CS 252
TA 7
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4.2 $EQ_{DFA/REX} = \{\langle B, R\rangle \mid B$ is a DFA, R is a regular expression and $L(M) = L(R)\}$
Construct a TM M which decides lang. $EQ_{DFA/REX}$
M = On input $\langle B, R\rangle$:
1. Make the regular expression R an equivalent NFA A
2. Convert NFA A into equivalent DFA C
3. Run TM on input $\langle B, C\rangle$. If it accepts, accept. Else, reject.

4.3 DFA A accepts all strings if and only if every reachable state from the start state is an accept state. Construct a TM M that decides $ALL_{DFA} = \{\langle A\rangle \mid A$ is a DFA and $L(A) = \Sigma^*\}$
1. Select and mark the start node
2. Repeat following step until no new nodes are marked:
3. Mark each node connected by any node that is already marked
4. Check all nodes. If all are marked, accept. Otherwise, reject

4.4 Similar to theorem 4.8. Create TM M that decides $A_{ECFG} = \{\langle G\rangle \mid G$ is a CFG that generates $\varepsilon\}$.
M =
1. Mark all ε symbols alone on the right-hand side of a rule
2. Repeat next step until no new marks are made:
3. Mark any variable A where G has a rule $A \rightarrow U_1 U_2 \ldots U_k$ and each symbol $U_1 \ldots U_k$ has already been marked
4. If the start variable is marked, accept. Otherwise, reject.

4.16 The language of all strings that are palindromes is a context free language generated by the grammar $S \to 1S1 \mid 0S0 \mid 0 \mid 1 \mid \varepsilon$. Let P be the PDA that recognizes the language. Build a TM M for PALDFA which operates as follows. On input $\langle B \rangle$, where B is a DFA, use P and B to construct a new PDA R that recognizes the intersection of the languages B and P. Then test whether R's language is empty. If its language is empty, reject. Otherwise, accept.