

浙江大学 2020 - 2021 学年春夏学期

《编译原理》课程期中考试试卷

课程号: 21120471, 开课学院: 计算机科学与技术学院

考试形式: 闭、开卷 (请在选定项上打 \checkmark), 允许带 一张 A4 材料 入场

考试日期: 2021 年 5 月 10 日, 考试时间: 90 分钟

诚信考试, 沉着应考, 杜绝违纪。

ID: _____ Name: _____ Major: _____

1. Mark each statement true or false (2 points each, 20 cents)

- 1) A LR(1) parser cannot parse any left-recursive CFG without ambiguity. (F)
- 2) LL(1) grammar cannot be left-recursive. (T)
- 3) Given a legal string of tokens for a CFG, there must be a unique parsing tree to derivate the string. (F)
- 4) The language $L=\{a^n b^n | n \geq 1\}$ can't be generated by any regular expression. (T)
- 5) There is only one parse tree for the string of an unambiguous grammar. (T)
- 6) If a grammar is LR(1), but not LALR(1). There may be shift-reduce conflicts in its parsing table of LALR(1). (F)
- 7) Finding the next handle is the main task of a LR parser. (T)
- 8) Both DFA and NFA can recognize regular set. (T)
- 9) The parse tree will completely reflect the derivation steps for a string. (F)
- 10) Left recursion is commonly used to make operations left associative. (T)

2. Multiple Choice (3 points each, 30 cents)

- 1) Given the CFG: $E' \rightarrow E, E \rightarrow E + n \mid n$, _____ is(are) the viable prefix(es) of the right sentential form 'n+n'. (ACD)
[A] n [B] n+ [C] E [D] E+
- 2) If a LL(1) grammar contains the rules: $A \rightarrow \alpha_1 | \alpha_2; B \rightarrow \beta_1 | \beta_2$, then the following condition _____ must be satisfied. (AD)
[A] $\text{First}(\beta_1) \cap \text{First}(\beta_2)$ is empty [B] $\text{First}(B) \cap \text{Follow}(A)$ is empty
[C] $\text{First}(A) \cap \text{Follow}(A)$ is empty [D] $\text{First}(\alpha_1) \cap \text{First}(\alpha_2)$ is empty
- 3) Given the production $A \rightarrow B\alpha C$, we have _____. (B)
[A] $\text{Follow}(C) \subset \text{Follow}(A), \text{First}(B) \subset \text{First}(A)$ [B] $\text{Follow}(A) \subset \text{Follow}(C), \text{First}(B) \subset \text{First}(A)$
[C] $\text{Follow}(C) \subset \text{Follow}(A), \text{First}(A) \subset \text{First}(B)$ [D] $\text{Follow}(A) \subset \text{Follow}(C), \text{First}(A) \subset \text{First}(B)$
- 4) Given the grammar rules: $A' \rightarrow A, A \rightarrow (A)A \mid \varepsilon$ and the rightmost derivation $A' \Rightarrow A \Rightarrow (A)A \Rightarrow (A)(A)A \Rightarrow (A)(A) \Rightarrow (A)() \Rightarrow ()()$. _____ is the viable prefix the sentential form (A)(A). (B)
[A] A [B] (A [C] ((A)A [D] ()
- 5) Give the LR(1) item $[A \rightarrow \cdot \alpha Bc, a/b]$, we have _____. (C)
(A) $\{a,b\} \subset \text{First}(A)$ (B) $\{a,b\} \subset \text{First}(B)$
(C) $\{a,b\} \subset \text{Follow}(A)$ (D) $\{a,b\} \subset \text{Follow}(B)$
- 6) Here is a grammar: (C)
 $X \rightarrow a \quad X \rightarrow \varepsilon \quad Y \rightarrow b \quad Y \rightarrow X$

$Z \rightarrow c$ $Z \rightarrow XYZ$ $W \rightarrow d$ $W \rightarrow XY$

Which symbol is not nullable?

