Automata Theory - Quiz I

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1 Instructions

1. The quiz should be returned by $9:15\ am$ on 9/21/04.

2. Each question is worth 2 points.

3. Attempt as many problems as you can. You will be given partial credit, as per the policy discussed in class.

2 Problems

1. Professor Sikorski claims to have an inductive proof for the following hypothesis: $S(n) : n = n + 1,\ \forall n \geq 1$. His proof is as follows: Assume that $S(k)$ is true. Therefore, $k = k + 1$. Now, consider $S(k + 1)$. We need to show that $k + 1 = k + 2$. From, the inductive hypothesis, $k = k + 1$. So we can substitute $k + 1$ for k in the hypothesis of $S(k + 1)$, which means that we have to show $(k + 1) + 1 = k + 2$. But this is trivially true, so $S(k + 1)$ holds. Since, we have established that $S(k) \rightarrow S(k + 1)$, it follows that $S(n)$ is true, i.e., $n = n + 1,\ \forall n \geq 1$. Can you spot the flaw in the Professor's argument?

2. Design a DFA to accept the following language:
$L = \{w \mid w \in \{0, 1\}^*$ and w when interpreted as a number is not divisible by 3. $\}$

3. Informally, describe the language accepted by the following DFA.

	0	1
$\rightarrow\ *A$	B	A
$*B$	C	A
C	C	C

4. Convert the following NFA to a DFA.

	0	1
$\rightarrow p$	$\{p, q\}$	$\{p\}$
q	$\{r\}$	$\{r\}$
r	$\{s\}$	ϕ
$*s$	$\{s\}$	$\{s\}$

5. Formally argue that the NFA in Figure 1 accepts the language L, where,
$L = \{w \mid w \in \{a,\ b\}^*$ and x consists of 0 or more $a's$, followed by a b $\}$.

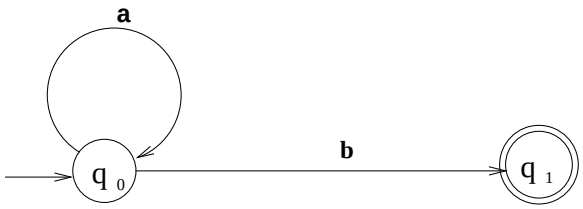

Figure 1: NFA accepting 0 or more $a's$, followed by a b