Q1 → $x_1 + \cdots + x_n = k$

$^{k+n-1}C_{n-1}$

Q2 → $x_1 + x_2 + x_3 = 4$; $^{4+3-1}C_{3-1}$

$= {}^6C_2 = 15$

Q3 → ~~chose~~ choose and permute

Q4 → 4 choice for each problem

Q5 → $x_1 + x_2 + \cdots + x_7 = 15$

Q6 → $= 8$

~~Q8~~ Q8 → $x_1 + x_2 + \cdots + x_4 = 9$

Q9 → $x_1 + \cdots + x_9 = 10$

— four cases

$$x_t + x_c + x_o = 4$$

x_t	x_c	x_o
0	0	4
1	1	2

$(0, 2, 3, 4) \leftarrow$

$A_1 A_2$
$A_3 A_4$ must be different

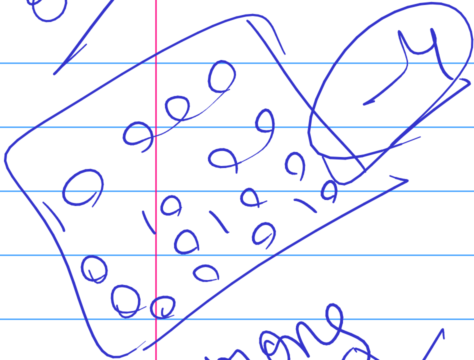
① → choose 7 candies $\quad {}^{15}C_7$

② → distribute them $\quad 7!$

③ → distrib rem 8 in any way $\quad 7^8$

overcounting

Candy A → W_1 → step ①
$\quad\quad\quad\;\,$ → W_2 → step ③



5	0	5	0
10	0	0	0

wrong

$$\underbrace{{}^{12}C_2 \times {}^{10}C_2 \times {}^{8}C_2 \times \cdots \times {}^{2}C_2}_{6!}$$

$P_1 P_2$

$${}^{10}C_4 \times {}^{10}C_2 \times {}^{10}C_3 \times {}^{10}C_4$$

$$\underbrace{0\,1\,2\,3\,4\,5\,6\,7\,8\,9}$$

$${}^{10}C_4 \times 1$$

Total $-$ $\underbrace{\text{inc}}$

$2\,3\,8\,9$

$$7^{15} - {}^{7}C_1 \times 6^{15} + {}^{7}C_2 \times 5^{14}$$

$$- {}^{7}C_3 \times 3^{13}$$

15 distinct candy → 7 distinct people

Total = 7^{15} $\boxed{\text{PIE}}$

atleast 1 candy for each person

$f(1) = {}^{7}C_{1} \times 6^{15}$

$f(2) = {}^{7}C_{2} \times 5^{15}$

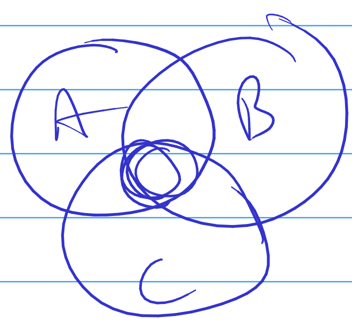
Total $- f(1) + f(2) - f(3) + f(4) - \ldots$

letters $1, 2, 3, 4, \ldots, n$

$\Downarrow$

envelopes ordered

derangement



$A + B + C - A \cap B - B \cap C - C \cap A + A \cap B \cap C$

set theory