NAME: _____ FLORIDA INT'L UNIV.

MAD 3512: Quiz #1 - FALL 2011 TIME: 25 min.

Say which are "TRUE" or "FALSE" (2 points each)

(10) 1(a) If L is a **language** on $\{0,1\}$, we can never have $(L^*)^c = (L^c)^*$. _____

(b) The set of **all languages** on the alphabet $\{a\}$ is countable. _____

(c) If L contains L^*, then L has to be a infinite language. _____

(d) If G has 3 productions and **no useless** ones, then $L(G) \neq \emptyset$. _____

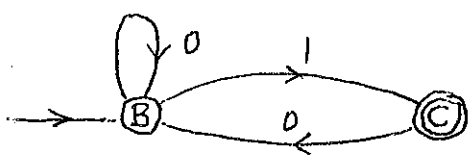
(e) If a DFA M has **no inaccessible** states and it has a loop at an **accepting state**, then L(M) is infinite. _____

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

(18) 2(a) Find a **regular expression** *E* for the set of all strings in $\{0,1\}^*$ which contains at least 2 occurrences of the string 11.

Ans: *E* =

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



(c) If $G = \{S \to AASB,\ S \to b,\ A \to a,\ B \to b,\ B \to \lambda\}$, then

L(G) =

(d) Find a **RLG** *G* for $\underline{a}.(\underline{ab})^*.\underline{a}^*$

Ans: *G* =

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

Ans: *M* =

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

(12) 3(a) Define what are **non-terminating** & **unreachable productions** in a CFG.

(b) Define what it means for a context-free grammar G to be **ambiguous**.

(c) Define what it means for a state B in DFA *M* to be ***inaccessible***.

(d) Define the **extended transition function** of an DFA and specify its ***domain and co-domain***.

MAD 3512 - Theory of Algorithms — Florida Int'l Univ.

Solutions to Quiz #1 — Fall 2011

1(a) TRUE. For any L, $\lambda \in (L^c)^*$ but $\lambda \notin (L^*)^c$ since $\lambda \in L^*$.

(b) FALSE. The set of all lang. on $\{a\}$ is uncountable.

(c) FALSE. Take $L = \{\lambda\}$. Then $L \supseteq L^*$ but L is not inf.

(d) TRUE. $L(G) \neq \emptyset$ because we have 3 useful productions.

(e) TRUE. $L(M)$ will be infinite because of the loop.

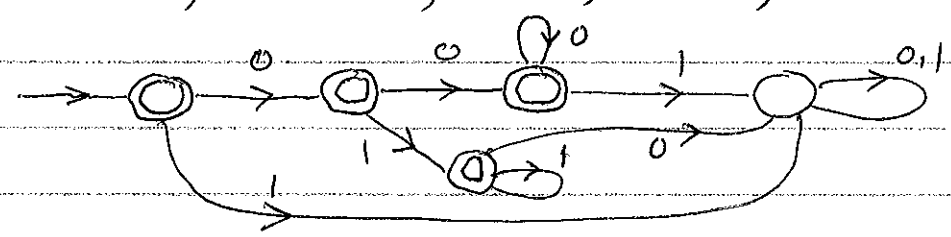
2(a) $E = (\underline{0}+\underline{1})^*.(\underline{1}\,\underline{1}\,\underline{1} + \underline{1}\,\underline{1}.(\underline{0}+\underline{1})^*.\underline{1}\,\underline{1}).(\underline{0}+\underline{1})^*$

(b) $L(M) = \underline{0}^*.\underline{1}.(\underline{0}.\underline{0}^*\underline{1})^*$

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

(d) $S \to aA$, $A \to abA$, $A \to B$, $B \to aB$, $B \to \lambda$

(e)



3 (a) A non-terminating production is one which contains a variable that does not eventually terminate into terminal symbols. An unreachable production is one which involves a variable that cannot be reached from the starting variable of the CFG.

(b) A CFG is ambiguous if it generates a string which has 2 or more left-most derivations in G.

(c) A state B in a DFA M is inaccessible if there is no string $\varphi \in \Sigma^*$ such that $\delta^*(q_0, \varphi) = B$. Here q_0 = the initial state of M and Σ = input alphabet of M.

(d) The extended transition function $\delta^* : Q \times \Sigma^* \to Q$ of a DFA is defined recursively as follows. (a) $\delta^*(q, \lambda) = q$ and (b) $\delta^*(q, \varphi a) = \delta(\delta^*(q, \varphi), a)$ for any $a \in \Sigma$ & $\varphi \in \Sigma^*$.