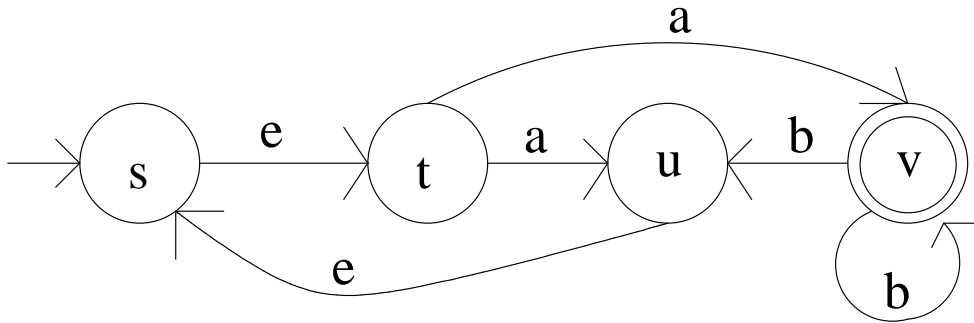# CSC 320 Midterm Exam

June 19, 1998

1. [20 marks] Use the construction described in class (which is the same as the one in the text) to convert this NDFA to an equivalent DFA:

State	Symbol			Next state

Start state: _____

Final states: _____

A picture of your final DFA:

2. Circle **True** or **False** and justify your answer. **No marks will be given unless there is a correct justification.**

(a) [5 marks] The set $\{L : L$ is a regular language over $\Sigma = \{a, b, c\}\}$ is countable.

True   False

(b) [5 marks] Every subset of a regular language is regular.

True   False

(c) [5 marks] Regular languages are closed under difference.

True   False

3. [20 marks] Define $L_1 = \{w \in \{0, 1\}^* : w$ ends with $0\}$.

Define $L_2 = \{w \in \{0, 1\}^* :$ the number of $1's$ in w is not divisible by $3\}$.

Design a **DFA** for the strings in $L_1 \cup L_2$.

4. [20 marks] Give a context-free grammar for $L = \{a^n b^m c^{n+m} : n, m \geq 0\}$.

5.(a) [10 marks] State precisely the pumping lemma for regular languages.

(b) [15 marks] Apply the pumping lemma to $w = a^k b c^{k^2}$. to prove that $L = \{a^n b c^p : n \leq p \leq n^3\}$ is not accepted by a DFA with k states.