Chapter 3 & 4

1) (10) Given the grammar below, identify which sentences are in the language (which are valid sentence).
    a. baab
    b. bbbab
    c. bbaaaaaa
    d. bbaab

<S> → <A> a <B> b
<A> → <A> b | b
<B> → a <B> | a

Based on the grammar rules above,

a. baab
d. bbaab

are valid.

2) (10) Identify all of the tokens (categories of lexemes) in the grammar below, and which lexemes they categorize. Put them in a table.

<assign> → <id> = <expr>

<id> → A | B | C

<expr> → <id> + <expr>

| <id> * <expr>

| (<expr>)

| <id>

Token	Lexemes
Identifiers	A,B,C
Operators	=, +, *
Parenthesis	(,)

3) (10) Given the grammar from question 2, show a left-most derivation and draw the parse tree for the following statement.
   a. B = B + (C + (A * A))

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

-> B = <expr>

-> B = <id> + <expr>

-> B = B + <expr>

-> B = B + (<expr>)

-> B = B + (<id> + <expr>)

-> B = B + (C + <expr>)

-> B = B + (C + (<expr>))

-> B = B + (C + (<id> * <expr>))

-> B = B + (C + (A * <expr>))

-> B = B + (C + (A * <id>))

-> B = B + (C + (A * A))

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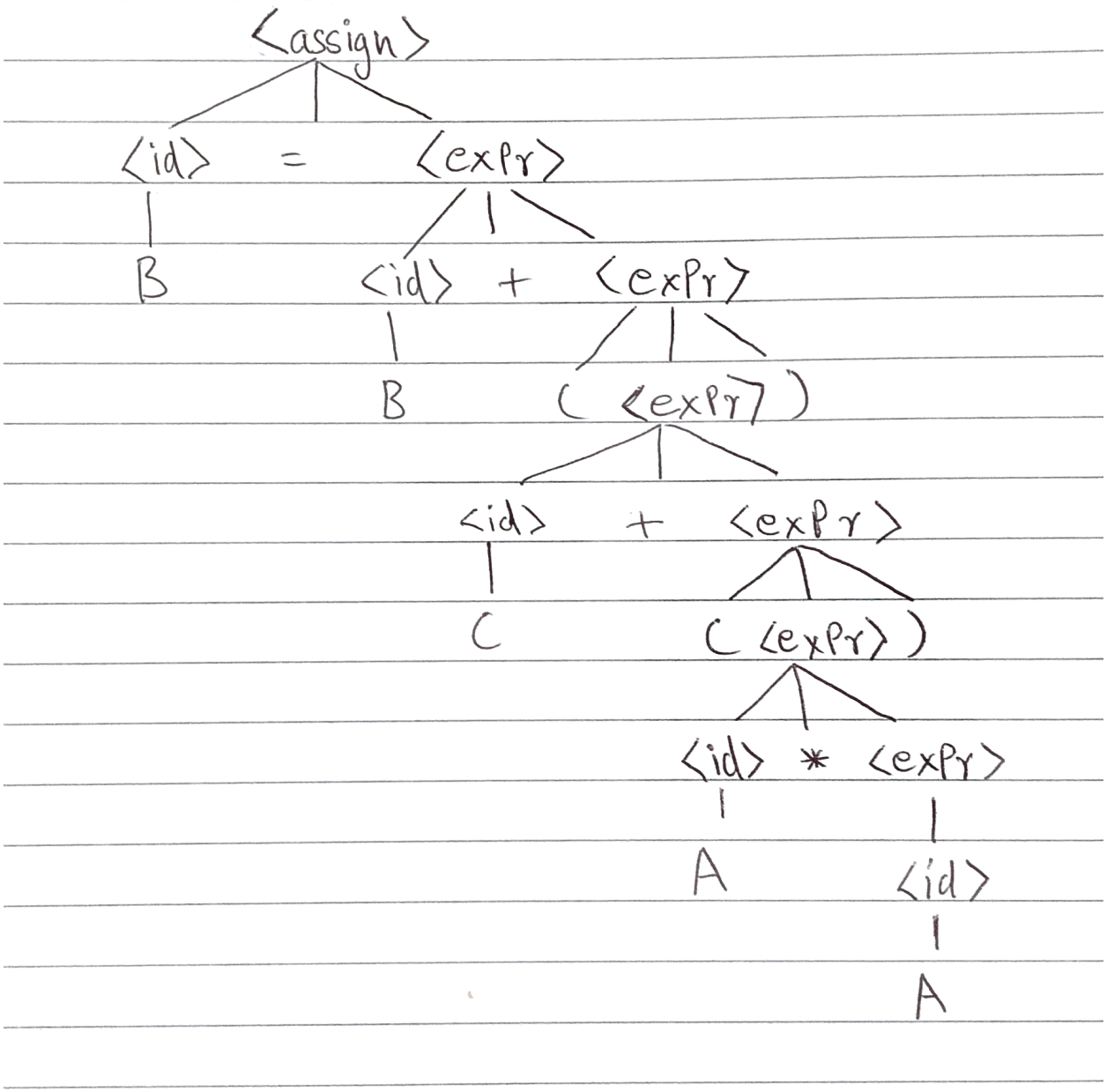
Parse Tree:



