Nhat Doan

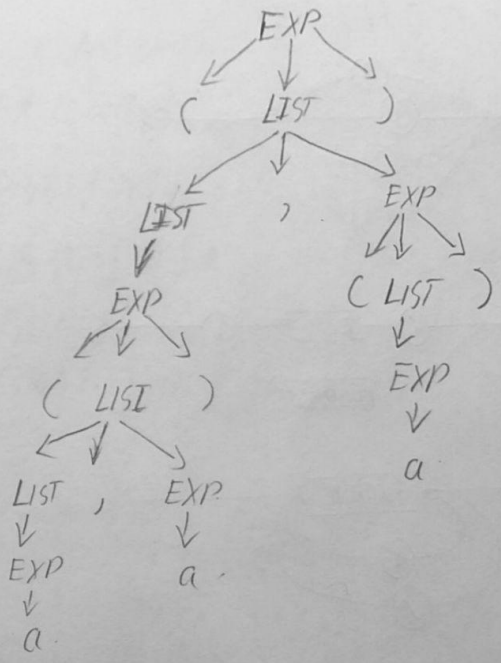
PL1

Part 2 :

(1) EXP ::= (LIST) | a

LIST ::= LIST , EXP | EXP

a) Parse tree for ((a,a),a,(a))

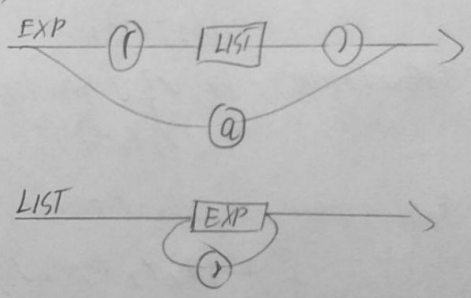


b) Translate to BNF

<EXP> ::= (LIST) | a

<LIST> ::= EXP {, EXP}

c)



d) First(EXP) = { (, a }.

First(LIST) = First(EXP) = { (, a }

Follow(EXP) = {) } ∪ Follow(LIST) = { , } ∪ {) } = { , ,) }

(2) EXP ::= EXP + TERM | EXP - TERM | TERM

TERM ::= TERM * FACTOR | TERM / FACTOR | FACTOR

FACTOR ::= (EXP) | DIGIT

DIGIT ::= 0 | 1 | 2 | 3.

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2) a) to EBNF

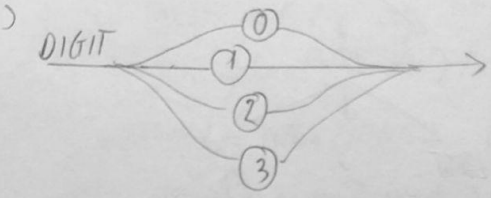
<EXP> ::= TERM {(+|-) TERM}

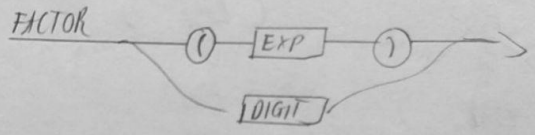
<TERM> ::= FACTOR {(*|/) FACTOR}

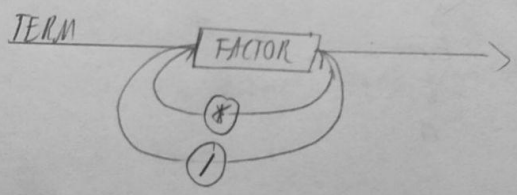
<FACTOR> ::= (EXP) | DIGIT

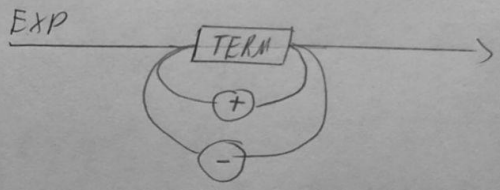
<DIGIT> ::= 0 | 1 | 2 | 3

b)









d) First(DIGIT) = {0, 1, 2, 3}

First(FACTOR) = {(} ∪ First(DIGIT)
= {(, 0, 1, 2, 3}

First(TERM) = First(FACTOR)
= {(, 0, 1, 2, 3}

First(EXP) = First(TERM)
= {(, 0, 1, 2, 3}

Follow(EXP) = {)}

Follow(TERM) = {+, -} ∪ Follow(EXP)
= {+, -,)}

Follow(FACTOR) = {*, /} ∪ Follow(TERM)
= {*, /, +, -,)}

Follow(DIGIT) = Follow(FACTOR)
= {*, /, +, -,)}

c) Two requirements on a grammar for a predictive parser to be able to make such choices:

- Firstsets of any two choices must not have any token in common.
- If A is optional, then First(A) ∩ Follow(A) should be empty.

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c) Prove that grammar satisfy the two requirements define in (c).

(1) First sets of any two choices must not have any token in common.

DIGIT is a trivial case

Factor : $\{(\} \cap First(DIGIT) = \{(\} \cap \{0,1,2,3\} = \phi$

TERM and EXP only have 1 first choice.

(2) If t is optional, then $First A \cap Follow(A)$ should be empty

$First(DIGIT) \cap Follow(DIGIT) = \{0,1,2,3\} \cap \{*, /, +, -,)\} = \phi$

$First(FACTOR) \cap Follow(FACTOR) = \{(,0,1,2,3\} \cap \{*, /, +, -,)\} = \phi$

$First(TERM) \cap Follow(TERM) = \{(,0,1,2,3\} \cap \{+, -,)\} = \phi$

$First(EXP) \cap Follow(EXP) = \{(,0,1,2,3\} \cap \{)\} = \phi$

(3) Recursive Descent recognizer Pseudocode.

```
Procedure Start:
    EXP
    if token => $error

Procedure EXP:
    TERM
    While (token is + or -)
        { match token
          TERM }

Procedure TERM
    FACTOR
    while (token is * or /)
        { match token
          FACTOR }
```

```
Procedure FACTOR:
    DIGIT
    if (token is "(")
        { match token
          DIGIT
          match ")" }
    else DIGIT
Procedure DIGIT
    if (token is 1 or 2 or 3 or 4.)
        match token.
    else $error.

Procedure match(input)
    if token match input
        advance next token.
    else $ error
```