

Assignment 1

Exercise 1

- (a) [public] [abstract|final] class <identifier_name>? [extends] <identifier_name>
 [implements] <identifier_name>?
- (b) <method_name> (<method_arguments>);
- (c) switch (<expression>) {<case num_char>: <statements>
 [default: <statements>]}

Exercise 2

(a) <assign> → <id> = <expr>

<id> → A | B | C

<expr> → <term> * <factor>
 | <factor>

<expr> → <term> + <expr>

| <term>

<factor> → (<expr>)

| <id>

<assign> → <id> = <expr>

<id> → A | B | C

<expr> → <expr> * <term>
 | <term>

<term> → <factor> + <term>

| <factor>

<factor> → (<expr>)

| <id>

(b) <assign> → <id> = <expr>

<id> → A | B | C

<expr> → <expr> + <term>
 | <term>

<term> → <term> * <factor>

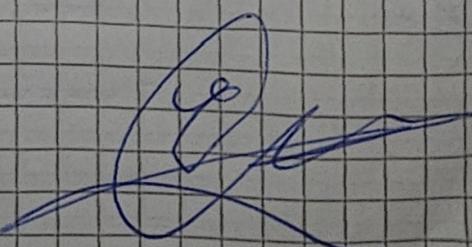
| <factor>

<factor> → (<expr>)

