1. (5pt) Exercise 1.4

單一語言較高效率的特點，使程式撰寫更為容易且易於理解，並能大幅減少相容性問題。

缺點則是程式碼過於複雜且龐大，對 compiler 負擔過重，且未能對所有產品都客製化專屬功能，會使程式碼執行效率難以提升。

2. (5pt) Exercise 1.18

Multiple-line comments:

優點：方便迅速

缺點：可能遺忘結尾注解，可靠性較低

One-line comments:

優點：可靠性較高

缺點：註解數量大時過於繁瑣

3. (5pt) Exercise 2.14

優點：不受 type 型態影響，增加程式彈性。

缺點：可靠性較差，compiler 難以辨識所有問題，增加 Programmer 之負擔。

4. (10pt) Exercise 3.4

<assign> → <id> = <expr>

{id} → A | B | C

<expr> → <expr> + <term> | <term>

<term> → <term> * <factor> | <factor>

<factor> → ( <expr> ) | <id> | <id> ++ | <id> --
5. (10pt) Exercise 3.7 (c) and (d)

(c.)

\[ A = A \ast (B + C) \]  

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

\[
=> A = <expr>
\]

\[
=> A = <term>
\]

\[
=> A = <term> \ast <factor>
\]

\[
=> A = <factor> \ast <factor>
\]

\[
=> A = <id> \ast <factor>
\]

\[
=> A = A \ast <factor>
\]

\[
=> A = A \ast (<expr>)
\]

\[
=> A = A \ast (<expr> + <term>)
\]

\[
=> A = A \ast (<term> + <term>)
\]

\[
=> A = A \ast (<factor> + <term>)
\]

\[
=> A = A \ast (<id> + <term>)
\]

\[
=> A = A \ast (B + <term>)
\]

\[
=> A = A \ast (B + <factor>)
\]

\[
=> A = A \ast (B + <id>)
\]

\[
=> A = A \ast (B + C)
\]
(d.)
A = B * (C * (A + B))  

<assign> => <id>=<expr>
   => A=<expr>
   => A=<term>
   => A=<term>*<factor>
   => A=<factor>*<factor>
   => A=<id>*<factor>
   => A=B*<factor>
   => A=B*(<expr>)
   => A=B*(<term>)
   => A=B*(<term>*<factor>)
   => A=B*(<factor>*<factor>)
   => A=B*(<id>*<factor>)
   => A=B*(C*<factor>)
   => A=B*(C*(<expr>))
   => A=B*(C*(<term>))
   => A=B*(C*(<term>*<factor>))
   => A=B*(C*(<factor>*<factor>))
   => A=B*(C*(<id>*<factor>))
   => A=B*(C*(A+<term>))
   => A=B*(C*(A+<factor>))
   => A=B*(C*(A+<id>))
   => A=B*(C*(A+B))
6. (5pt) Exercise 3.8
Ex:  $a+b+c$

parse tree 如上圖，可畫出不只一種，所以並不明確。

7. (10pt) Exercise 3.11

Consider the following grammar:

$<S> \rightarrow <A> a <B> b$

$<A> \rightarrow <A> b | b$

$<B> \rightarrow b$

Which of the following sentences are in the language generated by this grammar?

a. babb  
b. bbbabb  
c. bbbaaaabc  
d. aaaaaa

Ans: (a)、(b)

8. (10pt) Exercise 3.13

Write a grammar for the language consisting of strings that have $n$ copies of the letter a followed by one more number of copies of the letter b, where $n > 0$. For example, the strings abb, aaaabbbbb, and aaaaaaaaaabbbbbbbbb are in the language but a, ab, ba, and aaabb are not.

Ans:  $<S> \rightarrow abb | a <S> b$

9. (20pt) Exercise 3.23 (b) and (c)

(b.)

$(c + 10) / 3 > 6$
$c + 10 > 18$
$c > 8$
$\Rightarrow \{ c > 8 \} b = (c + 10) / 3 \{ b > 6 \}$

(c.)

$a + 2 \cdot b - 1 > 1$
$a + 2 \cdot b > 2$
$b > 2 - a$
$b > 1 - a/2$
$\Rightarrow \{ b > 1 - a/2 \} a = a + 2 \cdot b - 1 \{ a > 1 \}$
10. (10pt) Exercise 5.6

(a.) i. sub1
   ii. sub1
   iii. Main

(b.) i. sub1
   ii. sub1
   iii. sub1

11. (10pt) Exercise 5.8

Sub1: a(sub1), y(sub1), z(sub1), x(main).

Sub2: a(sub2), b(sub2), z(sub2), y(sub1), x(main)

Sub3: a(sub3), x(sub3), w(sub3), y(main), z(main)