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Language Engineering

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Derivation Sequences p32-3

- A configuration γ can have one of two forms:
  - Either it is an *incomplete* (or *intermediate*) configuration $\gamma = \langle S , \sigma \rangle$
  - Or it is a *terminal* (or *complete*) configuration of the form $\gamma = \sigma$
- An incomplete configuration γ can have one of two properties:
  - Either it is *stuck* if there is no γ' such that $\gamma \Rightarrow \gamma'$
  - Or it is *unstuck* if there is some γ' such that $\gamma \Rightarrow \gamma'$
- A derivation sequence from $\langle S,\sigma \rangle$ can have one of two forms
  - Either it is a *finite* sequence $\gamma_0, \gamma_1, \ldots, \gamma_n$ such that $\gamma_0 = \langle S,\sigma \rangle$ and $\gamma_i \Rightarrow \gamma_{i+1}$ for all $0 \leq i \leq n-1$ and γ_n is a terminal or stuck configuration
  - Or it is an *infinite* sequence $\gamma_0, \gamma_1, \gamma_2, \ldots$ such that $\gamma_0 = \langle S,\sigma \rangle$ and $\gamma_i \Rightarrow \gamma_{i+1}$ for all $0 \leq i$
- We write $\gamma \Rightarrow^k \gamma'$ to denote that γ' can be obtained from γ in *exactly* k steps using the transition relation $\Rightarrow$
- We write $\gamma \Rightarrow^* \gamma'$ to denote that γ' can be obtained from γ in some *finite* number of steps using the transition relation $\Rightarrow$

Termination and Looping p36

- The execution of statement S in state σ *terminates* iff there exists a finite derivation sequence from $\langle S , \sigma \rangle$
- The execution of statement S in state σ *loops* iff there exists an infinite derivation sequence from $\langle S , \sigma \rangle$
- A statement S always *terminates* iff its execution terminates in all states σ
- A statement S always *loops* iff its execution loops in all states σ
- An execution terminates *successfully* iff it ends with a terminal configuration

Determinism and Equivalence p38-9

- A structural operational semantics is strongly deterministic iff $\langle S,\sigma\rangle \Rightarrow \gamma$ and $\langle S,\sigma\rangle \Rightarrow \gamma'$ imply that $\gamma = \gamma'$ for all S ,σ, γ, γ'

- A structural operational semantics is weakly deterministic iff $\langle S,\sigma\rangle \Rightarrow^* \sigma'$ and $\langle S,\sigma\rangle \Rightarrow^* \sigma''$ imply that $\sigma' = \sigma''$ for all S ,σ, σ', σ''

- Two statements S_1 and S_2 are *semantically equivalent* (under the structural semantics) whenever it holds that for all states σ
  - $\langle S_1 , \sigma\rangle \Rightarrow^* \gamma$ iff $\langle S_2 , \sigma\rangle \Rightarrow^* \gamma$ whenever is γ stuck or terminal
  - There is an infinite derivation sequence from $\langle S_1 , \sigma\rangle$ iff there is an infinite derivation from $\langle S_2 , \sigma\rangle$