

NAME: \_\_\_\_\_

FLORIDA INTL UNIV.

MAD 3512: Quiz #1 - FALL 2013

TIME: 25 min.

Say which of the following are "TRUE" or "FALSE". (2 points each)

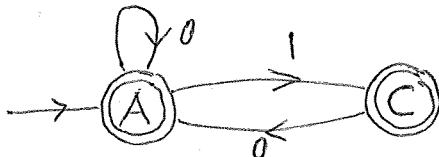
- (10) 1. (a) If  $L$  is any language on  $\{0,1\}$ , then we always have  $(L^R)^* = (L^*)^R$ . \_\_\_\_\_
- (b) The set of all infinite languages on the alphabet  $\{a\}$  is countable. \_\_\_\_\_
- (c) If  $L - \{\lambda\}$  contains  $L^*$ , then  $L$  has to be an infinite language. \_\_\_\_\_
- (d) If a CFG  $G$  has at least two productions and no useless ones, then  $L(G)$  is infinite. \_\_\_\_\_
- (e) If a DFA  $M$  has no inaccessible states, has a loop at a non-accepting state, and at least one accepting state, then  $L(M)$  must be infinite. \_\_\_\_\_

Just write down the correct answer. (3, 3, 4, 4, 4 points respectively)

- (18) 2. (a) Find a regular expression  $E$  which describes the set of all strings in  $\{0,1\}^*$  which contains at least 2 occurrences of the string 101.

Ans:  $E =$

- (b) If  $M$  is the NFA below, then  $L(M) =$



- (c) If  $G = \{S \rightarrow ASBB, S \rightarrow b, A \rightarrow aa, B \rightarrow b, B \rightarrow \lambda\}$ ,  
then  $L(G) =$

- (d) Find a RLG  $G$  which generates the language  $\underline{a} . (\underline{b} \underline{a})^* . \underline{c}^*$ .

Ans:  $G =$

- (e) Find a DFA  $M$  with  $L(M) = \underline{1}^* + (\underline{1} . \underline{0}^*)$ .

Ans:  $M =$

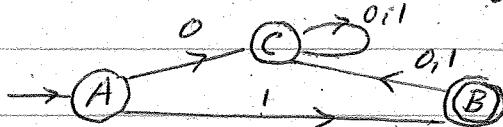
Use the back of this paper for question #3. (2, 3, 3, 4 points respectively)

- (12) 3. (a) A regular expression over  $\{a,b,c\}$  is a string of characters from which alphabet?
- (b) Define precisely what kinds of productions are allowed in a right linear grammar (RLG).
- (c) Define what it means for two states B & C in DFA  $M$  to be indistinguishable.
- (d) Define what is the transition relation  $\Delta$  of an NFA and specify its domain.

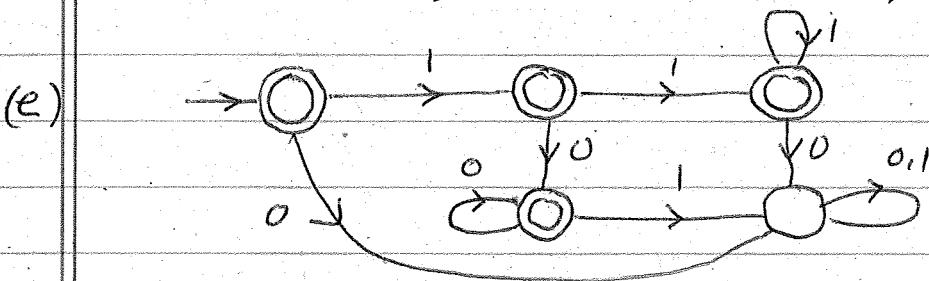
## Solutions to Quiz #1

Fall 2013

- (a) TRUE. This is a theorem from class,  $(L^R)^* = (L^*)^R$ .
- (b) FALSE. The set of all inf. languages on  $\{a\}$  is uncountable.
- (c) TRUE. If  $L - \{\lambda\} \supseteq L^*$ , then  $L$  has a nonempty string, so  $L^*$  is inf. & thus  $L$  is inf.
- (d) FALSE.  $S \rightarrow aA, A \rightarrow b$ .
- (e) FALSE.  $L(M) = \{1\}$



- 2(a)  $E = (0+1)^*. (10101 + 101.(0+1)^*.101).(0+1)^*$ .
- (b)  $L(M) = (0+10)^* + 0^*1(00^*1)^*$ .
- (c)  $L(G) = \{a^{2n}.b.b^k : n \geq 0, 0 \leq k \leq 2n\} = \{a^{2n}b^l : 1 \leq l \leq 2n+1\}$ .
- (d)  $\rightarrow A, A \rightarrow aB, B \rightarrow baB, B \rightarrow C, C \rightarrow cC, C \rightarrow \lambda$ .



- 3(a) A regular expression over  $\{a, b, c\}$  is a string of characters from the alphabet  $\{a, b, c, \lambda, \phi, +, \cdot, ^*, (), ()\}$ .
- (b) In a RLG only productions of the form  $A \rightarrow \alpha B$  or  $A \rightarrow \beta$  with  $A, B \in V$  &  $\alpha, \beta \in T^*$  are allowed.
- (c) Two states  $B$  &  $C$  in a DFA are indistinguishable in  $M$  if for each  $\varphi \in T^*$ ,  $\delta^*(B, \varphi) \in A(M) \Leftrightarrow \delta^*(C, \varphi) \in A(M)$ .
- (d) The transition relation of an NFA  $M$  is a binary relation  $\Delta$  from  $Q \times (T \cup \{\lambda\})$  to  $Q$  such that for each  $q \in Q$ ,  $\langle \langle q, \lambda \rangle, q \rangle \in \Delta$ . The domain of  $\Delta$  is  $Q \times (T \cup \{\lambda\})$  and the codomain of  $\Delta$  is  $Q$ .