COP 3502 2/6/2024

Brute Force

Odometer

0	0	0	0

0 0 0 1
0 0 0 2
0 0 1 0
0 0 1 1
⋮
2 2 2 2

dist fixed
1st open slot

odom([1|2|_], k=2, n=4, d=3)

```
if (k==n) {
    print([1|2|_])
    return
}
for (int i=0; i<d; itr) {
    odometer[k] = i
    odom(odometer, k+1, n, d);
}
```

[1|2|_]

odom [1|2|0] → 1200, 1201, 1202
odom [1|2|1] → 1210, 1211, 1212
odom [1|2|2] → 1220, 1221, 1222

Combinations

{A, B, C}

∅
{A}
{B}
{C}
{A, B}
{A, C}
{B, C}

{A, B, C}
0 0 0
0 0 1
0 1 0
0 1 1
1 0 0
1 0 1
1 1 0
1 1 1

Odometer

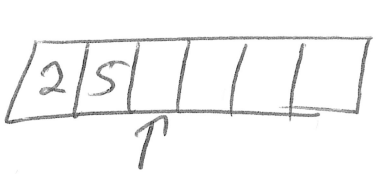
w/o A → ∅, {B}, {C}, {B, C}

w/ A → {A}, {A, B}, {A, C}, {A, B, C}

Permutation

0, 1, 2, .. n-1

0, 1, 2
0, 2, 1
1, 0, 2
1, 2, 0
2, 0, 1
2, 1, 0



perm(2 5 | | | , k=2, n=6, used F F T F F T) {

if (k==n) process + return

for (i=0; i<n; i++) {

if (used[i]) continue;

used[i] = 1;

perm[k] = i;

perm(perm, k+1, n, used);

used[i] = 0;

}

}

perm 2 5 | | , 2, 6, used

① perm 2 5 4 | | , 3, 6, used

② perm 2 5 1 | | , 3, 6 used

③ perm 2 5 3 | | , 3, 6, used

④ perm 2 5 4 | | , 3, 6, used

Permutations but item i can't be in slot i.

Derangements

	0	1	2
hat	1	2	0
hat	2	0	1

Perm

```
for (i=0; i<n; i++) {

    if (used[i]) continue;
    //skip giving me my own hat!
    if (i == k) continue;

    {
        reg PERM code
    }

}
```

Side note about permutations

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

$0 \to 6 \to 3 \to 0$

$1 \to 2 \to 1$

$4 \to 5 \to 4$

7 9

Upwards

act 1-gap upword of length 3
1 16

a e m z 3-gap upword of length 4
3 >3 >3

Input k-gap, n = length upword

Print out all k-gap upwords of length n.

ODOMETER

DIFFERENCE:

k=1

a e
b
g
d
e
.
.
z