4) (10) Remove all of the recursion from the following grammar:

S -> Aa | Bb
A -> Aa | AbC | C
B -> S | bb
C -> c

S -> Aa | Bb
A -> CA'
A' -> aA' | bCA' | ε
B -> AaB' | bbB'
B' -> bB' | ε
C -> c

5) (10) Use left factoring to resolve the pairwise disjointness problems in the following grammar:

A -> aBc | ac | a

B -> b | aB

A -> aA'

A' -> Bc | c | ε

B -> b | aB

6) (20 pts) Create an LR(0) parse table for the following grammar. Show all steps (creating closures, the DFA, the transition table, and finally the parse table):

E -> E + T | E * T | T

T -> (E) | id

r0: S’ -> E$

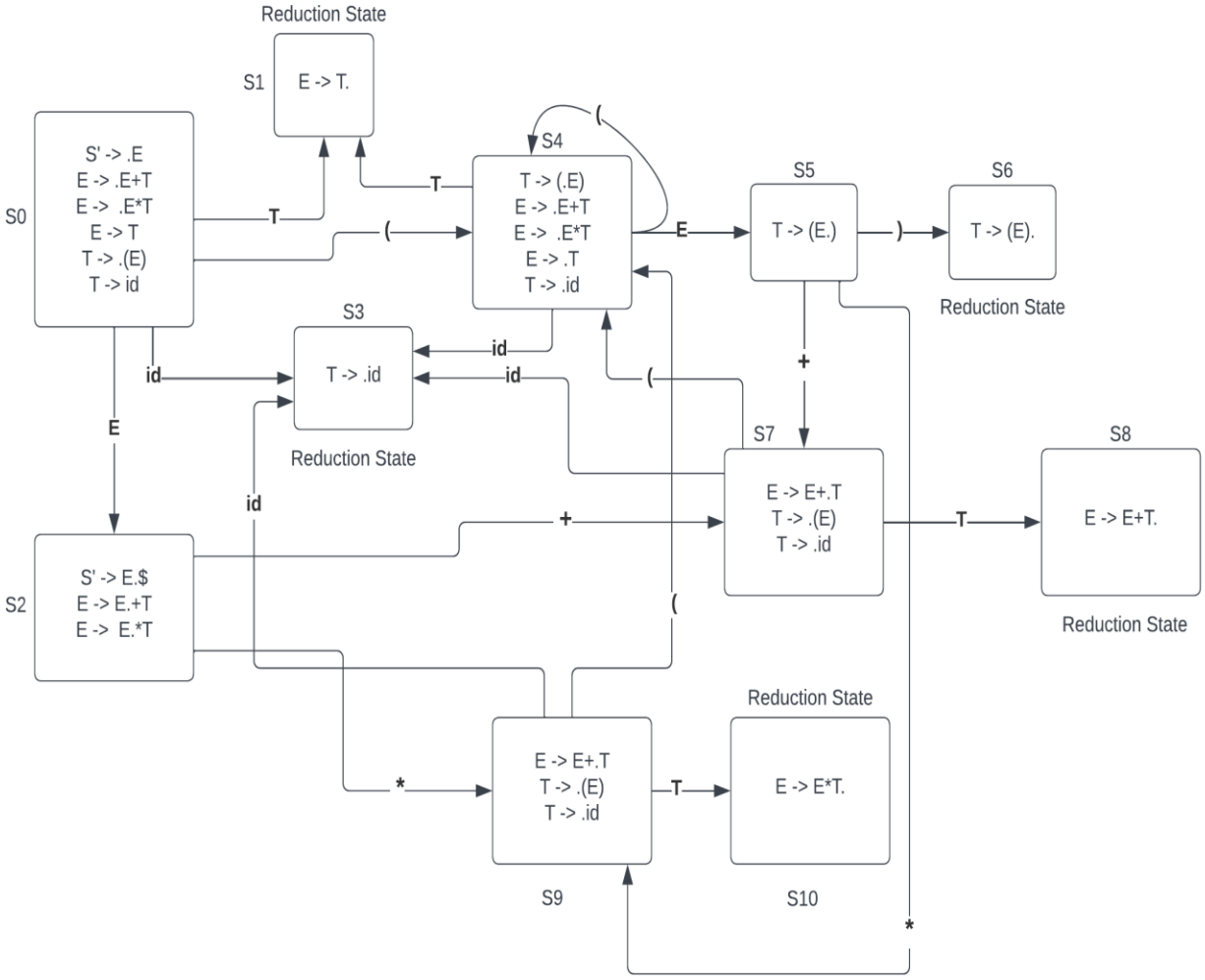
r1: E -> E + T

r2: E -> E * T

r3: E -> T

r4: T -> (E)

r5: T -> id



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Transition Table:

	T	(	E	Id	+	*	)
S0	S1	S4	S2	S3			
S1							
S2					S7	S9	
S3							
S4	S1	S4	S5	S3			
S5					S7	S9	S6
S6							
S7	S8			S3			
S8							
S9	S10			S3			
S10							

Parse Table:

States	Action					Go To		
	(	+	*	)	$	E	T	id
S0	S4					S2	S1	S3
S1	R3	R3	R3	R3	R3			
S2		S7	S9		accept			
S3	R5	R5	R5	R5	R5			
S4	S4					S5	S1	S3
S5		S7	S9	S6				
S6	R4	R4	R4	R4	R4			
S7							S8	S3
S8	R1	R1	R1	R1	R1			
S9							S10	S3
S10	R2	R2	R2	R2	R2			

7) (20 pts) Show a complete bottom-up parse, including the parse stack contents, input string, and action for the string below using the parse table you created in step 6. Think about how I went through this in class.

(id + id) * id

Step 1:

Input: .(id + id) * id

Stack: 0

Output:

Step 2:

Input: (.id + id) * id

Stack: 0 (4

Output:

Step 3:

Input: (id. + id) * id

Stack: 0 (4 id 3

Output:

Step 4:

Input: (id. + id) * id

Stack: 0 (4 T 1

