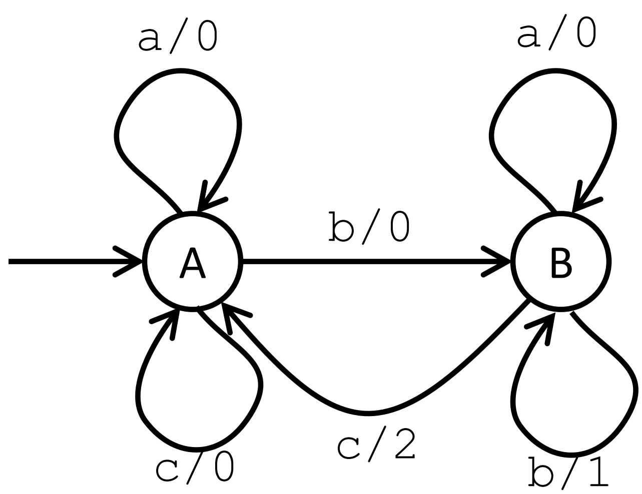
Name ____ Discrete II, Big Quiz 3, Spring 2017

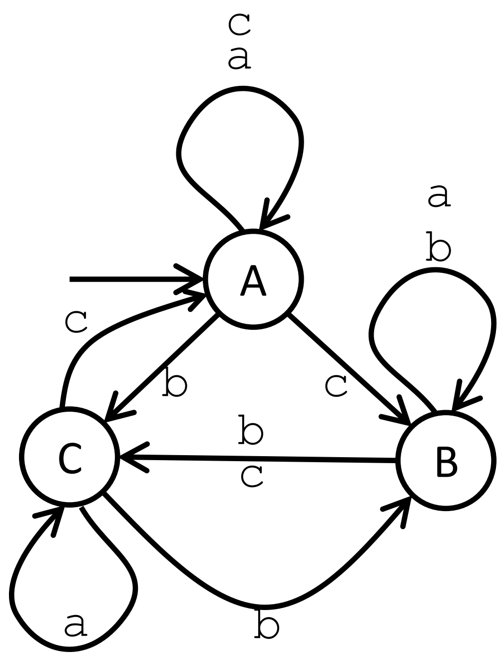
1) Given the finite state machine (I, O, S, f, g, σ) with $I = \{a, b, c\}$, $O = \{0,1,2\}$, $S = \{A, B\}$, $\sigma = A$, and f, g as described in the table below, draw the corresponding transition diagram. (10 points)

	f			g		
$S\backslash I$	a	b	c	a	b	c
A	A	B	A	0	0	0
B	B	B	A	0	1	2



2) Given the finite state automata shown below, is the string "abcabcbbb" accepted? Show your work or justify your answer. (5 points)

This will not be accepted. We could trace through all the states it visit: A, C, A, A, etc. However ,note that there are no accepting states. Hence this string and every other string is rejected. The language created has no words.



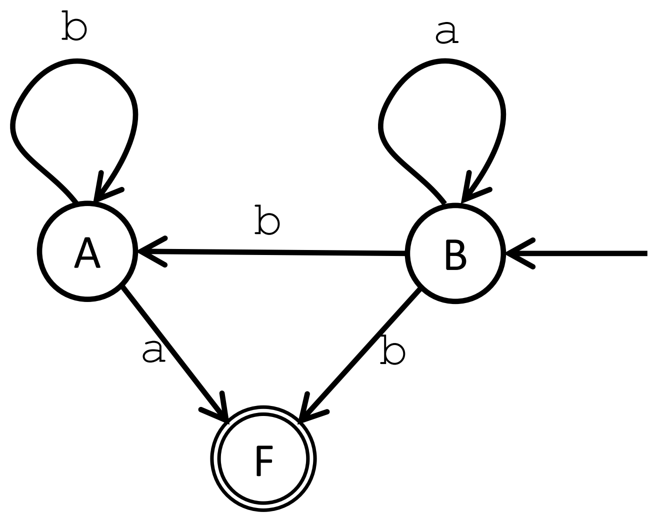
3) Given the grammar $G = (N, T, P, \sigma)$ with $N = \{A\}$, $T = \{a, b, d\}$, $\sigma = A$, and P consisting of the productions below, give a derivation to show that $abab \in L(G)$. (10 points)

$$A \to a|b|abA|bA$$
$$aA \to A$$
$$bA \to A$$

$$\sigma = A \Rightarrow abA \Rightarrow ababA \Rightarrow abaA \Rightarrow abab$$

4) Given the grammar $G = (N, T, P, \sigma)$ with $N = \{A, B\}$, $T = \{a, b, d\}$, $\sigma = B$, and P consisting of the productions below, create the transition diagram for a nondeterministic finite state automata that has the same language. (10 points)

$$A \rightarrow a|bA$$
$$B \rightarrow b|aB|bA$$



5) What is the langauge created by G in the previous question? Describe it either mathematically or in words. You may use regular expressions if you're familiar with them. (5 points)

This grammar consists of any number of a's (at least 0) followed by a single b, or any number of a's (at least 0), followed by any number of b's (at least 1), followed by a single a.

Using a regular expression, we could write this as:

$$(a^*b)|(a^*b^+a)$$

The expression a^*b can be read as "any number of a's (at least 0) followed by a single b"
The expression a^*b^+a can be read as "any number of a's (at least 0), followed by any number of b's (at least 1), followed by a single a"

6) Given the infix expression below, create the binary expression tree that represents it. (5 points)

$$3 \cdot 2 + 4 \cdot 5$$

7) Evaluate the postfix expression below. (5 points)

$$6 5 + 2 6 - \div$$