Homework 1

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February 25

1 Задание 1

$\Sigma = \{a, b\}$

1. $\begin{cases} b \to a \\ a \to .\varepsilon \end{cases}$

    a) $aaaa \Rightarrow aaa.$

    b) $bbbbb \Rightarrow abbbb \Rightarrow aabbb \Rightarrow ... \Rightarrow aaaaa \Rightarrow aaaa.$

    c) $\varepsilon.$

    d) $abababab a \Rightarrow aaababab a \Rightarrow ... \Rightarrow aaaaaaaaa \Rightarrow aaaaaaaa.$

    e) $bbbabaaabbb \Rightarrow abbabaaabbb \Rightarrow ... \Rightarrow aaaaaaaaaaa \Rightarrow aaaaaaaaaa.$

    f) $aabbaaabbba \Rightarrow aaabaaabbba \Rightarrow ... \Rightarrow aaaaaaaaaaa \Rightarrow aaaaaaaaaa.$

    g) $bbababaaaa \Rightarrow ababab aaaa \Rightarrow ... \Rightarrow aaaaaaaaaa \Rightarrow aaaaaaaaa.$

    h) $bababaaabb \Rightarrow aababaaabb \Rightarrow ... \Rightarrow aaaaaaaaaa \Rightarrow aaaaaaaaa.$

2. $\begin{cases} bab \to a \\ a \to .b \end{cases}$

    a) $aaaa \Rightarrow baaa.$

    b) $bbbbb.$

    c) $\varepsilon.$

    d) $abababab a \Rightarrow aaababa \Rightarrow aaaaa \Rightarrow baaaa.$

    e) $bbbabaaabbb \Rightarrow bbaaaabbb \Rightarrow bbbaaabbb.$

    f) $aabbaaabbba \Rightarrow babbaaabbba.$

    g) $bbababaaaa \Rightarrow baabaaaa \Rightarrow bbabaaaa.$

    h) $bababaaabb \Rightarrow aabaaabb \Rightarrow babaaabb.$

3. $\begin{cases} bba \to ab \\ ab \to a \\ b \to \varepsilon \end{cases}$

a) $aaaa$.

b) $bbbbb \Rightarrow bbbb \Rightarrow \dots \Rightarrow \varepsilon$.

c) ε.

d) $abababab a \Rightarrow aababab a \Rightarrow aaabab a \Rightarrow aaaab a \Rightarrow aaaaa$.

e) $bbbabaaabb \Rightarrow babbaaabb \Rightarrow baabaabb \Rightarrow baaaabb \Rightarrow baaaab \Rightarrow baaaa \Rightarrow aaaa$.

f) $aabbaaabbba \Rightarrow aaabaabbba \Rightarrow aaabaabab \Rightarrow aaaaabab \Rightarrow aaaaaab \Rightarrow aaaaaa$.

g) $bbababaaaa \Rightarrow abbabaaaa \Rightarrow aabbaaaa \Rightarrow aaabaaa \Rightarrow aaaaaa$.

h) $bababaaabb \Rightarrow baabaaabb \Rightarrow baaaaabb \Rightarrow baaaaab \Rightarrow baaaaa \Rightarrow aaaaa$.

4. $\begin{cases} ba \to ab \\ ab \to a \\ a \to \varepsilon \end{cases}$

a) $aaaa \Rightarrow aaa \Rightarrow \dots \Rightarrow \varepsilon$.

b) $bbbbb$.

c) ε.

d) $abababab a \Rightarrow aabbabab a \Rightarrow aababbab a \Rightarrow aaabbbab a \Rightarrow aaabbabba \Rightarrow aaababbba \Rightarrow aaaabbbba \Rightarrow aaaabbbab \Rightarrow aaaabbabb \Rightarrow aaaababbb \Rightarrow aaaaabbbb \Rightarrow aaaaabbb \Rightarrow aaaaabb \Rightarrow aaaaab \Rightarrow aaaaa \Rightarrow \dots \Rightarrow \varepsilon$.