- [A]. X [B]. Y [C]. Z [D]. W

7) The parsing method of YACC is _____. (A)

- [A] LALR(1) [B] LR(1) [C] SLR(1) [D] LL(1)

8) Which action is not in a LL(1) parsing table? (AD)

- [A] Shift [B] Generate [C] Accept [D] Reduce

9) The output of the parser is _____. (B)

- [A] token [B] syntax tree [C] target code [D] intermediate code

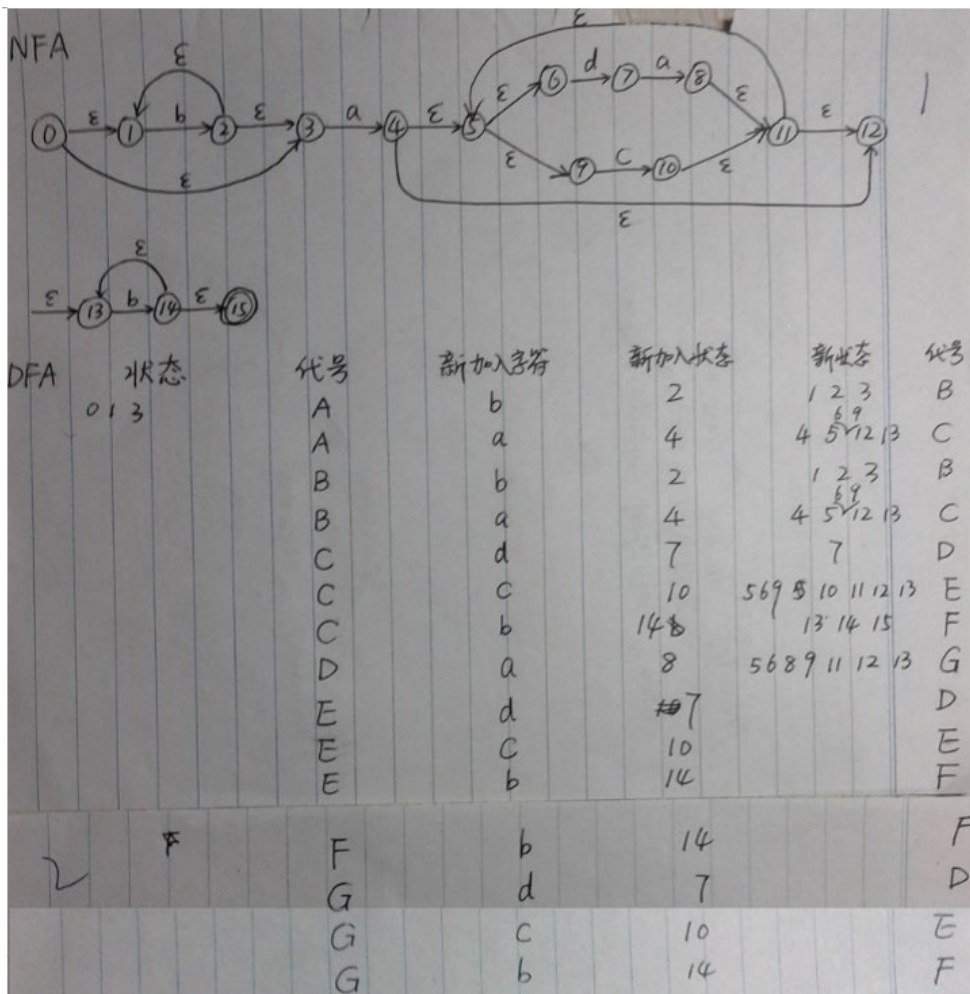
10) Which one is not related to the LL(1) parsing method. (D)

- [A] Left factoring [B] First set and follow set
 [C] Remove left recursion [D] Remove right recursion

