Theory of Algorithms. Spring 2000. Homework 5 Solutions.

Section 3.3

(3) Right Linear

$$S \to aaA$$
$$A \to aA \mid bbbB$$
$$B \to bB \mid \lambda$$

Left Linear

$$S \to Abbb$$
$$A \to Ab \mid Baa$$
$$B \to Ba \mid \lambda$$

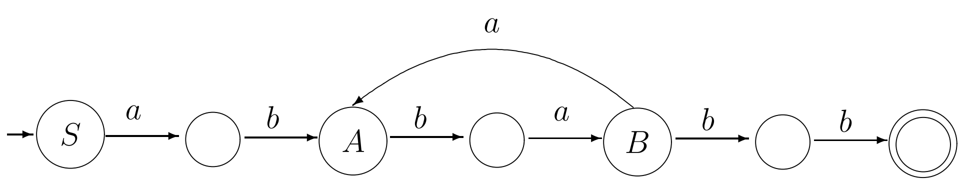
(5)

$$S \to bS \mid \lambda \mid aA$$
$$A \to bA \mid \lambda \mid aB$$
$$B \to bB \mid \lambda \mid aC$$
$$C \to bC \mid \lambda$$

(9)

$$S \to A \mid B$$
$$A \to aaA \mid C$$
$$B \to aaB \mid abC$$
$$C \to bbC \mid \lambda$$

Extra problem 1. Using the right-linear grammar given in exercise 1 of section 3.3.



Extra problem 2. Sorry, I meant Figure 2.6 on page 46, not page 47.
(Let $S \sim q_0$, $A \sim q_1$, $B \sim q_2$, $C \sim q_3$.)

$$S \to bA \mid aB$$
$$A \to aA \mid bA$$
$$B \to bB \mid aC$$
$$C \to aC \mid bB \mid \lambda$$

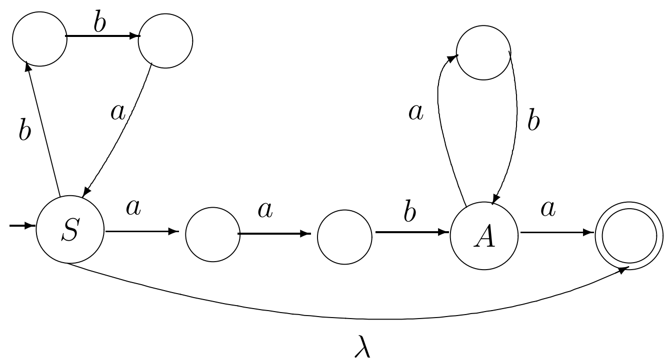
Extra problem 3. Let G_1 be the following left-linear grammar:

$$S \to Sabb \mid Abaa \mid \lambda$$
$$A \to Aba \mid a$$

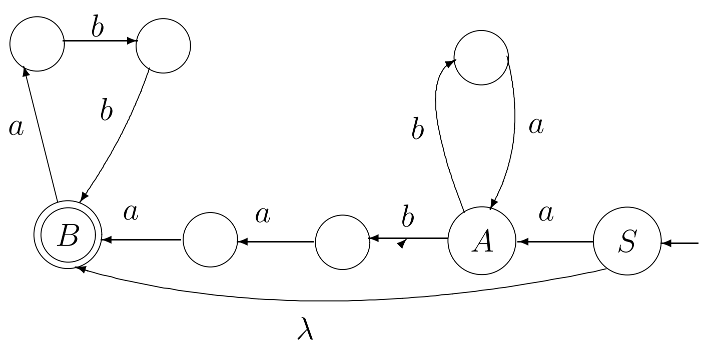
(a) A right linear grammar G_2 such that $L(G_2) = L(G_1)^R$.

$$S \to bbaS \mid aabA \mid \lambda$$
$$A \to abA \mid a$$

(b) An nfa M such that $L(M) = L(G_2)$.



(c) An nfa N such that $L(N) = L(M)^R$.



(e) A right-linear grammar G such that $L(G) = L(N) = L(G_1)$.

$$
\begin{aligned}
S &\to aA \,|\, B \\
A &\to baA \,|\, baaB \\
B &\to abbB \,|\, \lambda
\end{aligned}
$$