

# CS 310T-31 - TPCS: Theory of Computation

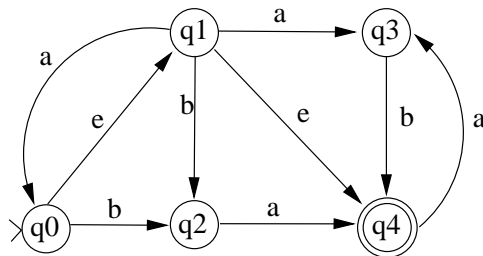
## Midterm

September 20, 2004

1. Draw a state diagram for a nondeterministic finite automata that accepts the following language:

$$(aba \cup aab \cup bab)^*$$

2. Given the following NFA, convert it to a DFA



3. Construct deterministic finite automata accepting each of the following languages

(a)  $\{ w \in \{a, b\}^* : \text{each } b \text{ is immediately followed by two } a\text{'s} \}$

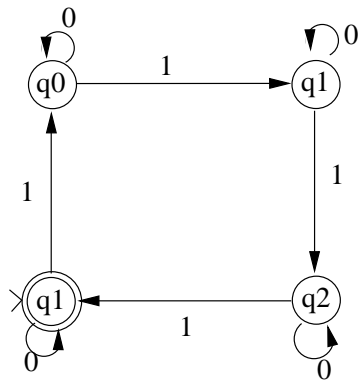
(b)  $\{ w \in \{0, 1\}^* : w \text{ has a number of } 0\text{'s that is multiple of three} \}$

4. Give some examples of strings in, and not in, these sets where  $\Sigma = \{0, 1\}$ .

(i)  $\{ w : \text{for some } u \in \Sigma\Sigma\Sigma, w = uu \}$

(ii)  $\{ w : \text{for some } u \in \Sigma^*, w = uu \}$

5. Derive the regular expression corresponding to the following FA



6. What language is represented by the regular expression  $(a^*ba^*ba^*ba^*)^*$ ?

7. Use the pumping lemma to show that the language  $B = \{a^j b^k \mid k = 2j\}$  is not regular

8. Draw a parse tree for the following grammar and example:

$G = (W, \Sigma, R, S)$ , where

$W = \{S, (, )\}$ ,

$\Sigma = \{(, )\}$ ,

$R = \{S \rightarrow e, S \rightarrow SS, S \rightarrow (S)\}$

Example:  $((()(())))$