程式語言 HW2

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1. Write the BNF for the following operators.

$$
\begin{aligned}
\langle id \rangle &\rightarrow A|B|C \\
\langle expression \rangle &\rightarrow \langle expression \rangle \ \&\& \ \langle relation \rangle \\
&\quad | \ \langle expression \rangle \ || \ \langle relation \rangle \\
&\quad | \ \langle relation \rangle \\
\langle relation \rangle &\rightarrow \langle relation \rangle \ < \ \langle expr \rangle \\
&\quad | \ \langle relation \rangle \ <= \ \langle expr \rangle \\
&\quad | \ \langle relation \rangle \ = \ \langle expr \rangle \\
\langle expr \rangle &\rightarrow \langle expr \rangle \ + \ \langle term \rangle \\
&\quad | \ \langle expr \rangle \ - \ \langle term \rangle \\
&\quad | \ \langle term \rangle \\
\langle term \rangle &\rightarrow \langle term \rangle \ * \ \langle factor \rangle \\
&\quad | \ \langle term \rangle \ / \ \langle factor \rangle \\
&\quad | \ \langle factor \rangle \\
\langle factor \rangle &\rightarrow \langle id \rangle \ | \ (\langle expression \rangle)
\end{aligned}
$$

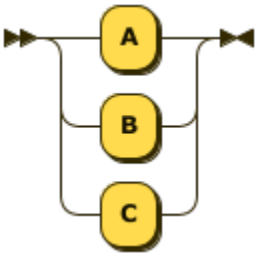
2. Write (1) EBNF, and (2) the syntax chart in question 1.

1 EBNF

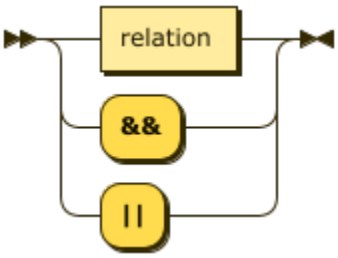
$$
\begin{aligned}
\langle id \rangle &\rightarrow A|B|C \\
\langle expression \rangle &\rightarrow \langle relation \rangle \ \{[\ \&\& \ | \ || \ ] \ \langle relation \rangle\} \\
\langle relation \rangle &\rightarrow \langle expr \rangle \ \{[\ < \ | \ <= \ | \ = \ ] \ \langle expr \rangle\} \\
\langle expr \rangle &\rightarrow \langle term \rangle \ \{[\ + \ | \ - \ ] \ \langle term \rangle\} \\
\langle term \rangle &\rightarrow \langle factor \rangle \ \{[\ * \ | \ / \ ] \ \langle factor \rangle\} \\
\langle factor \rangle &\rightarrow \langle id \rangle \ | \ (\langle expression \rangle)
\end{aligned}
$$

2 Syntax Chart

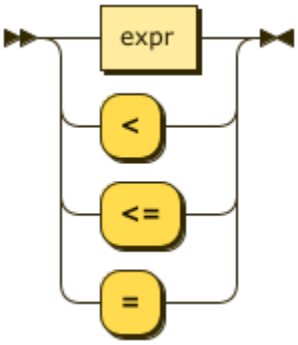
ID:



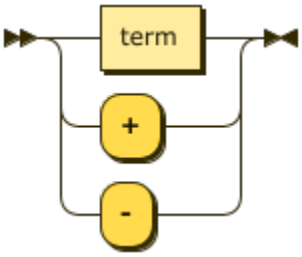
expression:



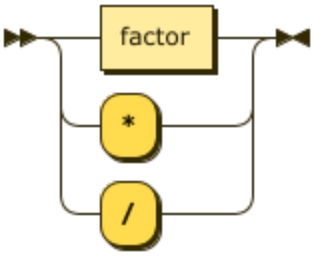
relation:



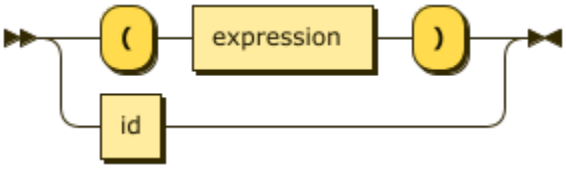
expr:



term:



