Theory of computation Midterm Fall 2005

Name____

1) (10 points) Give the formal definition of the DFA M_1 given in Figure 1

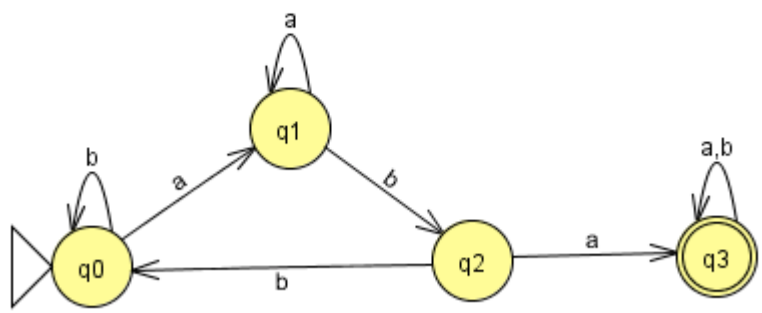

Figure 1: Machine M_1

2) (10 points) Give a regular expression for the language generated by the DFA shown in Figure 2. Describe the Language.

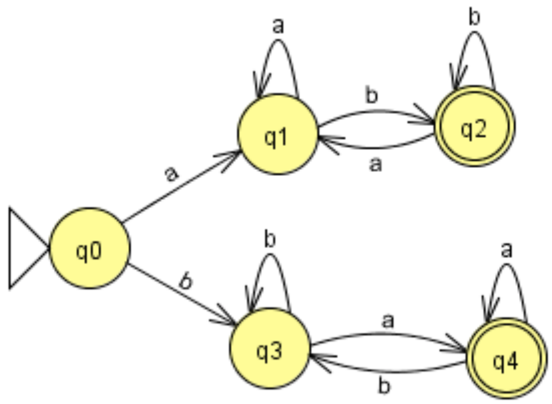

Figure 2:

Description

REGEX:____

3) (10 points) Draw the state diagram for the following NFA
$M_2=\{Q=\{1,2,3,4,5\},\Sigma=\{a,b\},\delta,1,\{1,3\}\}$
where δ is given by the following table:

$\delta\ (1,a) = \{2,3\}$	$\delta\ (1,b) = \emptyset$	$\delta\ (1,c) = \{3\}$
$\delta\ (2,a) = \emptyset$	$\delta\ (2,b) = \{2,4\}$	$\delta\ (2,c) = \emptyset$
$\delta\ (3,a) = \{5,2\}$	$\delta\ (3,b) = \emptyset$	$\delta\ (3,c) = \emptyset$
$\delta\ (4,a) = \emptyset$	$\delta\ (4,b) = \emptyset$	$\delta\ (4,c) = \{3\}$
$\delta\ (5,a) = \emptyset$	$\delta\ (5,b) = \{3,5\}$	$\delta\ (5,c) = \emptyset$

4) (10 pts) Draw a transition diagram for a DFA machine M_3 that accepts any and only binary string that start with **bab**.

5) (20 points) Write a regular expression that describes formally the following informally described languages. Assume **Σ={a,b}.**
   a) **w** contain a **b** in the third symbol from the left.

   b) **w** contain a **b** in the third symbol from the left.

   c) **w** contain both **aaa** or **bbb** as a substring.

   d) **w** contain either **aaa** or **bbb** as a substring.

6) (10 points) Write a context-free grammar that generates he following languages. Assume Σ={a,b,#}.
{ $\#a^{2n}\#\#b^{n}\#$ | $n > 0$} this language has two a's for each b.

7) (10 points) Use the pumping lemma to show that the following language is not regular. Assume Σ={a,b }.
a) {$a^{n}b^{2n}$ | $n > 0$} this language has two b's for each a.