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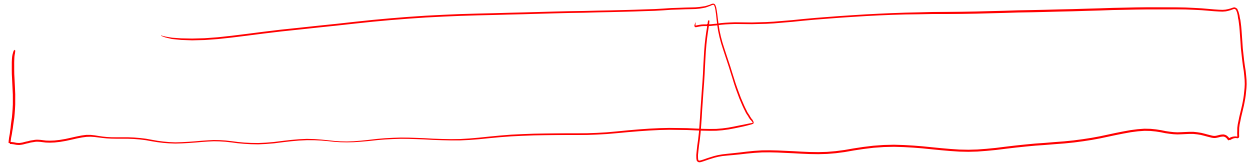
$$P(n) \blacksquare \sum_{i=1}^{n-5} 1 = (n-5) + 5$$

$$\boxed{(3n)^2 + (3n-1)^2 + (3n-2)^2} + (3n-3)^2 + \dots$$

$$(3n-3)^2 + \dots$$

$$(2n)^2 + (2n-1)^2 + (2n-2)^2 + \dots$$

$$\boxed{(2n-2)^2 + (2n-1)^2} + (2n)^2 + \dots$$



length
 2
 3
 4
 Sequence
 tuple
 length

non
 pair
 triple
 4-tuple
 (1, 2, 3)

Order matters
 duplicates

$$(1, 2) \neq (2, 1)$$

$$(1, 2, 1, 2, 1, 2) \text{ ok}$$

Values

Set
 cardinality

{1, 2, 3}

$$\{1, 2\} = \{2, 1\}$$

$$\{1, 2\} \neq (1, 2)$$

STRUCTURES

- integers
- rational
- sets
- seq
- symbol (character)

$$= \begin{aligned} a &= a \\ a &\neq b \\ a &\neq 1 \\ a &\neq \{a\} \end{aligned}$$

Seq of Symbols is called
 a string

$$"abc" = (a, b, c)$$

$(0,0,0,0)$
 $(0,0,0,1)$
 $(0,1,0,0)$
 $(1,0,0,0)$
 $(0,0,1,0)$

Permutation

How many

Seq of length 4 contain digits $(0,1,2,\dots,9)$

Set

$$\left(\begin{array}{cccc} \downarrow & & \downarrow & \\ 10 & \times & 10 & \times & 10 & \times & 10 & \times & 10 \end{array} \right) = 10,000 = 10^4$$

→ Seq of len 4 of digits w/ no duplicates

$$\left(\begin{array}{cccc} 10 & \times & 9 & \times & 8 & \times & 7 \end{array} \right) = \frac{10!}{6!} = \frac{10!}{(10-4)!}$$

