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Homework 5

The original grammar:

$$I \rightarrow iES \mid iESeS$$
$$E \rightarrow EoG \mid G$$
$$G \rightarrow x \mid y \mid z \mid w$$
$$S \rightarrow s \mid dLb$$
$$L \rightarrow s \mid sL$$

Q1: Derive: ioxoyowdssbes

$$I \rightarrow iESeS$$

Result: iESeS

$$E \rightarrow EoG$$

Result: iEoGSeS

$$E \rightarrow EoG$$

Result: iEoGoGSeS

$$E \rightarrow G$$

Result: iGoGoGSeS

$$G \rightarrow x$$

Result: ixoGoGSeS

$$G \rightarrow y$$

Result: ixoyoGSeS

$G \rightarrow w$

Result: ixoyowSeS

$S \rightarrow dLb$

Result: ixoyowdLbeS

$L \rightarrow sL$

Result: ixoyowdsLbeS

$L \rightarrow s$

Result: ixoyowdssbeS

$S \rightarrow s$

Result: ixoyowdssbes

Derive: ixoys

$I \rightarrow iES$

Result: iES

$E \rightarrow EoG$

Result: iEoGS

$E \rightarrow G$

Result: iGoGS

$G \rightarrow x$

Result: ixoGS

$G \rightarrow y$

Result: ixoyS

$S \rightarrow s$

Result: ixoys

Q2: $E \rightarrow EoG \mid G$ has left recursion.

This can be transformed into:

$$E \rightarrow GE'$$

$$E' \rightarrow oGE' \mid \varepsilon$$

Q3:

parse-I function:

- If i, match and call parse-E, parse-S, and possibly parse-S' again (depending on the I parse, Left Factoring needed)
- Else, there is an error

parse-E function:

- If x, y, z, w, call parse-G and parse-E'
- Else, there is an error

parse-E' function:

- If o, consume o, call parse-G, parse-E'
- Else, return empty(ε)

parse-G function:

- If x, y, z, w, consume token
- Else, error

parse-S function:

- If s, consume s
- If d, consume d, call parse-L, consume b
- Else, error

parse-L function:

- If s, consume s, optionally call parse-L

- Else, return an error

Q4: Problematic rule: $I \rightarrow iES \mid iESeS$

This can be changed to:

$I \rightarrow iES'$

$S' \rightarrow S \mid SeS$

Q5:

parse-I function:

- If i, consume i and call parse-E, and parse-S' (handles S or SeS)
- Else, return an error

parse-S' function:

- If S, call parse-S
- If next is an e, consume and call parse-S
- If next is empty(ϵ), return ϵ .
- Else, return an error

Q6: This is on GitHub.

Q7: Also listed on GitHub:

Valid Cases:

(parse '(i w o y s))

(parse '(i x o y o w d s b))

(parse '(i x o y d s b))

(parse '(i z o x o y o w s))

(parse '(i x o y o z d s s b))

(parse '(i y o x o z o w o y d s s b))

(parse '(i w o y o z o x o y o w d s b))

Invalid Cases:

(parse '(x y s q r))

(parse '(i a x s t))

(parse '(i x o y z))

(parse '(i w o d b b))

(parse '(i o x y o w s))

(parse '(i x y w d s s))

(parse '(i y z d s b e s))