

1.

1. Consider the following context-free grammar

$$S \rightarrow ( L ) \mid a$$

$$L \rightarrow L , S \mid S$$

and the string  $((a, a), a, (a))$ .

- What are the terminals, nonterminals, and start symbol of the grammar?
- Construct a leftmost derivation for the string.
- Construct a rightmost derivation for the string.
- Construct a parse tree for the string.

a.

terminals :  $( ) a ,$

non-terminals :  $S L$

start symbol :  $S$

production:

$$1. S \Rightarrow ( L )$$

$$2. S \Rightarrow a$$

$$3. L \Rightarrow L , S$$

$$4. L \Rightarrow S$$

b. left-most derivation

$S$

$$\Rightarrow ( \underline{L} )$$

$$\Rightarrow ( \underline{L} , S )$$

$$\Rightarrow ( \underline{L} , S , S )$$

$$\Rightarrow ( \underline{S} , S , S )$$

$$\Rightarrow ( ( \underline{L} ) , S , S )$$

$$\Rightarrow ( ( \underline{L} , S ) , S , S )$$

$$\Rightarrow ( ( \underline{S} , S ) , S , S )$$

$$\Rightarrow ( ( a , \underline{S} ) , S , S )$$

$$\Rightarrow ( ( a , a ) , \underline{S} , S )$$

$$\Rightarrow ( ( a , a ) , a , \underline{S} )$$

$$\Rightarrow ( ( a , a ) , a , ( \underline{L} ) )$$

$$\Rightarrow ( ( a , a ) , a , ( \underline{S} ) )$$

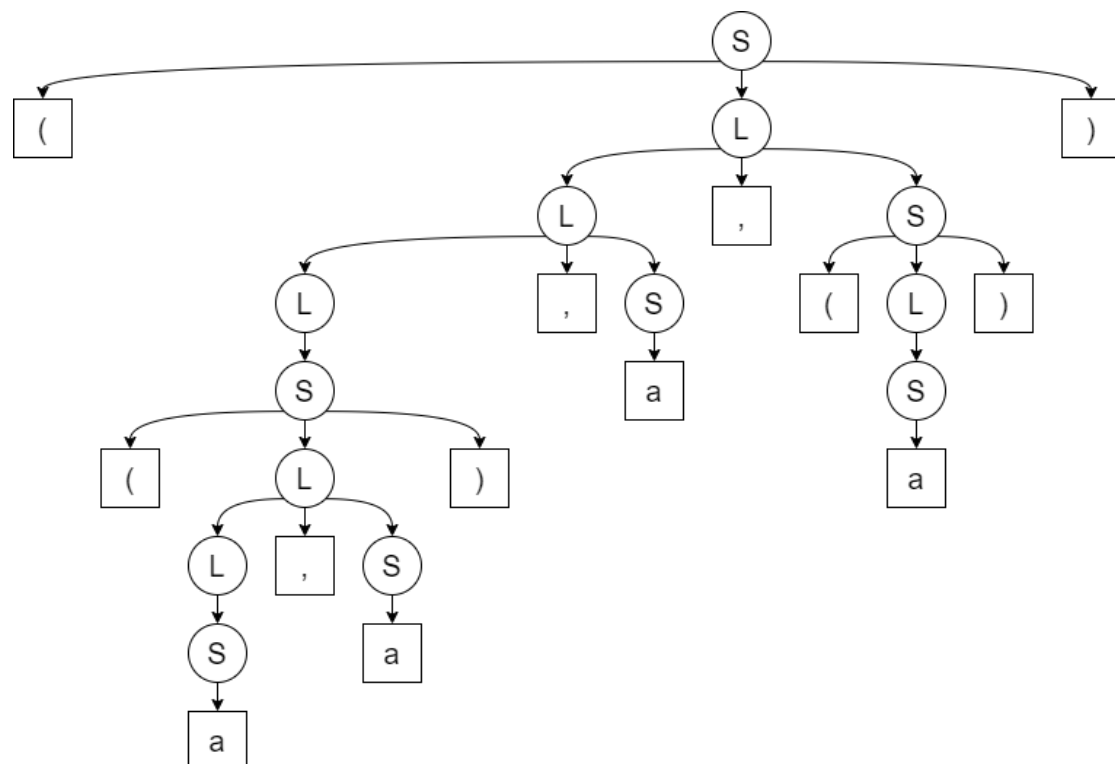
$$\Rightarrow ( ( a , a ) , a , ( a ) )$$

c. right-most derivation

S

$$\Rightarrow (\underline{L})$$
$$\Rightarrow (L, \underline{S})$$
$$\Rightarrow (L, (\underline{L}))$$
$$\Rightarrow (L, (\underline{S}))$$
$$\Rightarrow (\underline{L}, (a))$$
$$\Rightarrow (L, \underline{S}, (a))$$
$$\Rightarrow (\underline{L}, a, (a))$$
$$\Rightarrow (\underline{s}, a, (a))$$
$$\Rightarrow ((\underline{L}), a, (a))$$
$$\Rightarrow ((L, \underline{S}), a, (a))$$
$$\Rightarrow ((\underline{L}, a), a, (a))$$
$$\Rightarrow ((\underline{s}, a), a, (a))$$
$$\Rightarrow ((a, a), a, (a))$$

d. parse tree



2.