no dup

OPM

OPM

posim

Sets of len 4 of digits

$$\frac{10!}{6!4!} = \frac{10!}{(10-4)!4!} = \binom{10}{4}$$

uncanceled

10 choose 4

$$\prod_{i=7}^{10} i$$

Permutation of seq

- seq
- same kmp
- same element same num of times
- different order

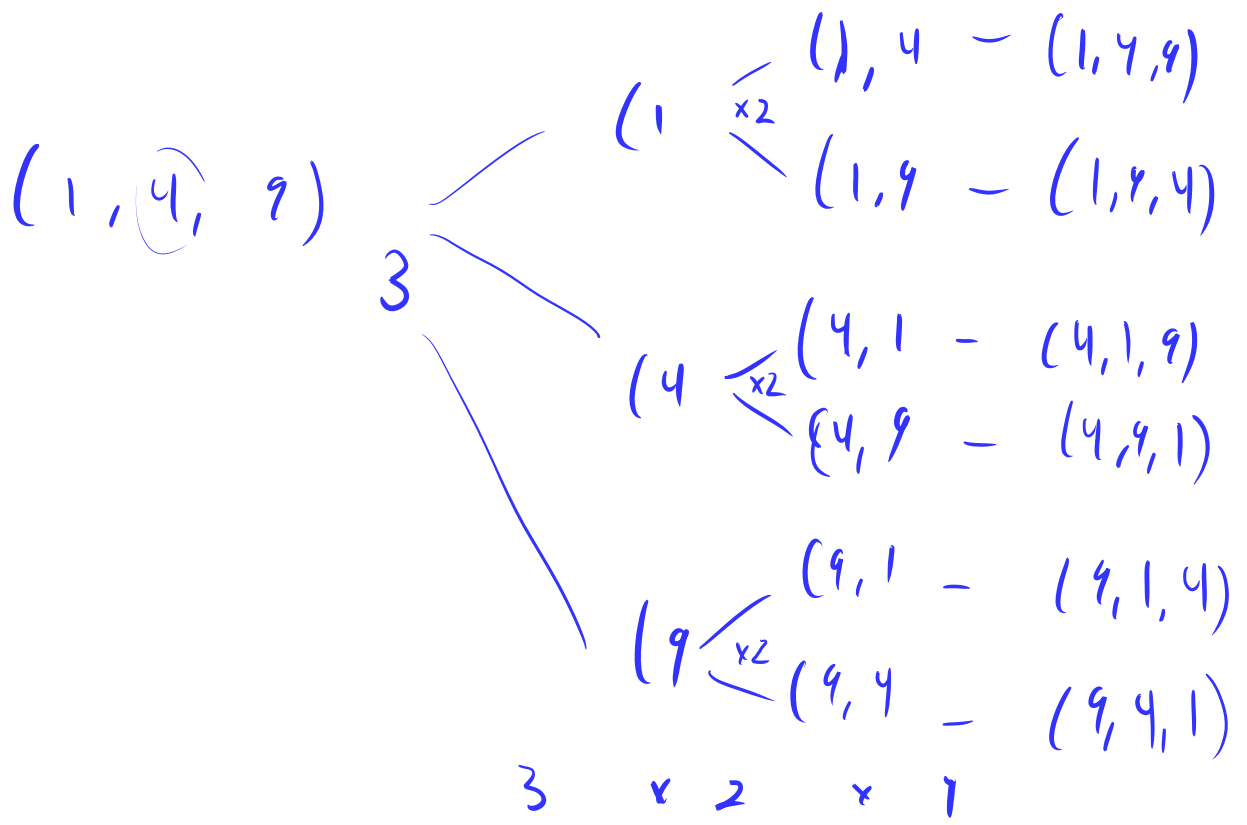
(x , y , z , w)



(4 , 3 , 2 , 1)

no duplca

perm of seq of len x = x!



$$\prod_{i=1}^x i = x! = x \cdot (x-1) \cdot (x-2) \cdot \dots \cdot 2 \cdot 1$$

$$\frac{10!}{6!} = \frac{10 \cdot 9 \cdot 8 \cdot 7 \cdot \cancel{6} \cdot \cancel{5} \cdot \cancel{4} \cdot \cancel{3} \cdot \cancel{2} \cdot \cancel{1}}{\cancel{6} \cdot \cancel{5} \cdot \cancel{4} \cdot \cancel{3} \cdot \cancel{2} \cdot \cancel{1}}$$

Concatenate (1, 2, 3) and (3, 4)

to get (1, 2, 3, 3, 4)

Cartesian Product

$$\{1, 2, 3\} \times \{8, 9\} = \{(1, 8), (2, 8), (3, 8), (1, 9), (2, 9), (3, 9)\}$$

$$A \times B = \{(a, b) \mid a \in A \wedge b \in B\}$$

$$A \times B \times C = \{(a, b, c) \mid a \in A \wedge b \in B \wedge c \in C\}$$

$$A^3 = A \times A \times A$$

$\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}^4$
set of all seq of 4 digits

Kleene star

$$A = \{a, b\}$$

$$A^* = A^0 \cup A^1 \cup A^2 \cup A^3 \cup \dots$$

$$\{\epsilon, (a), (b), (a, a), (a, b), (b, a), (b, b), (a, a, a) \dots\}$$