KUTAISI INTERNATIONAL UNIVERSITY

Exercise/TTF
for Basic Principles of Operating Systems 2023
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Exercises for week 1

1 A simple grammar

Consider the grammar G with:

$$\begin{array}{rcl} N & = & \{S\} \\ T & = & \{a, e, m\} \\ S & \rightarrow & m \mid aSee \end{array}$$

1. Draw derivation trees for all words in $L(G)$ which can be derived with at most 3 steps (derivation trees with at most 3 inner nodes)? (20 credit points)
2. Prove:
$$a^n m e^{2n} \in L(G) \quad \text{for all} \quad n \geq 0.$$
(10 credit points)
3. Prove:
$$L(G) = \left\{a^n m e^{2n} \middle| n \geq 0\right\}.$$
(20 bonus credit points)

2 Getting familiar with the C0 grammar

This follows the pattern of the first and second week's slides (they are uploaded). Draw derivation trees—if there is one—showing derivations.

1. Constants: from $\langle C \rangle$ to 324.
2. Names: from $\langle Na \rangle$ to $G680$.
3. Expressions: from $\langle E \rangle$ to $8/X - 989$.

   Compress subtrees with roots $\langle C \rangle$ and $\langle N \rangle$.
4. Statements: from $\langle StS \rangle$ to $Y \ = \ Y - 1; P \ = \ \texttt{new}\ OLD*$.

   Compress subtrees with roots $\langle Na \rangle$ and $\langle E \rangle$. Do not worry about the effect of the new-statement. This is only about syntax.
5. Function calls: from $\langle St \rangle$ to $v = ge(60,\ t * 8)$.

6. Type declarations: from $\langle TyD \rangle$ to `typedef uint` $[0]$ *empty_arr*.
   Compress subtrees with roots $\langle Na \rangle$.

7. Type declarations: from $\langle TyD \rangle$ to `typedef bool` $[N]$ *parametrized_arr* .
   Compress subtrees with roots $\langle Na \rangle$.

8. Function declarations: from $\langle FuD \rangle$ to `char` $main(\ )\{t = t/8;$`return` $A\}$.
   Compress subtrees with roots $\langle Na \rangle$ or $\langle E \rangle$.

Do not show pointed brackets in the trees. If there is no tree, explain why. (Each item 10 credit points)