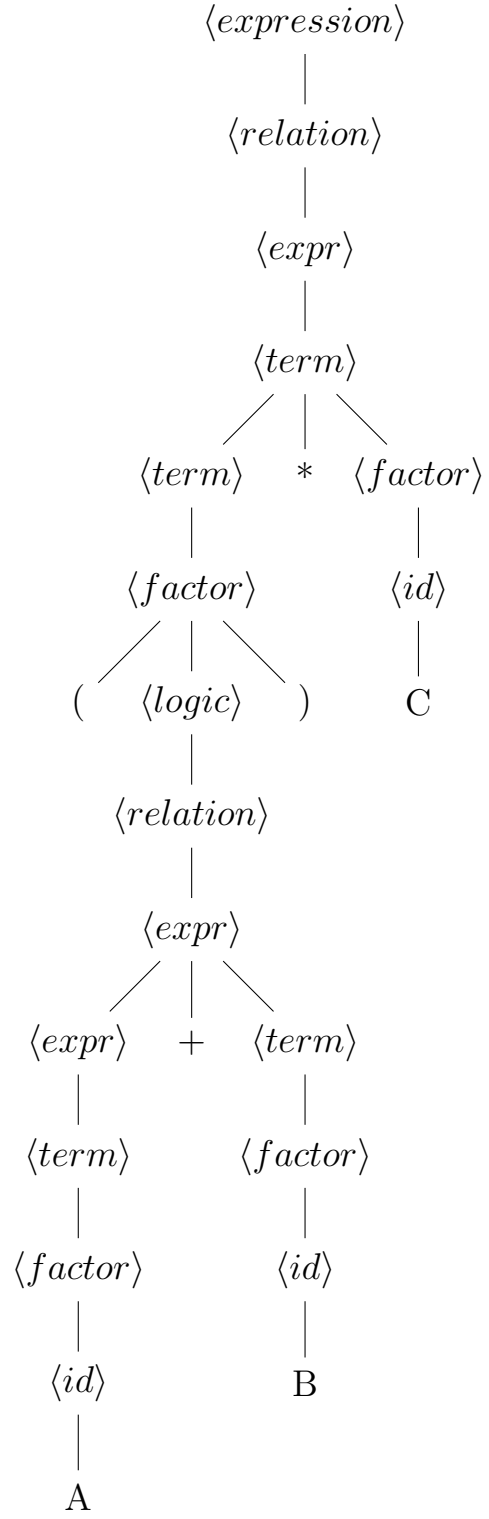
factor:



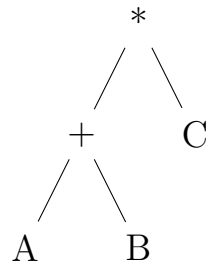
3. For each of the following strings, draw parse trees and abstract syntax trees with respect to the grammar in question 1:

   (a) (A + B) * C

   Parse Tree:

