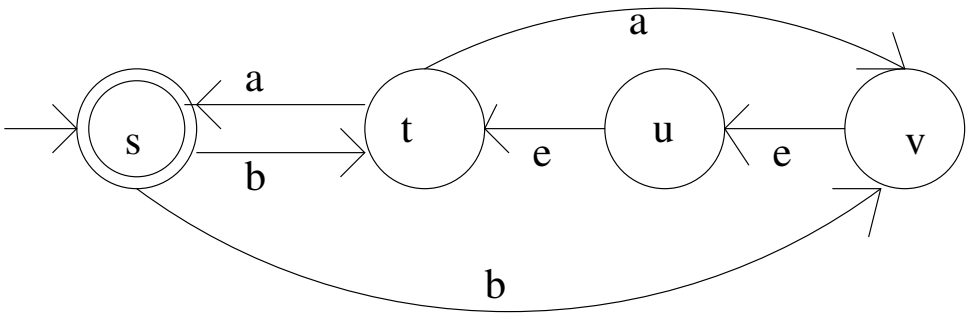
CSC 320 Midterm Exam

June 17, 1997

1. [30 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.(a) [10 marks] State the pumping lemma for regular languages (as presented in class, Exercise 2.6.4 of the text).

(b) [10 marks] Let $w = a^n b^m c^{n+m}$. Describe precisely by giving several cases all possible ways of choosing x, y, z such that $w = xyz$, and $y \neq \varepsilon$.

(c) [10 marks] Apply the pumping lemma to $w = a^n b^m c^{n+m}$ to prove that $L = \{a^n b^m c^p : p \leq n + m\}$ is not accepted by a DFA with $2 * n + 2 * m$ states.

(d) [10 marks] A more judicious choice for w would have made the argument for (c) much simpler. Suggest a better choice for w. How does this simplify the argument you gave for (c)?

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

(a) [6 marks] $\phi^* = \phi$

True False

(b) [6 marks] Every regular language has a **unique** regular expression that represents it.

True False

(c) [6 marks] Every subset of a regular language is regular.

True False

(d) [6 marks] If $x \notin L_1$ and $y \notin L_2$ then $x\,y \notin L_1 \cdot L_2$.

True False

(e) [6 marks] If $L = \{w \in \{a, b\}^* : w = a^n b^n,\ n \geq 0\}$, then $\bar{L} = \{w \in \{a, b\}^* : w = a^n b^m,\ n > m\}$ $\cup$ $\{w \in \{a, b\}^* : w = a^n b^m,\ n < m\}$.

True False