

# 浙江理工大学 2020—2021 学年第 一 学期

## 《编译原理（双语）》期末试卷（ A ）卷

（试题共 5 页）

本人郑重承诺：本人已阅读并且透彻地理解《浙江理工大学考场规则》，愿意在考试中自觉遵守这些规定，保证按规定的程序和要求参加考试，如有违反，自愿按《浙江理工大学学生违纪处分规定》有关条款接受处理。

承诺人签名：\_\_\_\_\_ 学号：\_\_\_\_\_ 班级：\_\_\_\_\_

1. (10 points) Write English description for the languages generated by following regular expression:

1)  $0^+(0|1)^+$

2)  $0^*(100^*)^*1^*$

2. (12 points)

a. Please check out which strings can be generated by the regular expression  $(ab|b)^*cc?$

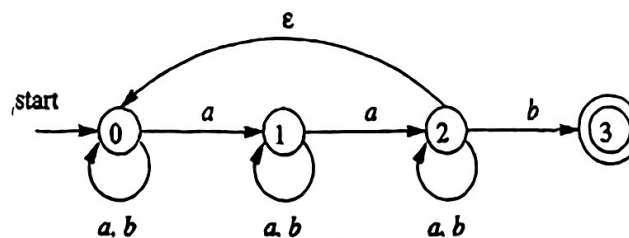
abbc, abab, bcc, babcc, aaabc

b. Please check out which strings can be generated by the regular expression  $(b|a)b+(ba)^*$ ?

aba, abb, ababa, aab, bbb

c. please determine which strings can be accepted by the NFA.

aab, bab, bbab, aaabb, abababab



3. (12 points) Consider the following regular expression from the alphabet  $\{a,b\}$ :

$$b^*a|bb$$

a. Use Thompson's construction to make an NFA from the regular expression (show it as a state diagram).

b. Use subset construction to create a DFA equivalent to the NFA you gave for part A.

4. (6 points) Given the grammar:

$$E \rightarrow T | E + T | E - T$$

$$T \rightarrow F | T * F | T / F$$

$$F \rightarrow (E) | i$$

Please list all non-terminals and terminals in this grammar, and give the start symbol of the grammar.

5. (10 points) Given the grammar

$$exp \rightarrow exp + term \mid exp - term \mid term$$

$$term \rightarrow term * factor \mid term / factor \mid factor$$

$$factor \rightarrow (exp) \mid number$$

Write down *leftmost derivations* for:  $3*(6-5)$  and *rightmost derivations* for  $16*6/4$

6. (25 point) Consider the following grammar:

$S \rightarrow Sb$     $S \rightarrow Ab$     $S \rightarrow b$     $A \rightarrow Aa$     $A \rightarrow a$

- a. remove the left recursion. (5 point)
- b. Construct First and Follow sets for the nonterminals of the resulting grammar. (6 point)
- c. Construct the LL(1) parsing table for the resulting grammar. (6 point)
- d. show the action of LL(1) parser that used the parsing table to recognize the following string: aaabb. (8 point)

---

7.(10 points)write an attribute grammar for the integer value of a number given by following grammar:

number  $\rightarrow$  digit number | digit

digit  $\rightarrow$  0|1|2|3|4|5|6|7|8|9

8. (15 point) Consider the following grammar with numbered productions

1)  $E \rightarrow E x T$

2)  $E \rightarrow E x$

3)  $E \rightarrow y T$

4)  $T \rightarrow y T$

5)  $T \rightarrow z$

Construct the SLR parsing tables for the grammar. In particular, show the following:

a. The augmented grammar

b. The DFA to recognize viable prefixes, including the set of items for each state.

c. The action and goto tables

1.Sol: (10 points)

1) 001, 011, 0001, 0011; any string of length 3 or greater that is one or more 0's are followed by one or more 1's.