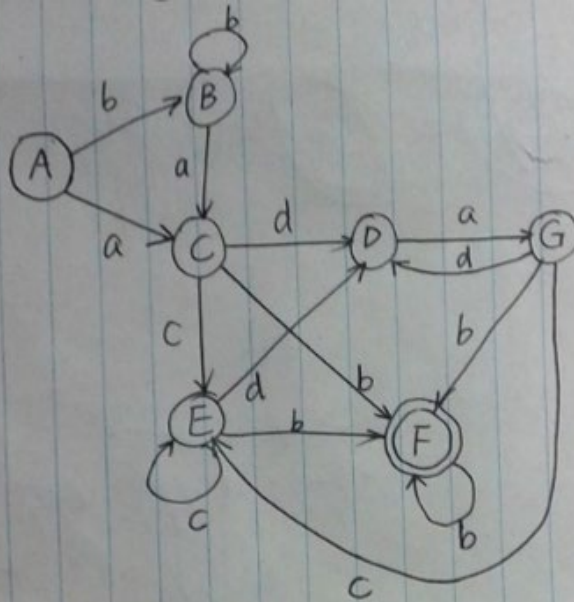
3. (15 cents) Given the regular expression $b^*a(da|c)^*b^+$, show the steps of converting the regular expression to the minimized DFA, and draw the DFA.

Solution:

评分标准: (给出 NFA 7 分, 给出最小化 DFA 8 分)



DFA:



} minimum DFA

非终态

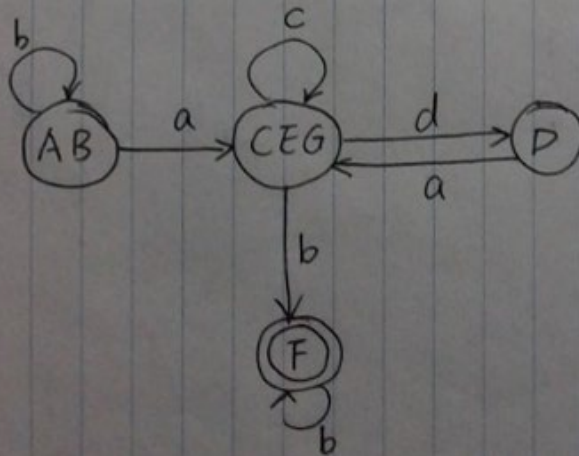
终态

{A B C D E G}

{F}

{A B D} {C E G} {F}

{A B} {D} {C E G} {F}



4. (20 cents) Consider the following grammar.

$S \rightarrow a|b|(T)$

$T \rightarrow T,S|S$

- (1) Remove the left recursion. (4 cents)
- (2) Construct First and Follow sets for the nonterminals of the resulting grammar. (6 cents)
- (3) Show that the resulting grammar is LL(1). (4 cents)
- (4) Construct the LL(1) parsing table for the resulting grammar. (6 cents)

Solution:

- (1) $S \rightarrow a$
 $S \rightarrow b$
 $S \rightarrow (T)$
 $T \rightarrow ST'$ (2分)
 $T' \rightarrow ,ST' | \epsilon$ (2分)

评分标准：左递归消除一个式子 2分

(2) 评分标准：共 6 分，错一个扣 1 分。

Nonterminal	First set	Follow set
S	a, b, (\$, ', ,)
T	a, b, ()
T'	', , ϵ)

(3) 评分标准：回答准确并简单说明理由 4分

$First(a) \cap First(b) \cap First((T))$ is empty

$First(ST') \cap First(\epsilon)$ is empty

$First(T') \cap Follow(T')$ is empty

Or

The associated LL(1) parsing table has at most one production in each table entry.

(4) 评分标准 (共 6 分，错一个扣 1 分)

	a	b	()	,	\$
S	$S \rightarrow a$	$S \rightarrow b$	$S \rightarrow (T)$			
T	$T \rightarrow ST'$	$T \rightarrow ST'$	$T \rightarrow ST'$			
T'				$T' \rightarrow \epsilon$	$T' \rightarrow ,ST'$	

5. (15 cents) Consider the following augmented grammar.