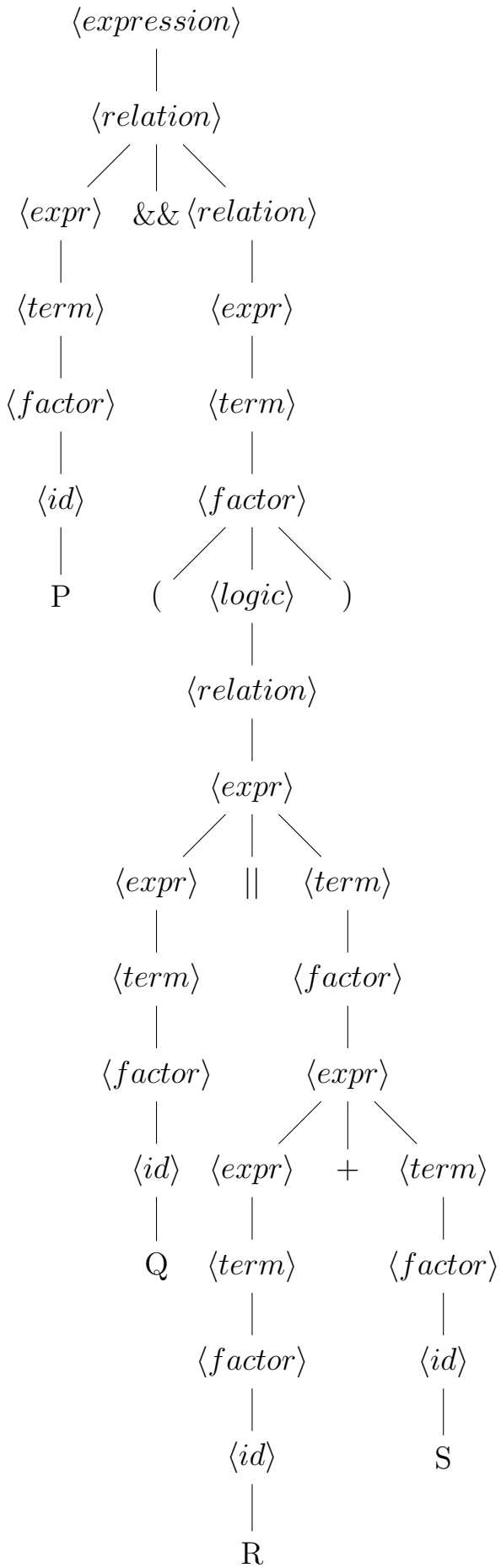


Abstract Syntax Tree:

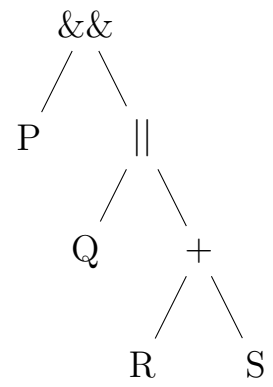


(b) P && (Q || R + S)

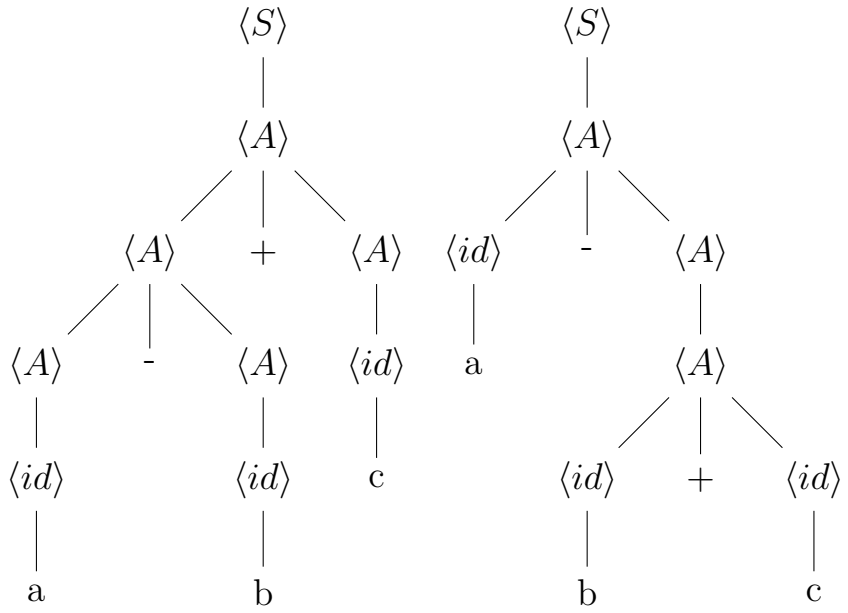
Parse Tree:


⟨expression⟩
⟨relation⟩
⟨expr⟩
&&
⟨relation⟩
⟨term⟩
⟨expr⟩
⟨factor⟩
⟨term⟩
⟨id⟩
⟨factor⟩
P
(
⟨logic⟩
)
⟨relation⟩
⟨expr⟩
⟨expr⟩
||
⟨term⟩
⟨term⟩
⟨factor⟩
⟨factor⟩
⟨expr⟩
⟨id⟩
⟨expr⟩
+
⟨term⟩
Q
⟨term⟩
⟨factor⟩
⟨factor⟩
⟨id⟩
⟨id⟩
S
R

Abstract Syntax Tree:



4. Prove that grammar is ambiguous



5. Write a regular expression for floating-point numbers

```
^[\+|\-]?0?\.\d+$|^[\+|\-]?[1-9]+\d+\.\d+$
```