

$x, y, z \in \text{Var}$   
 $n, m \in \text{Int } \mathbb{Z}$   
 $e \in \text{Exp}$

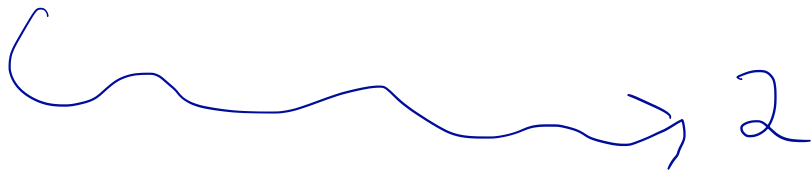
$e ::= x \mid n \mid e_1 + e_2 \mid e_1 * e_2 \mid$

$x \leftarrow e_1 ; e_2$

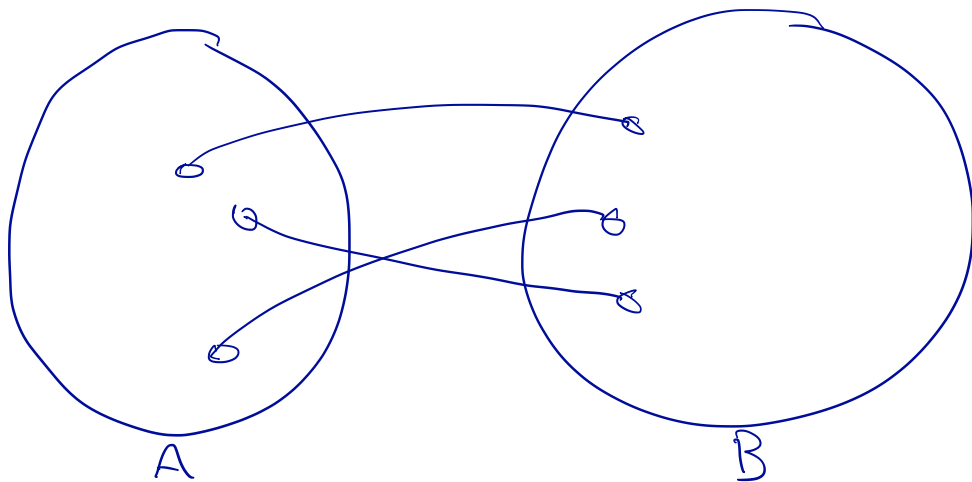
$5 + 2$

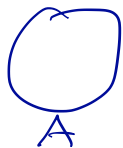
$x := y ; z$

$x := (y := 5 ; 2) ; x$

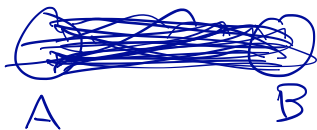


$$R \subseteq A \times B$$





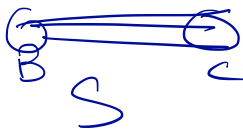
EMPTY



TOTAL



IDENTITY



COMPOSITION

$R ; S$

$$\forall \sigma, \langle \sigma, 21 * 2 \rangle \rightarrow \langle \sigma, 42 \rangle$$

$$\langle \sigma, 21 * (1+1) \rangle \rightarrow \langle \sigma, 21 * 2 \rangle$$

$$\langle \sigma, (1+1) * (1+1) \rangle \rightarrow \langle \sigma, 2 * (1+1) \rangle$$

$$\langle \{(x, 4)\}, x \rangle \rightarrow \langle \{(x, 4)\}, 4 \rangle$$

$$\begin{aligned} \langle \emptyset, x := 2; 21 * x \rangle &\rightarrow \langle \{(x, 2)\}, 21 * x \rangle \\ &\rightarrow \langle \quad, 21 * 2 \rangle \\ &\rightarrow \langle \quad, 42 \rangle \end{aligned}$$

$$\langle \{(y, 4)\}, x := 2; x + y \rangle$$

$$\rightarrow \langle \{(y, 4), (x, 2)\}, x + y \rangle$$

$$\rightarrow \langle \{(y, 4), (x, 2)\}, 2 + y \rangle$$

$$\rightarrow \langle \quad \quad \quad, 2 + 4 \rangle$$

$$\rightarrow \langle \quad \quad \quad, 6 \rangle$$

$\langle \{(y, 4)\}, x := y + 2; x \rangle$

$\rightarrow \langle \{(y, 4)\}, x := 4 + 2; x \rangle$