2) 0, 1, 01, 0101; any string that has no substring 110

2. Sol:(12 points)

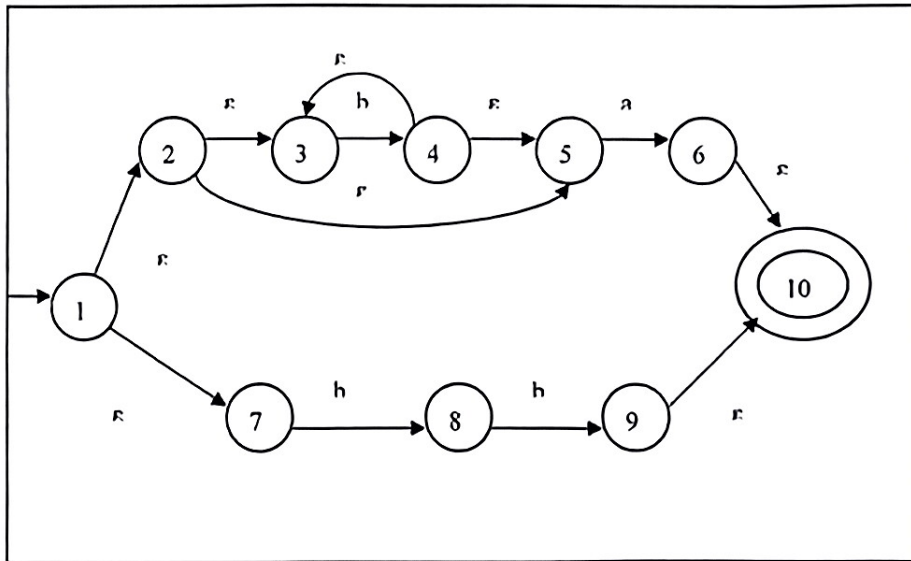
a) abbe abab bcc babcc aaabe

b) aba, abb, ababa, aab, bbb

c) aab bab bbaa aaabb abababab

3. Sol: (12 points)

Thompson's Construction



part B. Use subset construction to create a DFA equivalent to the NFA you gave for part A. Show your work. Show it as a state table, using the sets from the NFA as the names for the new states, as we did in examples in lecture.

Start state: {1}

$\epsilon$  closure[1]=[12357]

mov(12357,a)=[6]

$\epsilon$  closure[6]=[6 10] -Final state

mov(12357,b)=[48]

$\epsilon$  closure[48]=[3458]

mov(3458,a)=[6]

$\epsilon$  closure[6]=[6 10] -Final state

mov(3458,b)=[49]

$\epsilon$  closure[49]=[3459 10]

mov(3 4 5 9 10,a)=[6]

$\epsilon$  closure[6]=[6 10] -Final state

mov(3 4 5 9 10,b)=[4]

$\epsilon$  closure[4]=[345]

mov(3 4 5,a)=[6]

$\epsilon$  closure[6]=[6 10] -Final state

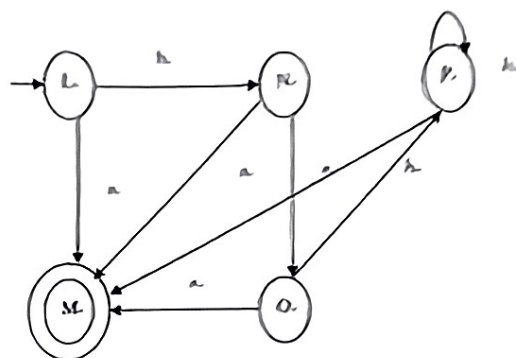
mov(3 4 5,b)=[4]

$\epsilon$  closure[4]=[345]

		A	B
L	[12357]	[6 10]	[3458]
M*	[6 10]	-	-
N	[3458]	[6 10]	[3459 10]
O	[3459 10]	[6 10]	[345]
P	[345]	[6 10]	[345]

\*Indicates Final state

# STATE DIAGRAM



4.Solu: (6 points)

The set of the terminals  $VT = \{+, -, *, /, (, ), i\}$ , The set of the nonterminals  $VN = \{E, T, F\}$ .