$$S' \rightarrow S$$

$$S \rightarrow a|(T)$$

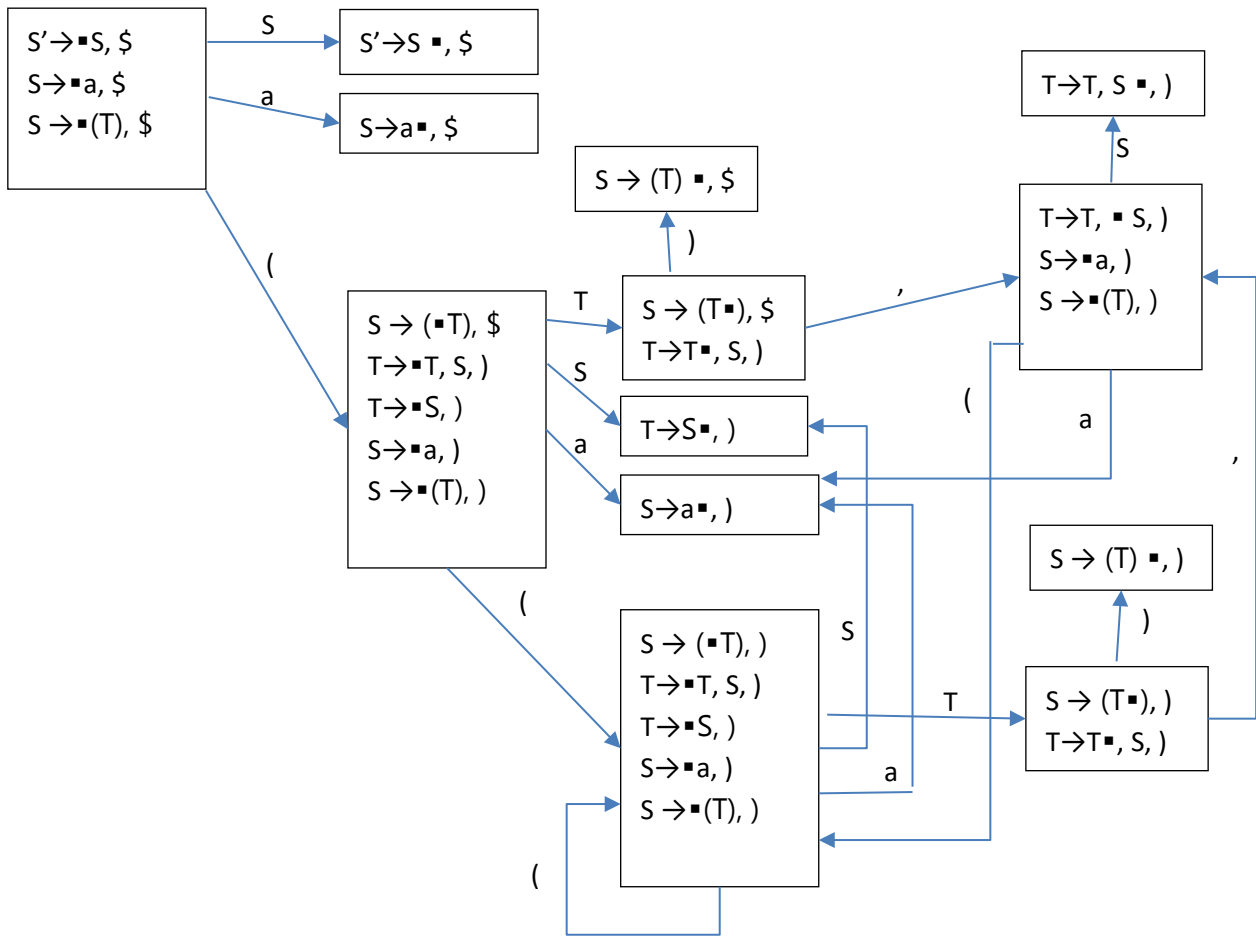
$$T \rightarrow T,S|S$$

(1) Construct the LR(1) DFA. (10 cents) (12 cents)

(2) Is the given left-recursive CFG LR(1)? (3 cents)

Solution:

(1) The LR(1) DFA is as follows



(2) The given CFG is LR(1).