SINTASSI ASTRATTA

$$E \to n \mid x \mid E_1 + E_2 \mid E_1 - E_2 \mid E_1 \times E_2$$ espressioni aritmetiche

$$B \to b \mid E_1 < E_2 \mid \neg B_1 \mid B_1 \vee B_2$$ espressioni booleane

$$C \to \text{skip} \mid x := E \mid C_1 ; C_2 \mid$$ comandi

$$\text{if } B \text{ then } C_1 \text{ else } C_2 \mid$$

$$\text{for } x = E_1 \text{ to } E_2 \text{ do } C \mid$$

$$\text{while } B \text{ do } C$$

con $n \in \mathbb{N}$,

$x \in Var$,

$b \in Bool := \{tt, ff\}$

Esiste una operazione di aggiornamento:

$$\sigma[^n/_x](y) = \begin{cases} n & \text{se } y = x \\ \sigma(y) & \text{alt.} \end{cases}$$

Definisco la semantica delle espressioni aritmetiche:

$$\mathcal{E} : E \times (\underbrace{Var \to \mathbb{N}}_{\text{Memoria}}) \to \mathbb{N}$$

$$\mathcal{E}[\![n]\!]_\sigma = n$$

$$\mathcal{E}[\![x]\!]_\sigma = \sigma(x)$$

$$\mathcal{E}[\![E_1 + E_2]\!]_\sigma = \mathcal{E}[\![E_1]\!] \text{ più } \mathcal{E}[\![E_2]\!]$$

$$\mathcal{E}[\![E_1 \times E_2]\!]_\sigma = \quad \text{per}$$

$$\mathcal{E}[\![E_1 - E_2]\!]_\sigma = \quad \text{meno}$$

Allo stesso modo definisco la semantica delle espressioni booleane:

$$\mathcal{B} : B \times (Var \to \mathbb{N}) \to Bool$$

SISTEMI di TRANSIZIONE

$(\Gamma, \to)$

Γ e' la classe delle configurazioni

(i.e. $\langle c, \sigma \rangle$ con $c \in C$)

$\to$ funzione di transizione

Un sistema di transizione e' una macchina che definisce in modo intensionale la semantica di un linguaggio di programmazione

$$\frac{-}{\langle \texttt{skip}, \sigma \rangle \to \sigma} \qquad \frac{-}{\langle x := E, \sigma \rangle \to \sigma[n/x]}, \text{ se } \mathcal{E}[\![E]\!]\sigma = n$$

$$\frac{\langle C_1, \sigma \rangle \to \langle C_1', \sigma' \rangle}{\langle C_1; C_2, \sigma \rangle \to \langle C_1'; C_2, \sigma' \rangle} \qquad \frac{\langle C_1, \sigma \rangle \to \sigma'}{\langle C_1; C_2, \sigma \rangle \to \langle C_2, \sigma' \rangle}$$

$$\frac{-}{\langle \texttt{if } B \texttt{ then } C_1 \texttt{ else } C_2, \sigma \rangle \to \langle C_1, \sigma \rangle}, \text{ se } \mathcal{B}[\![B]\!]\sigma = tt$$

$$\frac{-}{\langle \texttt{if } B \texttt{ then } C_1 \texttt{ else } C_2, \sigma \rangle \to \langle C_2, \sigma \rangle}, \text{ se } \mathcal{B}[\![B]\!]\sigma = ff$$

$$\frac{-}{\langle \texttt{for } i = E_1 \texttt{ to } E_2 \texttt{ do } C, \sigma \rangle \to \langle i := n_1;\ C;\ \texttt{for } i = n_1 + 1 \texttt{ to } n_2 \texttt{ do } C, \sigma \rangle}$$
$$\text{se } \mathcal{B}[\![E_2 < E_1]\!]\sigma = ff \wedge \mathcal{E}[\![E_1]\!]\sigma = n_1 \wedge \mathcal{E}[\![E_2]\!]\sigma = n_2$$

$$\frac{-}{\langle \texttt{for } i = E_1 \texttt{ to } E_2 \texttt{ do } C, \sigma \rangle \to \sigma} \qquad \text{se } \mathcal{B}[\![E_2 < E_1]\!]\sigma = tt$$

$$\frac{-}{\langle \texttt{while } B \texttt{ do } C, \sigma \rangle \to \langle \texttt{if } B \texttt{ then } C;\ \texttt{while } B \texttt{ do } C \texttt{ else skip}, \sigma \rangle}$$

Commenti alle definizioni sopra. P.e. sul $\texttt{for } i = n_1 + 1 \texttt{ to } n_2 \texttt{ do } C$ che mescola sintassi E con semantica $n_1 + 1$; da aggiustare con gli assegnamenti $z := E_1; w := E_2$, con $z, w \notin fn(E1, E_2, C)$.