
    long long t0,t1,*w;  
    int k;  
    for (i = 0;i < nn; i++)  
        if (rev[i] > i)  
            swap(x[rev[i]],x[i]);  
    w = (I == 1?w1:w2);  
    for (i = 1;i < nn; i <<= 1) {  
        for (j = 0;j < nn; j += (i<<1)) {  
            for (k = 0;k < i; k++) {  
                t0 = x[j+k],t1 = (long long)w[i|k]*x[i|j+k]%mod;  
                x[j+k] = (t0+t1)%mod;  
                x[i|j+k] = ((t0-t1)%mod+mod)%mod;  
            }  
        }  
    }  
    if (I == -1)  
        for (int i = 0;i < nn; i++)  
            x[i] = (long long)x[i]*inv(nn)%mod;  
}  
  
int half;  
int aa,bb,cc,dd,n;  
void calc() {  
    for (int i = 0;i < half; i++)  
        w1[i|half] = power(3,(mod-1)/nn*i);  
    for (int i = half-1;i>0; --i)  
        w1[i] = w1[i<<1];  
    for (int i = 1;i < nn; i++)  
        w2[i] = inv(w1[i]);  
    NTT(a,1);  
    NTT(b,1);  
    for (int i = 0;i < nn; i++)  
        a[i] = (long long)b[i]*a[i]%mod;  
    NTT(a,-1);  
    for (int i = n+1;i <= nn; i++)  
        a[i] = 0;  
}  
  
long long njc[1010];  
inline void work(int p) {  
    memset(a,0,sizeof(a));  
    memset(b,0,sizeof(b));  
    for (int i = 0;i <= min(aa-p,n); i++)  
        a[i] = njc[i];  
}
```

```

    for (int i = 0; i <= min(bb-p,n); i++)
        b[i] = njc[i];
    calc();
    memset(b,0,sizeof(b));
    for (int i = 0; i <= min(cc-p,n); i++)
        b[i] = njc[i];
    calc();
    memset(b,0,sizeof(b));
    for (int i = 0; i <= min(dd-p,n); i++)
        b[i] = njc[i];
    calc();
}

long long C[1010][1010];
long long f[1010];
int main() {
    scanf("%d%d%d%d",&n,&aa,&bb,&cc,&dd);
    C[0][0] = 1;
    for (int i = 0; i <= 1000; i++) {
        C[i][i] = C[i][0] = 1;
        for (int j = 1; j < i; j++)
            C[i][j] = (C[i-1][j]+C[i-1][j-1])%mod;
    }
    njc[0] = 1;
    while (nn <= n+n)
        nn <<= 1;
    half = nn/2;
    for (int i = 1; i < nn; i++)
        rev[i] = (rev[i>>1]>>1)|((i&1)?half:0);
    for (int i = 1; i <= n; i++) {
        njc[i] = njc[i-1]*inv(i)%mod;
    }
    long long ans = 0;
    for (int i = 0; i <= n/4; i++) {
        if (i > aa || i > bb || i > cc || i > dd)
            break;
        work(i);
        f[i] = a[n-4*i]*inv(njc[n-4*i])%mod*C[n-3*i][i]%mod;
        if (i&1)
            ans -= f[i];
        else
            ans += f[i];
    }
    // cout<< i << " " << f[i] << endl;
}
for (int i = n/4; ~i; i--) {
    for (int j = i+1; j <= n/4; j++)
        (f[i] -= f[j]*C[j][i]) %= mod;
}
f[0] += mod;
f[0] %= mod;
ans %= mod;


```

```
ans += mod;  
ans %= mod;  
// cout << ans << endl;  
printf("%lld", f[0]);  
return 0;  
}
```

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