| <id>

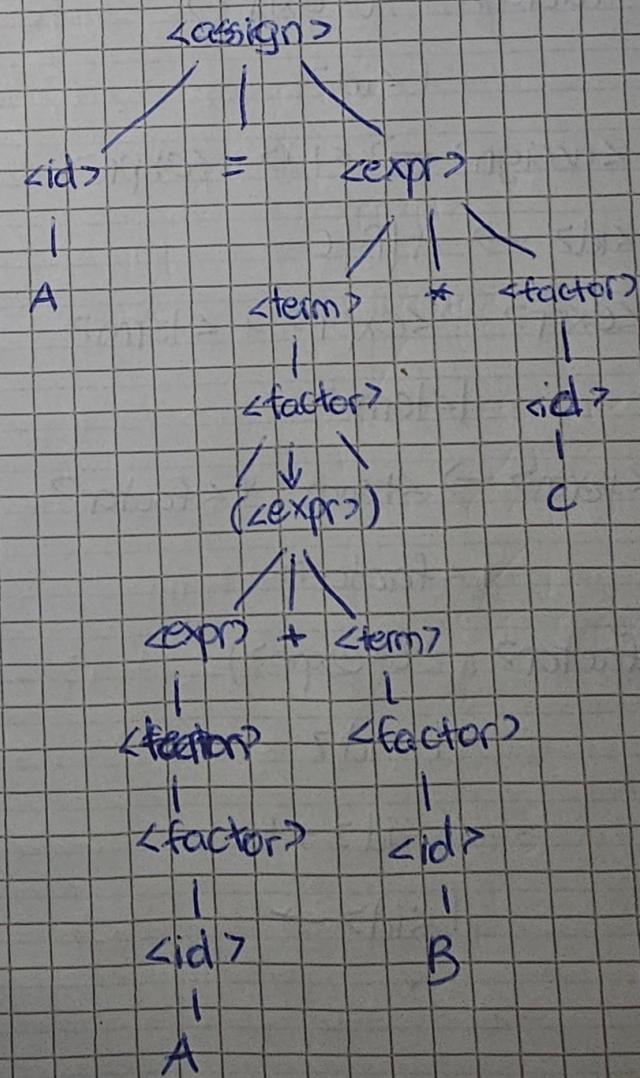
| <id> ++

| <id> --



Exercise 3

① $A = (A + B) * C$
 $\langle \text{assign} \rangle \Rightarrow \langle \text{id} \rangle = \langle \text{expr} \rangle$
 $\Rightarrow A = \langle \text{expr} \rangle$
 $\Rightarrow A = \langle \text{term} \rangle * \langle \text{factor} \rangle$
 $\Rightarrow A = \langle \text{factor} \rangle * \langle \text{factor} \rangle$
 $\Rightarrow A = (\langle \text{expr} \rangle) * \langle \text{factor} \rangle$
 $\Rightarrow A = (\langle \text{term} \rangle + \langle \text{term} \rangle) * \langle \text{factor} \rangle$
 $\Rightarrow A = (\langle \text{factor} \rangle + \langle \text{factor} \rangle)^{\text{term}} * \langle \text{factor} \rangle$
 $\Rightarrow A = (\langle \text{factor} \rangle + \langle \text{factor} \rangle) * \langle \text{factor} \rangle$
 $\Rightarrow A = (\langle \text{id} \rangle + \langle \text{factor} \rangle) * \langle \text{factor} \rangle$
 $\Rightarrow A = (A + \langle \text{factor} \rangle) * \langle \text{factor} \rangle$
 $\Rightarrow A = (A + \langle \text{id} \rangle) * \langle \text{factor} \rangle$
 $\Rightarrow A = (A + B) * \langle \text{factor} \rangle$
 $\Rightarrow A = (A + B) * \langle \text{id} \rangle$
 $\Rightarrow A = (A + B) * C$



(b) $A = B + C + A$

$\langle \text{assign} \rangle \Rightarrow \langle \text{id} \rangle = \langle \text{expr} \rangle$

$\Rightarrow A = \langle \text{expr} \rangle$

$\Rightarrow A = \langle \text{expr} \rangle + \langle \text{term} \rangle$

$\Rightarrow A = \langle \text{expr} \rangle + \langle \text{term} \rangle + \langle \text{term} \rangle$

$\Rightarrow A = \langle \text{term} \rangle + \langle \text{term} \rangle + \langle \text{term} \rangle$

$\Rightarrow A = \langle \text{factor} \rangle + \langle \text{term} \rangle + \langle \text{term} \rangle$

$\Rightarrow A = \langle \text{id} \rangle + \langle \text{term} \rangle + \langle \text{term} \rangle$

$\Rightarrow A = B + \langle \text{term} \rangle + \langle \text{term} \rangle$

$\Rightarrow A = B + \langle \text{factor} \rangle + \langle \text{term} \rangle$

$\Rightarrow A = B + C + \langle \text{term} \rangle$

$\Rightarrow A = B + C + \langle \text{factor} \rangle$

$\Rightarrow A = B + C + \langle \text{id} \rangle$

$\Rightarrow A = B + C + A$

$\langle \text{assign} \rangle$

$\langle \text{id} \rangle$

$= \langle \text{expr} \rangle$

A

$\langle \text{expr} \rangle$

$+ \langle \text{term} \rangle$

$\langle \text{expr} \rangle$

$+ \langle \text{term} \rangle$

$\langle \text{factor} \rangle$

$\langle \text{term} \rangle$

$\langle \text{factor} \rangle$

$\langle \text{id} \rangle$

$\langle \text{factor} \rangle$

$\langle \text{id} \rangle$

A

$\langle \text{id} \rangle$

B

~~OK~~

A * (B + C)

<assign> \Rightarrow <id> = <expr>

\Rightarrow A = <expr>

\Rightarrow A = <term>

\Rightarrow A = <term> * <factor>

\Rightarrow A = <factor> * <factor>

\Rightarrow A = <id> * <factor>

\Rightarrow A = A * <factor>

\Rightarrow A = A * (<expr> + <term>)

\Rightarrow A = A * (<term> + <term>)

\Rightarrow A = A * (<factor> + <term>)

\Rightarrow A = A * (<id> + <term>)

\Rightarrow A = A * (B + <term>)

\Rightarrow A = A * (B + <factor>)

\Rightarrow A = A * (B + <id>)

\Rightarrow A = A * (B + C)

~~OT~~

<assign>

<id> = <expr>

| | |
A <term>

/ | \ |
<term> + <factor>

| | |
<factor> / \ |
<exp> | |

| | |
<id> / \ |
<expr> + <term>

| | |
<term> <factor>
<factor> | |
<id> | |

| | |
<factor> / \ |
<id> | |

| | |
<id> / \ |
<id> | |

③ $A = B * C * (A + B)$

$\langle \text{assign} \rangle \Rightarrow \langle \text{id} \rangle = \langle \text{expr} \rangle$

$\Rightarrow A = \langle \text{expr} \rangle$

$\Rightarrow A = \langle \text{term} \rangle$

$\Rightarrow A = \langle \text{term} \rangle * \langle \text{factor} \rangle$

$\Rightarrow A = \langle \text{factor} \rangle * \langle \text{factor} \rangle$

$\Rightarrow A = \langle \text{id} \rangle * \langle \text{factor} \rangle$

$\Rightarrow A = B * \langle \text{factor} \rangle$

$\Rightarrow A = B * (\langle \text{expr} \rangle)$

$\Rightarrow A = B * (\langle \text{term} \rangle)$

$\Rightarrow A = B * (\langle \text{term} \rangle * \langle \text{factor} \rangle)$

