Syntax and Semantics Exam

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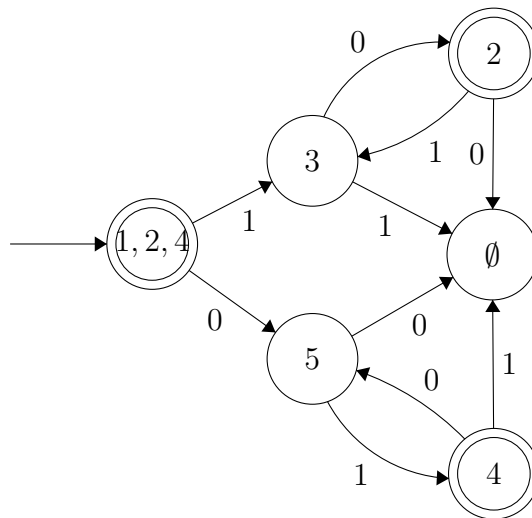# 1 Exercise

1.1

Accepted words: 10, 01. Rejected words: 1, 0.
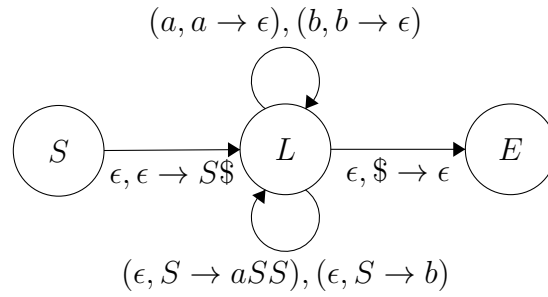
1.2

(01)*|(10)*

1.3

2 Exercise

2.1

$$S \Rightarrow b$$
$$S \Rightarrow aSS \Rightarrow abS \Rightarrow abb$$
$$S \Rightarrow aSS \Rightarrow aaSSS \Rightarrow aabSS \Rightarrow aabbS \Rightarrow aabbb$$

2.2

2.3

3 Exercise

For context-free languages the following holds. For any word w, where $\mid w \mid \geq p$ the following conditions will be satisfied.

- for all $i \geq 0, uvxyz \in L$

- $|vy| > 0$

- $|vxy| \leq p$

We assume that L' is context-free and choose the word $a^p b^{p+1} c^{p+2}$ which is in L' and is clearly longer than p.

4 Exercise

4.1

$$\frac{}{\underline{0} \to 0} \text{ by rule 0}$$
$$\frac{}{\underline{10} \to 2} \quad k = 2^{|0|} + 0, \text{ by rule 3}$$
$$\frac{}{\underline{110} \to 6} \quad k = 2^{|10|} + 2, \text{ by rule 3}$$

4.2

First we create the base cases for $\underline{1}$, $\underline{2}$, and $\underline{3}$.

$$[r_0] \quad \frac{}{\underline{0} \to 0}, \quad [r_1] \quad \frac{}{\underline{1} \to 1}, \quad [r_2] \quad \frac{}{\underline{1} \to 2} \tag{1}$$

Now for the rest.

$$[r_3] \quad \frac{w \to k'}{\underline{0}w \to k} \quad k = k' \tag{2}$$

$$[r_4] \quad \frac{w \to k'}{\underline{1}w \to k} \quad k = 3^{|w|} + k' \tag{3}$$

$$[r_5] \quad \frac{w \to k'}{\underline{2}w \to k} \quad k = 2 \cdot 3^{|w|} + k' \tag{4}$$

5 Exercise

3, 6, 5