SNU 4541.664A Program Analysis Spring 2005 Note 5

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계획

1. 의미구조 정의하기 연습

2. 프로그램의 의미는 아직도 고정점

회로도

$$
\begin{array}{rcll}
C & \to & \bot & \\
& | & \top & \\
& | & \neg\, C & \\
& | & \times\, C\; C & \\
& | & +\, C\; C & \\
& | & \oplus\, C\; C & \text{arbitration} \\
& | & \otimes\, C\; C\; C & \text{multiplexing}
\end{array}
$$

- by structural operational semantics
- by evaluation context semantics
- by transition semantics

C----

$$
\begin{array}{rcl}
C & \rightarrow & \mathtt{skip} \\
  & \mid & x \; \mathtt{:=} \; E \\
  & \mid & C \; ; \; C \\
  & \mid & \mathtt{if} \; E \; C \; C \\
  & \mid & \mathtt{while} \; E \; \mathtt{do} \; C \\
E & \rightarrow & n \quad (n \in \mathbb{Z}) \\
  & \mid & E \; \mathtt{+} \; E \\
  & \mid & \mathtt{-} \; E
\end{array}
$$

- by evaluation context semantics
- by abstract machine semantics

C---

$$
\begin{array}{rcl}
C & \rightarrow & \texttt{skip} \\
  & \mid & x \; \texttt{:=} \; E \\
  & \mid & C \; \texttt{;} \; C \\
  & \mid & \texttt{if} \; E \; C \; C \\
  & \mid & \texttt{while} \; E \; \texttt{do} \; C \\
  & \mid & \texttt{local} \; x \; \texttt{:=} \; E \; \texttt{in} \; C \\
E & \rightarrow & n \quad (n \in \mathbb{Z}) \\
  & \mid & E \; \texttt{+} \; E \\
  & \mid & \texttt{-} \; E
\end{array}
$$

C--

$$
\begin{array}{rcl}
C & \to & \texttt{skip} \\
 & \mid & x \ \texttt{:=}\ E \ \mid\ \texttt{*}x \ \texttt{:=}\ E \\
 & \mid & C \ ;\ C \\
 & \mid & \texttt{if}\ E\ C\ C \\
 & \mid & \texttt{while}\ E\ \texttt{do}\ C \\
 & \mid & \texttt{local}\ x \ \texttt{:=}\ E\ \texttt{in}\ C \\
E & \to & n \quad (n \in \mathbb{Z}) \\
 & \mid & E\ \texttt{+}\ E \\
 & \mid & \texttt{-}\ E \\
 & \mid & x \ \mid\ \texttt{*}x \ \mid\ \texttt{\&}x
\end{array}
$$

C---+

$$
\begin{array}{rcl}
C & \rightarrow & \texttt{skip} \\
 & | & x \; \texttt{:=} \; E \\
 & | & C \; ; \; C \\
 & | & \texttt{if} \; E \; C \; C \\
 & | & \texttt{while} \; E \; \texttt{do} \; C \\
 & | & \texttt{raise} \\
 & | & \texttt{try} \; C \; \texttt{handle} \; C \\
E & \rightarrow & n \quad (n \in \mathbb{Z}) \\
 & | & E \; \texttt{+} \; E \\
 & | & \texttt{-} \; E
\end{array}
$$

의미는 아직도 고정점

- 한 실행과정: $M \vdash C \Rightarrow M'$의 증명 또는 $(M, C) \to (M_1, C_1) \to \cdots$

- $$[\![C]\!]\, M = \mathit{fix}\,\lambda t.(M, C) \sqcup (t \to (M_{i+1}, C_{i+1}))$$
  $$\text{where } t = \cdots \to (M_i, C_i)$$
  $$\wedge\ (M_i, C_i) \to (M_{i+1}, C_{i+1})$$

- $$[\![C]\!] = \mathit{fix}\,\lambda f.\lambda M.(M, C) \sqcup (f(M) \to (M_{i+1}, C_{i+1}))$$
  $$\text{where } f(M) = \cdots \to (M_i, C_i)$$
  $$\wedge\ (M_i, C_i) \to (M_{i+1}, C_{i+1})$$

$$
\begin{array}{rcl}
[\![C]\!]\,M & = & \mathit{fix}\,\lambda T. \\
& & \{(M,C)\}\sqcup \\
& & \{t \to (M_{i+1}, C_{i+1}) \mid \\
& & \ \ t \in T,\ t = \cdots \to (M_i, C_i),\ (M_i, C_i) \to (M_{i+1}, C_{i+1})\}
\end{array}
$$

$$
[\![C]\!] = \mathit{fix} \cdots
$$

$$
\begin{array}{rcl}
[\![C]\!]\,M & = & \mathit{fix}\,\lambda S. \\
& & \{(M,C)\}\sqcup \\
& & \{(M_{i+1}, C_{i+1}) \mid \\
& & \ \ (M_i, C_i) \to (M_{i+1}, C_{i+1}),\ (M_i, C_i) \in S\}
\end{array}
$$

$$
[\![C]\!] = \mathit{fix} \cdots
$$