

Chapter 1 Section 3 Exercises

1. While passwords generally have few restrictions, they are normally not totally free. Suppose that in a certain system, passwords can be of arbitrary length but must contain at least one letter, $a - z$, and one number $0 - 9$. Construct a grammar that generates the set of such legal passwords.

Solution. The grammar G is $G = (\{\langle password \rangle, \langle letter \rangle, \langle number \rangle, \langle rest \rangle\}, \{a, b, \dots, z, 0, 1, \dots, 9\}, \{\langle password \rangle\}, P)$ where P is given by

$$\langle password \rangle \rightarrow \langle rest \rangle \langle letter \rangle \langle rest \rangle \langle number \rangle \langle rest \rangle,$$

$$\langle password \rangle \rightarrow \langle rest \rangle \langle number \rangle \langle rest \rangle \langle letter \rangle \langle rest \rangle,$$

$$\langle rest \rangle \rightarrow \langle letter \rangle \langle rest \rangle \mid \langle number \rangle \langle rest \rangle \mid \lambda,$$

$$\langle letter \rangle \rightarrow a \mid b \mid \dots \mid z,$$

$$\langle number \rangle \rightarrow 0 \mid 1 \mid \dots \mid 9.$$