**CS403/503 Programming Languages  
Spring 2021**Assignment #1

1. Problem 3 of Chapter 3 on Page 157

Answer:

<assign> -> <id> = <expr>

<id> -> A | B | C

<expr> -> <expr> \* <term>

| <term>

<term> -> <factor> + <term>

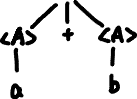
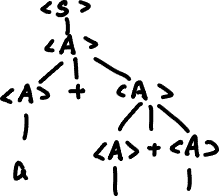
| <factor>

<factor> -> (<expr>) | <id>

1. Problem 8 of Chapter 3 on Page 158

Answer:

There could be two different parse tree which can prove the grammar is ambiguous



1. Problem 20 of Chapter 3 on Page 159

3.2

<assign> → <id> = <expr>

<id> → A| B | C

<expr> → <id> + <expr>

| <id> \* <expr>

| ( <expr>)

| <id>

Answer:

* Syntax: <assign> -> <id> = <expr>

Semantic : <expr>.expected\_type <- <id>.actual\_type

predicate: <expr>.actual\_type == <expr>.expected\_type

* Syntax: <expr>[1] -> <id> + <expr>[2]

Semantic: <expr>[1].actual\_type <-

if (<id>.actual\_type = int and <expr>[2].actual\_type = int)

then int

else float

end if

* Syntax: <expr>[1] -> <id> \* <expr>[2]

Semantic: <expr>[1].actual\_type <-

if (<id>.actual\_type = int and <expr>[2].actual\_type = int)

then int

else float

end if

* Syntax: <expr>[1] -> (<expr>[2])

Semantic: <expr>[1].actual\_type <- <expr>[2].actual\_type

* Syntax: <expr> -> <id>

Semantic: <expr>.actual\_type <- <id>.actual\_type

* Syntax: <id> -> A | B | C

Semantic: <id>.actual\_type <- look-up(<id>.string)

1. Problem 8 of Chapter 4 on Page 194

Answer: (id + id) \* id

|  |  |  |
| --- | --- | --- |
| Stack | Input | Action |
| 0 | (id + id) \* id$ | Shift 4 |
| 0(4 | id + id) \* id$ | Shift 5 |
| 0(4id5 | + id) \* id$ | Reduce 6 , Goto[4,F] |
| 0(4F3 | + id) \* id$ | Reduce 4, Goto[4,T] |
| 0(4T2 | + id) \* id$ | Reduce 2, Goto[4,E] |
| 0(4E8 | + id) \* id$ | Shift 6 |
| 0(4E8+6 | id) \* id$ | Shift 5 |
| 0(4E8+6id5 | ) \* id$ | Reduce 6, Goto[6,F] |
| 0(4E8+6F3 | ) \* id$ | Reduce 4, Goto[6,T] |
| 0(4E8+6T9 | ) \* id$ | Reduce 1, Goto[4,E] |
| 0(4E8 | ) \* id$ | Shift 11 |
| 0(4E8)11 | \* id$ | Reduce 5, Goto[0,F] |
| 0F3 | \* id$ | Reduce 4, Goto[0,T] |
| 0T2 | \* id$ | Shift 7 |
| 0T2 \* 7 | id$ | Shift 5 |
| 0T2 \* 7id5 | $ | Reduce 6, Goto[7,F] |
| 0T2 \* 7F10 | $ | Reduce 3, Goto[0,T] |
| 0T2 | $ | Reduce 2, Goto[0,E] |
| 0E1 | $ | Accept |