



Why cases

1. $\textcircled{\vdash} A \vee B$

$n=0 \vee n>0$

Induction not from $\textcircled{\vdash}$

2. $A \vdash C$

$n=0 \textcircled{\vdash} \text{Thm}$

WOP $x \in \mathbb{N} \rightarrow \exists y \in x. \forall z \in x. z \neq x \rightarrow z > x$

3. $B \vdash C$

$n>0 \textcircled{\vdash} \text{Thm}$
induc. assum

Cases vs Induction

$\textcircled{\vdash} C$

\forall $\textcircled{\text{even } x. x^2 \text{ is even}}$

0

2

4

6

8

bc: 0

is: $n \rightarrow n+2$

$n \rightarrow 3n+3$

$\forall n \in \mathbb{N} (2n)^2 \text{ is even}$

$\forall n \in \mathbb{N} E(x) \rightarrow E(x^2)$
 — even
 — odd

W.O.P - \mathcal{N}

Set of n for which $P(\mathcal{N})$ is me

$$A \subset \mathbb{Q}$$

$$A = \{x \mid x \in \mathbb{Q} \wedge x > 1\}$$

Combinations Permutations Counting

and Pick $\binom{X}{10} * \binom{Y}{20} = 200$

or Pick $\binom{X}{10} + \binom{Y}{20} = 30$

Order repetition pick 4 of 20 things

	repeat	no repeat
()	20^4 $20 \cdot 20 \cdot 20 \cdot 20$	$20! / 16!$ $20 \cdot 19 \cdot 18 \cdot 17$
{ }	not in this class	$\frac{20!}{16!} = 4!$

$$\frac{20 \cdot 19 \cdot 18 \cdot 17 \cdot 16 \cdot 15 \cdot 14 \cdot \dots \cdot 2 \cdot 1}{10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot \dots \cdot 2 \cdot 1}$$

(a, b, c, d)
reorder

$$4 \cdot 3 \cdot 2 \cdot 1 = 4!$$

$$\binom{20}{4} = \frac{20!}{(20-4)! 4!}$$

shufflings of

$(\underbrace{0, 0, 0}_{\text{rearrange}}, \overbrace{1, 1}, \underbrace{2, 2, 2})$

rearrange

$8!$

$3! 2! 3!$

Sets - Ordovless

\subset
 \subseteq
 \in

$\{ _ | _ \}$

ds.

$P(X)$

logs - CoB
Prod
quotient

$P(\{0, \{0\}\})$

seq - rep
order matters

$\{\{\}, \{0\}, \{\{0\}\}, \{0, \{0\}\}\}$

subsequence $(1, 2, 3, 4) \xrightarrow{ss} (1, 3, 4)$

substring $(1, 2, 3, 4) \xrightarrow{ss} (2, 3, 4)$

$A \times B$ - Set of seq of 2 elems each $\{(a, b) \mid a \in A, b \in B\}$
 A^2 A^*

automata

graphs

(V, E)
 \uparrow
 (v, v)

relations $\left\{ \begin{array}{l} \text{rel} \\ \text{func} \end{array} \right.$
inverse
transim
reflexiv
sym $f(x) = |x|$
one ω -down for each down