Homework 1

due Friday Oct 12 in class

- 1. Give DFA's accepting the following languages over the alphabet $\{0, 1\}$:
 - (a) The set of all strings ending in 00.
 - (b) The set of all strings with three consecutive 0's (not necessarily at the end).
 - (c) The set of strings with 011 as a substring.
- 2. Convert to a DFA the following NFA:

	0	1
$\begin{array}{c} & \rightarrow p \\ & *q \end{array}$	$\begin{cases} \{q,s\} \\ \{r\} \end{cases}$	$ \begin{array}{c} \{q\} \\ \{q,r\} \end{array} $
$r \\ *s$	$\left \begin{array}{c} \{s\} \\ \emptyset \end{array} \right $	$\begin{array}{c} \{p\} \\ \{p\} \end{array}$

3. Convert the following NFA to a DFA and informally describe the language it accepts.

	0	1
$\rightarrow p$ q	$\begin{cases} \{p,q\} \\ \{r,s\} \end{cases}$	$\begin{cases} p \\ \{t\} \end{cases}$
$r \\ *s$	$\left \begin{array}{c} \{p,r\}\\ \emptyset\end{array}\right $	$\left\{ t ight\} \emptyset$
*t	Ø	Ø

- 4. Give nondeterministic finite automata to accept the following languages. Try to take advantage of nondeterminism as much as possible.
 - (a) The set of strings over alphabet $\{0, 1, \ldots, 9\}$ such that the final digit has appeared before.
 - (b) The set of strings over the alphabet $\{0, 1, \ldots, 9\}$ such that the final digit has *not* appeared before.
 - (c) The set of strings of 0's and 1's such that there are two 0's separated by a number of positions that is a multiple of 4. Note that 0 is an allowable multiple of 4.
- 5. Write regular expressions for the following languages:
 - (a) The set of strings over alphabet $\{a, b, c\}$ containing at least one a and at least one b.
 - (b) The set of strings of 0's and 1's whose tenth symbol from the right end is 1.
 - (c) The set of strings of 0's and 1's with at most one pair of consecutive 1's.