Selected solutions from Ch. 2, 5th edition.

§1.2

\( \Sigma^* = L \cup \Sigma \). If \( L \) is finite, then \( \Sigma^* \) is infinite.

No. For any \( L \), let \( \Sigma^* \) be the star closure of every language \( (L)^k \).

Yet \( \lambda \in \Sigma^* \) because \( \lambda \) is in the star closure of any language \( (L)^k \).

(a) \( S \rightarrow \lambda, \quad \lambda \rightarrow \lambda \).

(b) \( S \rightarrow \lambda, \quad \lambda \rightarrow \lambda \).

(c) \( S \rightarrow \lambda, \quad \lambda \rightarrow \lambda \).

\[ \{ (a \lambda)^n : n \geq 0 \} \]

L(\(\lambda\)) = \(\emptyset\) because no terminal strings are generated from \(S\).

(b) \( S \rightarrow \lambda \).

(c) \( S \rightarrow \lambda \).

\(L_1\) is generated by \(S \rightarrow A\), \(A \rightarrow aA\), \(A \rightarrow \lambda\), \(B \rightarrow bB\).

\(L_2\) is generated by \(S \rightarrow aBB\).

To get \(L_1 \cup L_2\), use \(S \rightarrow S_1 \) with \(S_1 \) and \(S_2 \) now leading into \(L_1 \) and \(L_2\). Thus: \(S \rightarrow SS_1 \), \(S_1 \rightarrow A\), \(A \rightarrow aA\), \(A \rightarrow \lambda\), \(B \rightarrow bB\).

(c) \( S \rightarrow \lambda \).

\(L_1 \cup L_2\) is generated by \(S \rightarrow SS_1 \).

(c) \( S \rightarrow \lambda \).

Here is a grammar, \(S \rightarrow aS \mid bS \mid \lambda \).

(a) \( S \rightarrow aS \).

(a) \( S \rightarrow aS \).

(b) \( S \rightarrow bS \).

(c) \( S \rightarrow \lambda \)