CSC 320: Midterm for Summer 2001

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

(a) [5 marks] The language $L = \{w : w$ contains aab and $aba\}$ defined over $\Sigma = \{ a, b \}$ is regular.

True False

(b) [5 marks] If L_1 and L_2 are regular languages, then so is $L_1 - L_2$.

True False

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

True False

(d) [5 marks] For every language L over $\Sigma = \{ a, b \}$, it is possible to find some regular language that is a subset of L.

True False

2 [20 marks] Given that $M_1 = (K_1, \Sigma, \Delta_1, s_1, F_1)$ is a FA that accepts a language L_1 and $M_2 = (K_2, \Sigma, \Delta_2, s_2, F_2)$ is a FA that accepts a language L_2, describe how to construct a finite automata $M = (K, \Sigma, \Delta, s, F)$ that accepts $L_1 \; o \; L_2$.

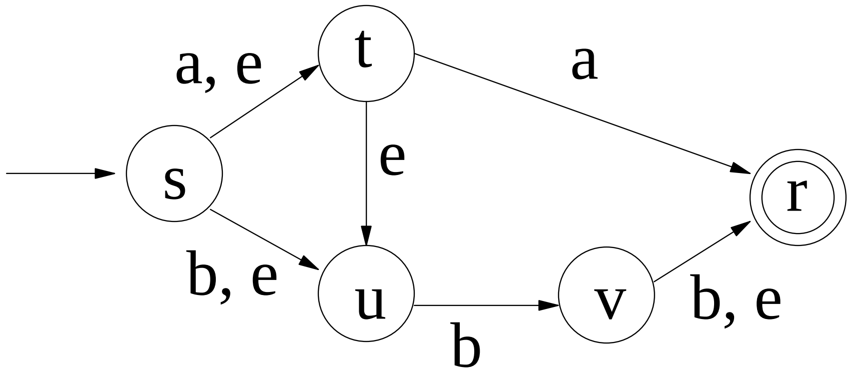
It is fine to draw a visual aid to help in determining your solution. However for full marks, you must precisely describe how to create M.

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

(b) [10 marks] Describe all ways of factoring $w = a^r \, b^s \, c^{r+s}$ as $x \, y \, z$ where y is not equal to the empty string.

4. [20 marks] Apply the pumping lemma to $w = a^r \, b^s \, c^{r+s}$. to prove that $L = \{a^n \, b^m \, c^p : n + m \leq p\}$ is not accepted by a DFA with $k = 2(r + s)$ states.

5. [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: $M = (K, \Sigma, \Delta, s, F)$.