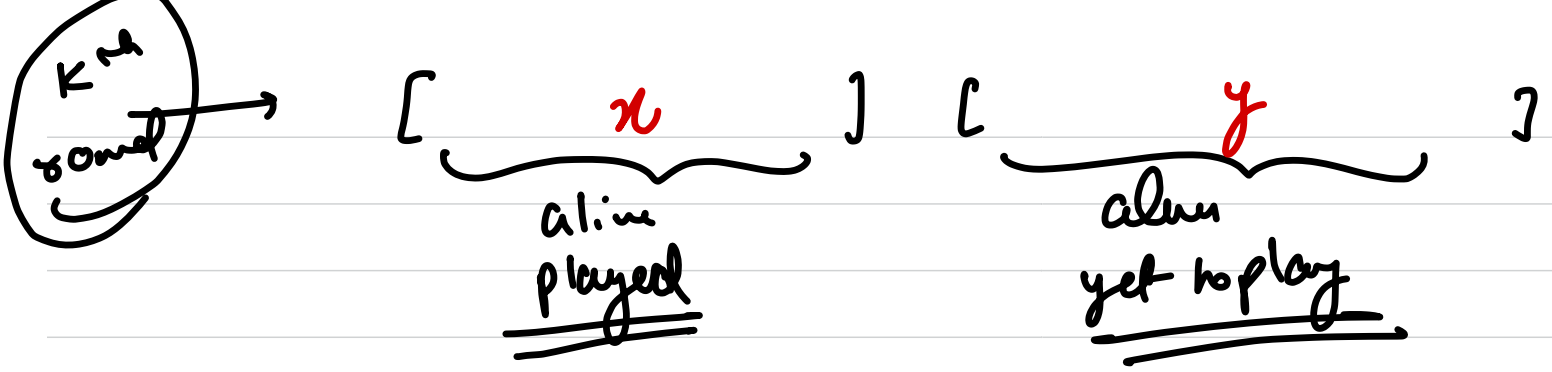
Q37 Game → Battle royal. N-people play the game.
Multi round game. Eliminatory game. Game ends
when there is 1 player left. M players → [1..m]
every i^{th} player choose a no. p_i equiprobably.
$(1 \le p_i \le x)$ $(p_i \neq i)$
→ if the i^{th} player is still in the game, eliminate p_i
→ if player i is already eliminated, nothing happens.
Calc expected no. of rounds



eliminate

$x + y + 2 = n$ → no. of players at the start of round x.

k^{th} round

N → # of players at start

[x] [y]

x : alive played

y : alive yet to play

$\frac{X}{N-1}$

→ probability that we chose someone who is alive & player the k^{th} round

because at start of round we have N players & one can't chose itself

$$\frac{Y-1}{N-1}$$

probability that you chose someone who has not played yet but is alive.

$$\frac{(N-1)-(X+Y-1)}{N-1}$$

probability that you chose a dead one.

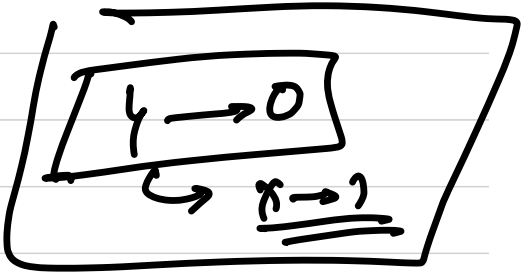
3d dp

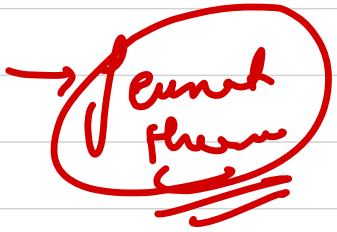
$$f(N, X, Y) = \frac{X}{N-1} \times f(N, X, Y-1) + \left(\frac{Y-1}{N-1}\right) \times f(N, X+1, Y-2) + \frac{(N-1)-(X+Y-1)}{N-1} \times f(N, X+1, Y-1)$$

no. of expected rounds

10^6

recursive





final ans — $1 + f(N, 0, N)$

Q. Players → CC

N elems → equi-probably choosed

$f(i, j)$

↓

probability to have j unique elements in a list of i elements.

$E = V \times C$

$\Rightarrow \boxed{f(d, n) \times l}$

expen

$f(i,0) \mathrel{+}= f(i-1,j) \times \frac{j}{n}$

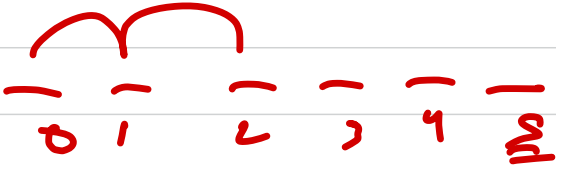
$f(i,0) \mathrel{+}= f(i-1,j) \times \frac{n-j}{n}$

Q) You start walking from position i=0. find the probability to reach i = n, if you can take only 2 or 3 steps from a pair. You're given probability of taking 2 steps from every pair.

$n = 5 \qquad p = 0.2$

↳ 0.32 one

$0.2 \times 0.8 = 0.16$
$0.8 \times 0.2 \rightarrow 0.16$ } + → 0.32



$f(N) = f(N-2) \times p + f(N-3) \times (1-p)$

$f(N)$ ↓ proba of reach N

→ 10 dp

→ takemath

Base Case

$f(0) = 1$

$f(1) = 0$

$f(2) = p$

$f(3) = 1-p$

$$f(T,K) = \frac{K}{T-K} \times \left(1 + f(T-2, K-1)\right) +$$

$$\left(\left(1 - \frac{K}{T-K}\right) \times \frac{1}{T-K-1}\right)\left(1 + f(T-2, K)\right) +$$

$$\left(1 - \frac{K}{T-K}\right) \times \left(\frac{K}{T-K-1}\right) \times \left(2 + f(T-2, K)\right) +$$

$$\left(1 - \frac{K}{T-K}\right)\left(1 - x - y\right) \times \left(1 + f(T, K+1)\right)$$

computed no of moves

x

y