BU CS320 Assignment 5: Context Free Grammars

Charleszy Li

November 2023

1 Homeworks

1.1 1)

Deriving the expression $12 + 2 * -07$ where $< expr >$ is the starting expression, with rightmost derivation:

$$
\begin{aligned}
&12 + 2 * -07 \\
&\quad < expr > \\
&\quad < expr > ::= \quad < expr > * < expr > \\
&\qquad\qquad\quad < expr > * < expr > \\
&\qquad\qquad\quad < expr > * < int > \\
&\qquad\qquad\quad < expr > *- < nat > \\
&\qquad\qquad\quad < expr > *- < digit >< nat > \\
&\qquad\qquad\quad < expr > * - 0 < digit > \\
&\qquad\qquad\quad < expr > * - 07 \\
&\qquad\qquad\quad < expr > + < expr > * - 07 \\
&\qquad\qquad\quad < expr > + < nat > * - 07 \\
&\qquad\qquad\quad < expr > + < digit > * - 07 \\
&\qquad\qquad\quad < expr > +2 * -07 \\
&\qquad\qquad\quad < nat > +2 * -07 \\
&\qquad\qquad\quad < digit >< nat > +2 * -07 \\
&\qquad\qquad\quad 1 < digit > +2 * -07 \\
&\qquad\qquad\quad 12 + 2 * -07
\end{aligned}
$$

1.2 2)

Deriving the expression:

```
for $x = -12$ to 10 do \{y = 0; pass\}
```

where $< stmt >$ is the starting expression, with leftmost derivation:

for x = -12 to 10 do {y = 0; pass}

$< stmt >$

$\langle stmt \rangle$ ::= for $\langle id \rangle = \langle expr \rangle$ to $\langle expr \rangle$ do $\langle stmt \rangle$
$\langle stmt \rangle$ ::= for $\langle letter \rangle = \langle expr \rangle$ to $\langle expr \rangle$ do $\langle stmt \rangle$
$\langle stmt \rangle$ ::= for x = $\langle expr \rangle$ to $\langle expr \rangle$ do $\langle stmt \rangle$
$\langle stmt \rangle$ ::= for x = $\langle int \rangle$ to $\langle expr \rangle$ do $\langle stmt \rangle$
$\langle stmt \rangle$ ::= for x = -$\langle nat \rangle$ to $\langle expr \rangle$ do $\langle stmt \rangle$
$\langle stmt \rangle$ ::= for x = -$\langle digit \rangle\langle nat \rangle$ to $\langle expr \rangle$ do $\langle stmt \rangle$
$\langle stmt \rangle$ ::= for x = -1$\langle digit \rangle$ to $\langle expr \rangle$ do $\langle stmt \rangle$
$\langle stmt \rangle$ ::= for x = -12 to $\langle expr \rangle$ do $\langle stmt \rangle$
$\langle stmt \rangle$ ::= for x = -12 to $\langle int \rangle$ do $\langle stmt \rangle$
$\langle stmt \rangle$ ::= for x = -12 to $\langle nat \rangle$ do $\langle stmt \rangle$
$\langle stmt \rangle$ ::= for x = -12 to $\langle digit \rangle\langle nat \rangle$ do $\langle stmt \rangle$
$\langle stmt \rangle$ ::= for x = -12 to 1$\langle digit \rangle$ do $\langle stmt \rangle$
$\langle stmt \rangle$ ::= for x = -12 to 10 do $\langle stmt \rangle$
$\langle stmt \rangle$ ::= for x = -12 to 10 do $\langle stmt \rangle$
$\langle stmt \rangle$ ::= for x = -12 to 10 do $\langle id \rangle = \langle expr \rangle$
$\langle stmt \rangle$ ::= for x = -12 to 10 do $\langle letter \rangle = \langle expr \rangle$
$\langle stmt \rangle$ ::= for x = -12 to 10 do y = $\langle expr \rangle$
$\langle stmt \rangle$ ::= for x = -12 to 10 do y = $\langle int \rangle$
$\langle stmt \rangle$ ::= for x = -12 to 10 do y = $\langle nat \rangle$
$\langle stmt \rangle$ ::= for x = -12 to 10 do y = $\langle digit \rangle$
$\langle stmt \rangle$ ::= for x = -12 to 10 do y = 0

We have derived the expression from the starting expression $< stmt >$.