$\Rightarrow A = B * (\langle \text{factor} \rangle * \langle \text{factor} \rangle)$

$\Rightarrow A = B * (\langle \text{id} \rangle * \langle \text{factor} \rangle)$

$\Rightarrow A = B * (C * \langle \text{factor} \rangle)$

$\Rightarrow A = B * (C * (\langle \text{expr} \rangle))$

$\Rightarrow A = B * (C * (\langle \text{expr} \rangle + \langle \text{term} \rangle))$

$\Rightarrow A = B * (C * (\langle \text{term} \rangle + \langle \text{term} \rangle))$

$\Rightarrow A = B * (C * (\langle \text{factor} \rangle + \langle \text{term} \rangle))$

$\Rightarrow A = B * (C * (\langle \text{id} \rangle + \langle \text{term} \rangle))$

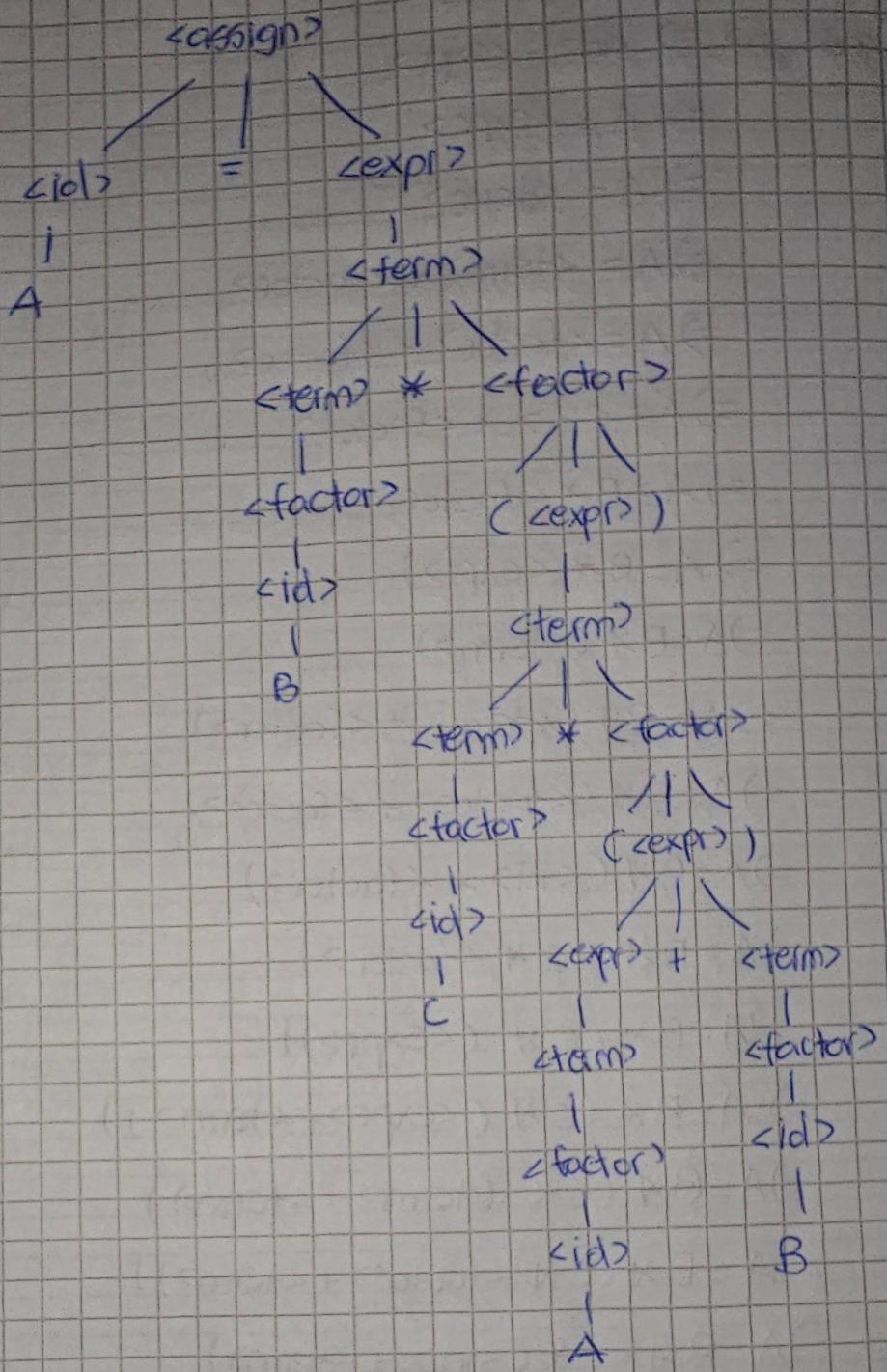
$\Rightarrow A = B * (C * (A + \langle \text{term} \rangle))$