Output: R5

Step 5:

Input: (id. + id) * id

Stack: 0 (4 E

Output: R5, R3

Step 6:

Input: (id. + id) * id

Stack: 0 (4 E 5

Output: R5, R3

Step 7:

Input: (id +. id) * id

Stack : 0 (4 E 5 + 7

Output: R5, R3

Step 8:

Input: (id + id.) * id

Stack : 0 (4 E 5 + 7 id 3

Output: R5, R3

Step 9:

Input: (id + id.) * id

Stack : 0 (4 E 5 + 7 T

Output: R5, R3, R5

Step 10:

Input: (id + id.) * id

Stack : 0 (4 E

Output: R5, R3, R5, R1

Step 11:

Input : (id + id.) * id

Stack : 0 (4 E 5

Output: R5, R3, R5, R1

Step 12:

Input: (id + id). * id

Stack : 0 (4 E 5) 6

Output: R5, R3, R5, R1

Step 13:

Input: (id + id). * id

Stack : 0 T 1

Output: R5, R3, R5, R1, R4

Step 14:

Input : (id + id). * id

Stack: 0 E 2

Output: R5, R3, R5, R1, R4, R3

Step 15:

Input: (id + id) *. Id

Stack: 0 E 2 * 9

Output: R5, R3, R5, R1, R4, R3

Step 16:

Input: (id + id) * id.

Stack: 0 E 2 * 9 id 3

Output : R5, R3, R5, R1, R4, R3

Step 17:

Input: (id + id) * id.

Stack: 0 E 2 * 9 T

Output : R5, R3, R5, R1, R4, R3, R5

Step 18:

Input: (id + id) * id.

Stack: 0 E 2 * 9 T 10

Output : R5, R3, R5, R1, R4, R3, R5

Step 19:

Input: (id + id) * id.

Stack: 0 E

Output : R5, R3, R5, R1, R4, R3, R5, R2

8) (10 pts) Show a rightmost derivation for the string above, and show how the bottom-up parse you completed in step 7 correctly finds all of the handles for the input string above.

r0: S' -> E$
r1: E -> E + T
r2: E -> E * T
r3: E -> T
r4: T -> (E)
r5: T -> id

(id + id) * id
Output: R5, R3, R5, R1, R4, R3, R5, R2

1. E
2. E * T (2)
3. E * id (5)
4. T * id (3)
5. (E) * id (4)
6. (E + T) * id (1)
7. (E + id) * id (5)
8. (T + id) * id (3)
9. (id + id) * id (5)