CS 321 Quiz 4 (25 min., 5 pts) October 23, 2015

Last Name = _____, First Name = _____

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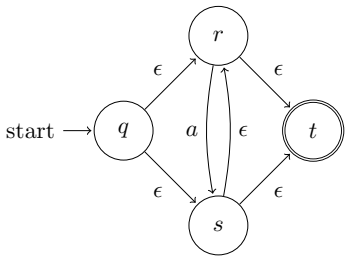
1. (1.5 pts) Yes or No. Justify your answer (correct yes/no without correct justification gets 0 pts).
   (a) technically, each DFA is also an ϵ-free NFA.
   (b) The δ in an NFA is of type $Q \times \Sigma \mapsto Q$.

2. (0.5 pts) When does an NFA accept the empty string? Use mathematical notations.

3. (0.5 pts) When is the language of an NFA non-empty? Use mathematical notations.

4. (1 pt) Construct an NFA for bitstrings $\{01, 001\}^*$ and then convert it to DFA.
   (a) NFA in **exactly 4 states** and **no ϵ arrows**.
   (b) converted DFA in a **3-states** (no trap state)

5. (0.5 pts) Given the following NFA with $\Sigma = \{a\}$, compute ϵ-closure for every state.



$E(q) =$

$E(r) =$

$E(s) =$

$E(t) =$

6. (0.5 pts) Convert the above NFA to DFA. You must result in a **2-state DFA** (no trap state).

7. (0.5 pts) Is this above DFA is equivalent to a smaller DFA? If so, draw it, otherwise explain.