e) $bbbabaaabb \Rightarrow bbabbaaabb \Rightarrow babbbaaabb \Rightarrow abbbbaaabb \Rightarrow \dots \Rightarrow aaaabbbbbb \Rightarrow aaaabbbbb \Rightarrow \dots \Rightarrow aaaa \Rightarrow aaa \Rightarrow \dots \Rightarrow \varepsilon$.

f) $aabbaaabbba \Rightarrow aababaabbba \Rightarrow \dots \Rightarrow aaaaaabbbbb \Rightarrow aaaaaabbbb \Rightarrow \dots \Rightarrow aaaaaa \Rightarrow aaaaa \Rightarrow \dots \Rightarrow \varepsilon$.

g) $bbababaaa \Rightarrow babbabaaa \Rightarrow \dots \Rightarrow aaaaaabbbb \Rightarrow aaaaaabbb \Rightarrow \dots \Rightarrow aaaaaa \Rightarrow aaaaa \Rightarrow \dots \Rightarrow \varepsilon$.

h) $bababaaabb \Rightarrow abbabaaabb \Rightarrow \dots \Rightarrow aaaaabbbbb \Rightarrow aaaaabbbb \Rightarrow \dots \Rightarrow aaaaa \Rightarrow aaaa \Rightarrow \dots \Rightarrow \varepsilon$.

5. $\begin{cases} aa \to aa \\ bb \to b \\ ab \to b \\ a \to .\varepsilon \end{cases}$

a) $aaaa \Rightarrow aaa \Rightarrow \dots \Rightarrow a \Rightarrow \varepsilon$.

b) $bbbbb \Rightarrow bbbb \Rightarrow \dots \Rightarrow b$.

c) ε.

d) $abababab a \Rightarrow babababa \Rightarrow bbababa \Rightarrow bababa \Rightarrow bbaba \Rightarrow baba \Rightarrow bba \Rightarrow ba \Rightarrow b.$

e) $bbbabaaabbb \Rightarrow bbbabaabbb \Rightarrow bbbababbb \Rightarrow bbababbb \Rightarrow ... \Rightarrow babab \Rightarrow bbab \Rightarrow bab \Rightarrow bb \Rightarrow b.$

f) $aabbaaabbba \Rightarrow abbaaabbba \Rightarrow ... \Rightarrow abbabbba \Rightarrow ababbba \Rightarrow ... \Rightarrow ababa \Rightarrow baba \Rightarrow bba \Rightarrow ba \Rightarrow b.$

g) $bbababaaaa \Rightarrow ... \Rightarrow bbababa \Rightarrow bababa \Rightarrow ... \Rightarrow ba \Rightarrow b.$

h) $bababaaabb \Rightarrow ... \Rightarrow babababb \Rightarrow bababab \Rightarrow bbabab \Rightarrow babab \Rightarrow ... \Rightarrow bb \Rightarrow b.$

6. $\begin{cases} aa \rightarrow aa \\ b \rightarrow bb \\ a \rightarrow .b \end{cases}$

a) $aaaa \Rightarrow ... \Rightarrow a \Rightarrow b.$

b) $bbbbb \Rightarrow bbbbbb \Rightarrow ... \Rightarrow bbbbbbbbbbbbbbbbbbbbbbbbbbb......$

c) $\varepsilon.$

d) $abababab a \Rightarrow ... \Rightarrow abbbbbbbb....ababab a$

e) $bbbabaaabb b \Rightarrow ... \Rightarrow bbbababbb \Rightarrow bbbbbbbbbbbbb...ababbb$

f) $aabbaaabbba \Rightarrow ... \Rightarrow abbabbba \Rightarrow ... \Rightarrow abbbbbbbbbbbbbbbb...abbba$

g) $bbababaaaa \Rightarrow ... \Rightarrow bbababa \Rightarrow bbbbbbbbbbbbbbb...ababa$

h) $bababaaabb \Rightarrow ...babababb \Rightarrow bbbbbbbbbbbbbbb...abababb$