Examples

$S \rightarrow 0S0|1S1|0|1|\varepsilon$

$S \rightarrow 0S|S1|\varepsilon$

$S \rightarrow (S)|SS|\varepsilon$

$S \rightarrow AB$
$A \rightarrow 0A1|\varepsilon$
$B \rightarrow 1B0|\varepsilon$

Arithmetic

$E \rightarrow E + E|E * E|(E)|x|y|z|0|1|2|3|4|5|6|7|8|9$

Generate $(2 * x) + y$

Generate $2 + 3 * 4$ in two different ways

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Relations

Relations

A (binary) relation from A to B is a subset of $A \times B$
A (binary) relation on A is a subset of $A \times A$

Wait what?

$\leq$ is a relation on $\mathbb{Z}$.

"$3 \leq 4$" is a way of saying "3 relates to 4" (for the $\leq$ relation)

$(3,4)$ is an element of the set that defines the relation.

Try a few of your own

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Decide whether each of these relations are

Reflexive, symmetric, antisymmetric, and transitive.

$\subseteq$ on $\mathcal{P}(\mathcal{U})$

$\geq$ on $\mathbb{Z}$

$>$ on $\mathbb{R}$

$|$ on $\mathbb{Z}^+$

$|$ on $\mathbb{Z}$

$\equiv (mod\ 3)$ on $\mathbb{Z}$

Symmetry: for all $a, b \in S$, $[(a,b) \in R \rightarrow (b,a) \in R]$

Antisymmetry: for all $a, b \in S$, $[(a,b) \in R \wedge a \neq b \rightarrow (b,a) \notin R]$

Transitivity: for all $a, b, c \in S$, $[(a,b) \in R \wedge (b,c) \in R \rightarrow (a,c) \in R]$

Reflexivity: for all $a \in S$, $[(a,a) \in R]$