CS 152: Exam-I (Feb. 5, 2021)   Name: _____

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1. (30 points) <u>Regular Expressions and Context Free Grammars</u>

i.   Given the following grammar: S → A B | ε   A → a A | ε   B → b B | ε
     Identify the string (if any) that has *multiple rightmost derivations*:
     a) a a a
     b) b b b
     c) ε
     d) None of the above

ii. Identify the *regular grammar* (if any) among the following:
     a) S → (S) S | ε
     b) S → a A | a   A → a A | ε
     c) S → a S a | a a | ε
     d) All of the above

iii. Identify the grammar (if any) that is *LL(1)* among the following:
     a) T → T * F | F   F → id | (E)
     b) A → a B | a   B → b B | b
     c) S → (S) S | ε
     d) None of the above

iv. Consider the regular expression $(x^* y)?$ x where Σ = {x,y}. Which of the
     following strings **cannot be** generated by the given regular expression.
     a) y
     b) x x x x
     c) x y y x x
     d) All of the above

v.   Consider the regular expression [5-7] | [23][0-8]. Which one of the
     following strings **cannot** be generated by the given regular expression.
     a) 620
     b) 59
     c) 39
     d) 20

vi. Which one of the following regular expressions is equivalent to the given
     regular expression: a . c where Σ = {a,b,c}.
     a) a c
     b) a c | a c c
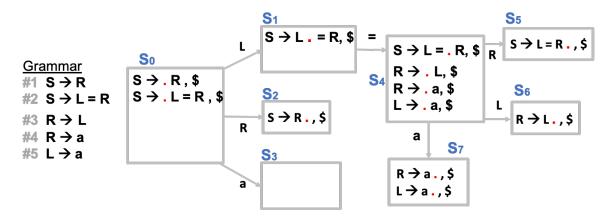   c) a a c | a b c | a c c
     d) a b c | a a c

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2. **(**25 points) <u>Top Down Parsing</u>. Given the following grammar where STMT is the start symbol:

#1 STMT → id R ; STMT   #3 R → ASSIGN   #5 ASSIGN → := num

#2 STMT → ϵ #4 R → CALL   #6 CALL → (id)

   i.   FIRST (STMT) =

   ii.   FOLLOW (STMT) =

   iii.   FIRST (R) =

   iv.   FOLLOW (R) =

   v.   TABLE [R, ( ] =

   vi.   TABLE [R, ;] =

   vii.   TABLE [STMT, $] =

   viii.   TABLE [ASSIGN, :=] =

   ix.   TABLE [CALL, id] =

   x.   TABLE [STMT, id] =

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3. (45 points) <u>Bottom-Up Parsing:</u> Given an incomplete SLR(1) state machine.

Grammar
#1 S → R
#2 S → L = R
#3 R → L
#4 R → a
#5 L → a

S0
S → . R , $
S → . L = R , $

S1
S → L . = R, $

S2
S → R . , $

S3
(empty)

S4
S → L = . R, $
R → . L, $
R → . a, $
L → . a, $

S5
S → L = R . , $

S6
R → L . , $

S7
R → a . , $
L → a . , $

i.   Provide *items missing* from state **S₀** :

ii. Provide *items missing* from state **S₁** :

iii. Provide *items missing* from state **S₃** :

iv. Provide action: **ACTION [S₀, a] =**

v.   Provide action: **ACTION [S₄, a] =**

vi. Provide action: **ACTION [S₁, =] =**

vii. Provide action: **ACTION [S₄, $] =**

viii. Provide action: **ACTION [S₂, $] =**

ix. Provide action: **ACTION [S₂, a] =**

x.   Provide action: **ACTION [S₆, $] =**

xi. Provide action: **ACTION [S₆, =] =**

xii. Provide action: **ACTION [S₅, $] =**

xiii. Identify states, if any, that contain a *shift-reduce* conflict?

xiv. Identify states, if any, that contains a *reduce-reduce* conflict?