

Syntax and Semantics Exam

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1 Exercise

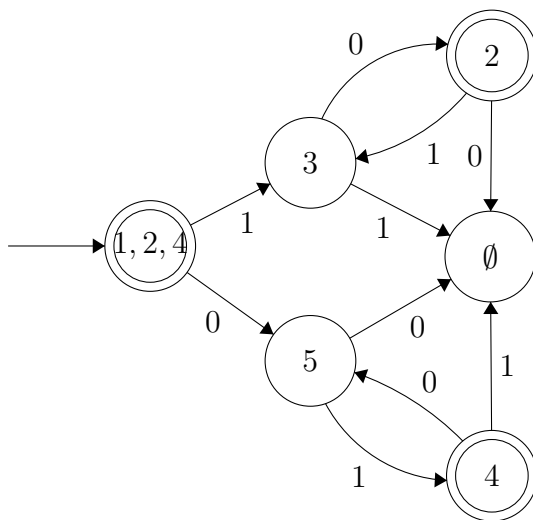
1.1

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

1.2

$(01)^*|(10)^*$

1.3



2 Exercise

2.1

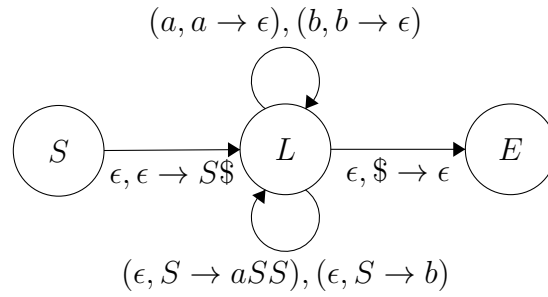
$$S \Rightarrow b$$

$$S \Rightarrow aSS \Rightarrow abS \Rightarrow abb$$

$$S \Rightarrow aSS \Rightarrow aaSSS \Rightarrow aabSS \Rightarrow aabbS \Rightarrow aabbb$$

2.2

2.3



3 Exercise

For context-free languages the following holds. For any word w , where $|w| \geq p$ 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

$$\begin{array}{l} \overline{\quad} \text{ by rule 0} \\ \underline{0} \rightarrow 0 \\ \underline{10} \rightarrow 2 \quad k = 2^{|0|} + 0, \text{ by rule 3} \\ \underline{110} \rightarrow 6 \quad k = 2^{|10|} + 2, \text{ by rule 3} \end{array}$$

4.2

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

$$[r_0] \quad \overline{\underline{0} \rightarrow 0}, \quad [r_1] \quad \overline{\underline{1} \rightarrow 1}, \quad [r_2] \quad \overline{\underline{1} \rightarrow 2} \quad (1)$$

Now for the rest.

$$[r_3] \quad \frac{w \rightarrow k'}{\underline{0}w \rightarrow k} \quad k = k' \quad (2)$$

$$[r_4] \quad \frac{w \rightarrow k'}{\underline{1}w \rightarrow k} \quad k = 3^{|w|} + k' \quad (3)$$

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

5 Exercise

3, 6, 5