Solutions for EECS337 Homework #02

2.2.1 a) $S \to \underline{S}S* \to \underline{S}S+S* \to aa+a*$

b)

c) postfix for example $a_1 a_2 + a_3 *$

where: $a_1 = 1$ $a_2 = 2$ $a_3 = 3$

$$\frac{12+3*}{\frac{33*}{9}}$$

2.2.2 a) $S \to 0S1 \mid 01$

output: 01, 0011, 000111, ...

$\underbrace{0 \cdots 0}\ \underbrace{1 \cdots 1}$

equal number of 0's and 1's

b) $S \to +SS \mid -SS \mid a$
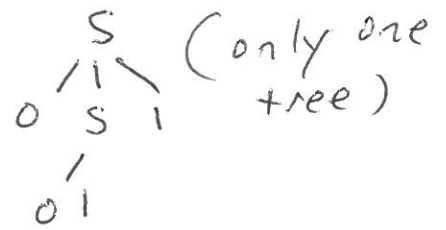
output: a, +aa, -aa, +--aaa, +a-aa

addition and subtraction of a's in prefix format

c) $S \to S(S)S \mid \epsilon$

output: empty, ( ), (( )), ( )( ), ( )( )( )

zero or more sets of parentheses in sequence or embedded

Solutions for EECS 337 Homework #02

2.2.3 a) is NOT ambiguous
for 0011

```
     S
    /|\
   0 S 1    (only one
     |        tree)
     S
     |
     01
```

b) is NOT ambiguous
for +-999

```
      S
     /|\
    + S  \S
      |   |\
     /|\  a
    - S S
      | |
      i i
      9 9
```

```
       S
      /|\_
     +  S   S
        /|\  |\
       - S S  a
         | |
         i i
         9 9
```

c) is ambiguous
for ()()
(two trees are
possible)

```
          S
        //|\ \
       S  ( S ) S
      /|/|\   |   |
     S(S)S    S   E
     | | |    |
     E E E    E
```

or

```
          S
        /|||\_
       S ( S ) S
       |   |  /|\_
       E   E S(S)S
             | | |
             E E E
```

Solutions EECS337 HW02
State Transition Diagram

KEY:
where c is input char

where X is all other chars not defined from state

nil = No output

SLASH2 — loop: $\frac{X}{nil}$; $\frac{'\backslash n'}{nil}$

STARZ — loop: $\frac{'*'}{nil}$

SLASH1 → STARZ via $\frac{'*'}{nil}$

STARZ: $\frac{X}{nil}$, $\frac{'/'}{nil}$

STAR1 — loop: $\frac{X}{nil}$, $\frac{'*'}{nil}$

SLASH1 → START: $\frac{X}{'/',c}$

SLASH1 → SLASH2: $\frac{'/'}{nil}$

START

START → POUND: $\frac{'\#'}{nil}$

POUND — loop: $\frac{X}{nil}$; POUND → START: $\frac{'\backslash n'}{'\backslash n'}$

START → IDENT: $\frac{isalpha(c)}{nil}$

IDENT text[index++]=c

IDENT → START: $\frac{X}{INT\ VOID\ CHAR\ RETURN\ IDENTIFIER\ text}$

IDENT loop: $\frac{isalpha(c)}{nil}$

START → STRING: $\frac{'"'}{STRING\_LITERAL\ text}$

STRING → START: $\frac{'"'}{nil}$

STRING text[index++]=c

STRING loop: $\frac{X}{nil}$

all defined below

TOKEN:
text:

$\frac{X}{nil}$ — white space other char

$'('$ $')'$ $'*'$ $'+'$ $','$ $';'$ $'='$ $'['$ $']'$ $'\{'$ $'\}'$ — $\frac{C}{C}$ — special characters

$\frac{isdigit(c)}{CONSTANT\ C}$ — digit