With E being the start symbol

5. 10 points

The leftmost derivations for the expression  $3*(6-5)$  and  $16*6/4$ :

$Exp \Rightarrow term \Rightarrow term * factor \Rightarrow factor * factor \Rightarrow num * factor \Rightarrow num * (exp) \Rightarrow$   
 $num * (exp - term) \Rightarrow num * (term - term) \Rightarrow num * (factor - term) \Rightarrow num * (num - term) \Rightarrow$   
 $num * (num - factor) \Rightarrow num * (num - num)$

$Exp \Rightarrow term \Rightarrow term / factor \Rightarrow term / 4 \Rightarrow term * factor / 4$   
 $\Rightarrow term * 6 / 4 \Rightarrow factor * 6 / 4 \Rightarrow 16 * 6 / 4$

6.solu:

for the grammar G:

Rewritten the grammar as:

$S \rightarrow Sb \quad S \rightarrow Ab \quad S \rightarrow b \quad A \rightarrow Aa \quad A \rightarrow a$

a)  $S \rightarrow bS' \quad S \rightarrow AbS' \quad S' \rightarrow bS' \quad S' \rightarrow \epsilon \quad A \rightarrow aA' \quad A' \rightarrow aA' \quad A' \rightarrow \epsilon$

b) First and follow sets

$S \rightarrow$	$First(S) = \{ b, a \}$	$Follow(S) = \{ \$ \}$
$S' \rightarrow$	$First(S') = \{ b, \epsilon \}$	$Follow(S') = \{ \$ \}$
$A \rightarrow$	$First(A) = \{ a \}$	$Follow(A) = \{ b \}$
$A' \rightarrow$	$First(A') = \{ a, \epsilon \}$	$Follow(A') = \{ b \}$

c) LL(1) Parsing table:



	a	b	\$
S	$S \rightarrow AbS'$	$S \rightarrow bS'$	
S'		$S' \rightarrow bS'$	$S' \rightarrow \epsilon$
A	$A \rightarrow aA'$		
A'	$A' \rightarrow aA'$	$A' \rightarrow \epsilon$	

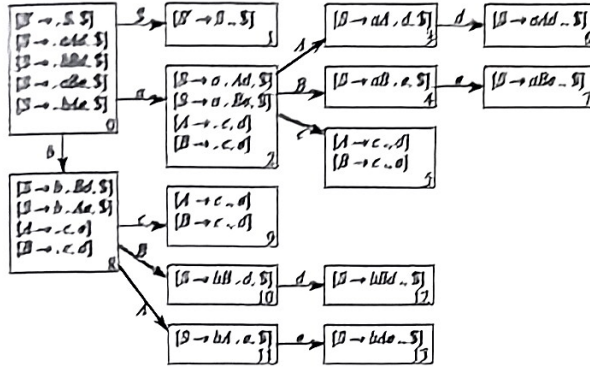
d)

Parsing stack	Input string	Action
\$ S	aaabb\$	$S \rightarrow AbS'$
\$ S' b A	aaabb\$	$A \rightarrow aA'$
\$ S' b A' a	aaabb\$	match
\$ S' b A'	aabb\$	$A \rightarrow aA'$
\$ S' b A' a	aabb\$	match
\$ S' b A'	abb\$	$A \rightarrow aA'$
\$ S' b A' a	abb\$	match
\$ S' b A'	bb\$	$A' \rightarrow \epsilon$
\$ S' b	bb\$	match
\$ S'	b\$	$S' \rightarrow bS'$
\$ S' b	b\$	match
\$ S'	\$	accept

7. sol:

Grammar Rule	Semantic Rules
$\text{Number1} \rightarrow \text{number2 digit}$	$\text{number1.val} = \text{number2.val} * 10 + \text{digit.val}$
$\text{Number} \rightarrow \text{digit}$	$\text{number.val} = \text{digit.val}$
$\text{digit} \rightarrow 0$	$\text{digit.val} = 0$
$\text{digit} \rightarrow 1$	$\text{digit.val} = 1$
$\text{digit} \rightarrow 2$	$\text{digit.val} = 2$
$\text{digit} \rightarrow 3$	$\text{digit.val} = 3$
$\text{digit} \rightarrow 4$	$\text{digit.val} = 4$
$\text{digit} \rightarrow 5$	$\text{digit.val} = 5$
$\text{digit} \rightarrow 6$	$\text{digit.val} = 6$
$\text{digit} \rightarrow 7$	$\text{digit.val} = 7$
$\text{digit} \rightarrow 8$	$\text{digit.val} = 8$
$\text{digit} \rightarrow 9$	$\text{digit.val} = 9$

soluc



But here is an LALR(1) DFA for the grammar. Because state 8 contains a reduce-reduce conflict, the grammar is not LALR(1).

But here is an LALR(1) DFA for the grammar. Because state 8 contains a reduce-reduce conflict, the grammar is not LALR(1).