$\Rightarrow A = B * (C * (A + \langle \text{factor} \rangle))$

$\Rightarrow A = B * (C * (A + \langle \text{id} \rangle))$

$\Rightarrow A = B * (C * (A + B))$

(G) Hk



Exercise 4

The correct option is ①. The structure for the sentence is

<S> → <A> 0.. b

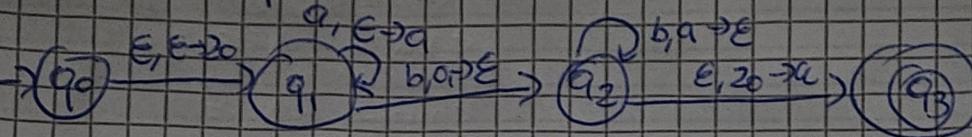
<A> can be b or bb, so b either way

 can is always b

so in the end we have babbb and this sentence is in the language of the grammar.

Exercise 5

We can use pushdown automation.



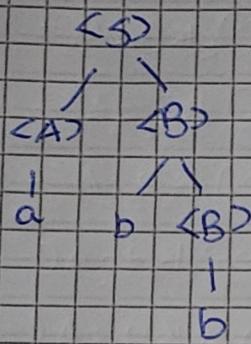
The grammar should be:

$$\langle S \rangle \rightarrow \langle A \rangle \langle B \rangle$$

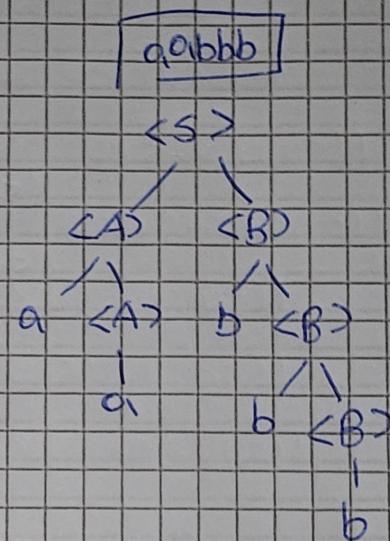
$$\langle A \rangle \rightarrow a \langle A \rangle | a$$

$$\langle B \rangle \rightarrow b \langle B \rangle | b$$

[abb]

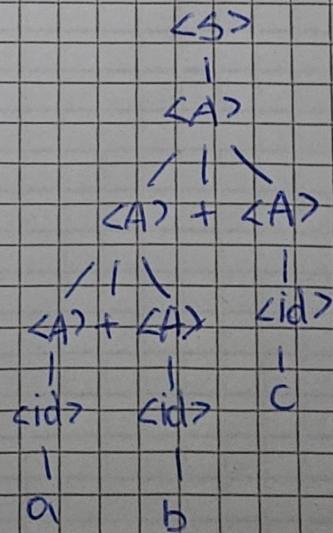
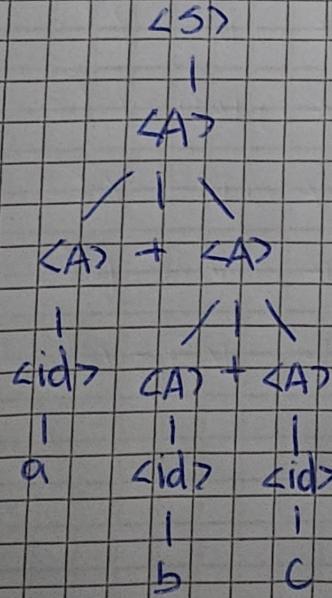


Parse trees:



Exercise 6

To prove that the grammar is ambiguous, we should prove that there are 2 or more parse trees for the same string. Let's take ab+bc.



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