

MAD 3512: Quiz #1 - Spring 09

TIME: 25 min.

Just write "TRUE" or "FALSE".

- (10) 1 (a) For any language A on $\{0,1\}$, we always have $(A^c)^R = (A^R)^c$. _____
- (b) The set of all infinite languages on $\{a\}$ is countable. _____
- (c) If a DFA, M has no inaccessible states then $L(M) \neq \emptyset$. _____
- (d) The DFA obtained from an NFA will always have more states. _____
- (e) If G is a CFG with a production of the form $A \rightarrow bA$ and G has no useless production, then $L(G)$ is infinite. _____

Just write down the correct answer.

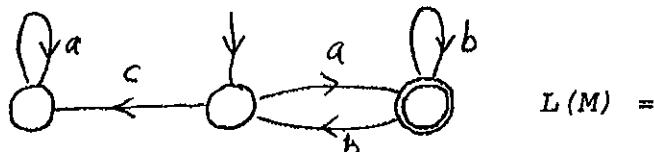
- (18) 2 (a) Find a regular expression E for the set of all strings in $\{0,1\}^*$ which contains at least two occurrences of the string 10.

Ans: $E =$

- (b) If $G = \{S \rightarrow ASA, S \rightarrow a, A \rightarrow b, A \rightarrow \lambda\}$, then

 $L(G) =$

- (c) If M is the NFA below, then



- (d) Find a RLG G for $0.1^*.0^*.1$

Ans: $G =$

- (e) Find a DFA M with $L(M) = (a^* \cdot b) + b^*$

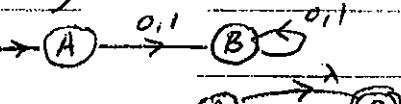
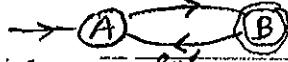
Ans: $M =$

Use the back of this paper for question #3.

- (12) 3 (a) Define what is a regular expression over the alphabet $\{0,1,2\}$.
- (b) Define what is an inherently ambiguous context-free language L.
- (c) Define when two states of a DFA M are indistinguishable.
- (d) Define what is the extended transition function of an DFA M.

MAD 3512 - Theory of Algorithms
Solutions to Quiz # 1

Florida Int'l Univ.
Spring 2009.

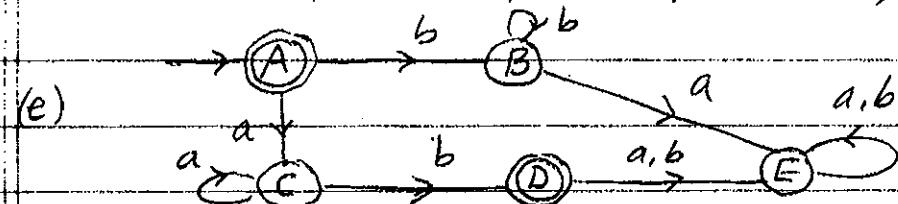
- 1.
- TRUE $\varphi \in (A^c)^R \Rightarrow \varphi^R \in A^c \Rightarrow \varphi^R \notin A \Rightarrow \varphi \notin A^R \Rightarrow \varphi \in (A^R)^c$, etc.
 - FALSE $\mathcal{L}(\{a\})$ is uncountable by a Theorem in class.
 - FALSE Consider the DFA 
 - FALSE Consider the NFA 
 - TRUE $A \rightarrow bA$ will generate $b^n A$ & the A will terminate

2. (a) $E = (0+1)^*, 10, (0+1)^*, 10, (0+1)^*$

(b) $L(G) = \{b^k a^{n+1} : 0 \leq k \leq 2n, n \geq 0\}$

(c) $L(M) = a \cdot (b + ba)^*$

(d) $S \rightarrow 0A, A \rightarrow 1A, A \rightarrow B, B \rightarrow 0B, B \rightarrow 1$



- 3.(a) A regular expression over $\{0,1,2\}$ is defined recursively as follows. (i) $0, 1, 2, \lambda$ and \emptyset are regular expressions, (ii) If E & F are reg. expr. then so are $(E+F)$, $(E \cdot F)$ & (E^*) .

- (b) An inherently ambiguous context-free language is a language that can be generated by an ambiguous CFG but cannot be generated by an un-ambiguous CFG.

- (c) Two states p & q in a DFA are indistinguishable if for each string w in Σ^* , $\delta^*(p, w) \in A \Leftrightarrow \delta^*(q, w) \in A$. Here Σ = input alphabet & A = set of accepting states of DFA

- (d) The extended transition function of a DFA M is defined recursively as follows. $\delta^* : Q \times \Sigma^* \rightarrow Q$ and (i) $\delta^*(q, \lambda) = q$
(ii) $\delta^*(q, wa) = \delta(\delta^*(q, w), a)$ for any $a \in \Sigma$ & $w \in \Sigma^*$.

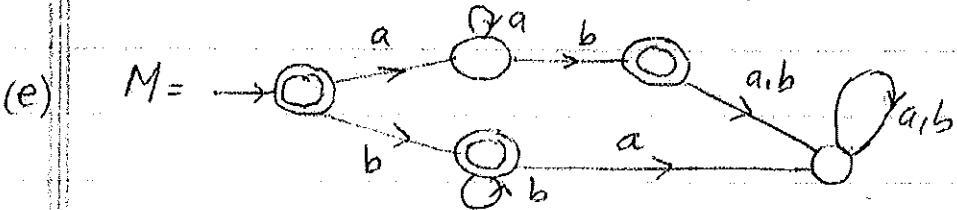
-) 1 (a) TRUE (b) FALSE, Set of all inf. lang. on $\{a\}$ is uncountable
 (c) FALSE, Consider a DFA with no accepting states
 (d) FALSE, Let the NFA be a DFA (e) TRUE

2 (a) $E = (\underline{0+1})^* \underline{10} \cdot (\underline{0+1})^* \underline{10} \cdot (\underline{0+1})^*$

(b) $L(G) = \{b^k a^{n+1} : 0 \leq k \leq n, n \geq 0\}$

(c) $L(M) = q_1 (b + b\underline{a})^* = \{a\} \cdot \{b, ba\}^*$

(d) $S \rightarrow 0A, A \rightarrow 1A/B, B \rightarrow 0B/1$



-) 3 (a) A regular expression over $\{0,1,2\}$ is defined recursively as follows: (a) $\underline{0}, \underline{1}, \underline{2}, \underline{\lambda}$ and \emptyset are regular expressions
 (b) If E & F are reg. expr. then so are $(E+F)$, $(E \cdot F)$ & (E^*) .
- (b) An inherently ambiguous context-free language is a context free language that cannot be generated by an unambiguous context-free grammar
- (c) Two states p and q in a DFA are indistinguishable if for each $w \in \Sigma^*$, $\delta^*(p, w) \in A$ if & only if $\delta^*(q, w) \in A$.
- (d) The extended transition function of a DFA is the function $\delta^* : Q \times \Sigma^* \rightarrow Q$ that is recursively defined as follows:
 $\delta^*(q, \lambda) = q$ and $\delta^*(q, \varphi a) = \delta(\delta^*(q, \varphi), a)$ for any $a \in \Sigma$ and any $\varphi \in \Sigma^*$.