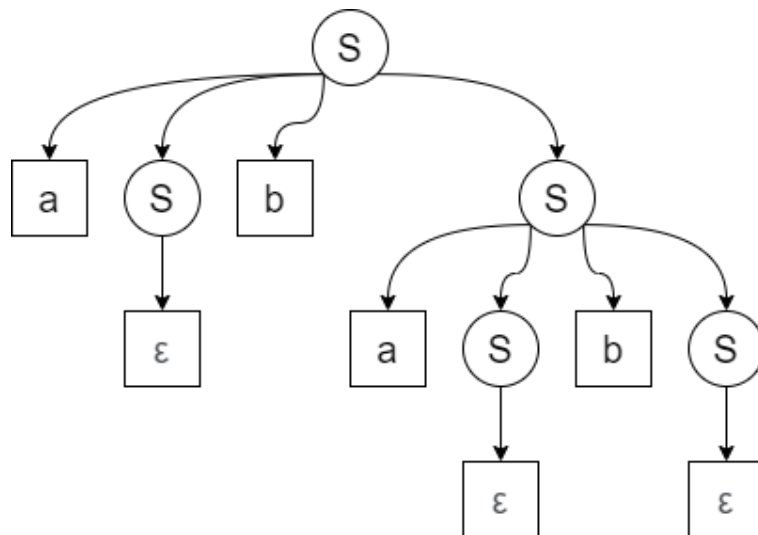
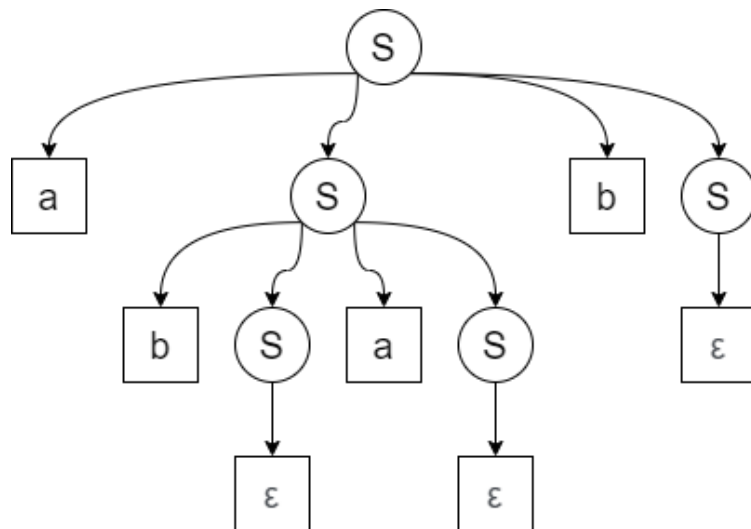
2. Consider the following context-free grammar

$$S \rightarrow a S b S \mid b S a S \mid \varepsilon$$

Show that this grammar is ambiguous.

存在一個字串，可以產生兩個不同的 parse tree，這個 grammar 即是 ambiguous

以字串  $a b a b$  為例



Q3.

3. Design a context-free grammar for each of the following languages.

- a) The set of all strings of 0's and 1's that are palindromes; that is, the string reads the same backward as forward.
- b) The set of all strings of 0's and 1's that do not contain the subsequence 011.

a.  $G = (V, \Sigma, S, R)$

$V : \{ S \}$

$\Sigma : \{ 0, 1 \}$

$S : S$

$R : \{ S \rightarrow 0 S 0 \mid 1 S 1 \mid 0 \mid 1 \mid \varepsilon \}$

b.  $G = (V, \Sigma, S, R)$

$V : \{ S, A, B \}$

$\Sigma : \{ 0, 1 \}$

$S : S$

$R : \{$

$S \rightarrow 1 S \mid 0 A \mid \varepsilon$

$A \rightarrow 0 A \mid 1 B \mid \varepsilon$

$B \rightarrow 0 B \mid \varepsilon$

$\}$

請注意 **substring** 與 **subsequence** 的不同