1. Convert the following nondeterministic finite automata to an equivalent finite automata.

![Nondeterministic Finite Automata Diagram]

2. Convert the following regular expressions to nondeterministic finite automata.
   (a) $(0 + 1)^*000(0 + 1)^*$
   (b) $(((00)^*(11)) + 01)^*$

3. Let $B_n = \{a^k | k \text{ is a multiple of } n\}$. Show that for each $n \geq 1$, the language $B_n$ is regular.

4. Convert the following finite automata to a regular expression.

![Finite Automata Diagram]

5. Write a Deterministic Finite Automata (DFA) for each of the following languages over $\Sigma = \{0, 1\}$.
(a) $\Sigma^*$
(b) $\emptyset$
(c) $\{\epsilon\}$
(d) All strings whose length is devisable by 5.
(e) All strings that do not include 1100 as a substring.
(f) All strings that include 00 as a substring and do not include 101.
(g) All strings whose binary value (e.g.: 101 is '5') is devisable by 5, but not by 10.

6. Let $D = \{w \mid w$ contains an equal number of occurrences of substrings 01 and 10\}. For example, 101 $\in D$, but 1010 $\notin D$. Show that $D$ is a regular language.

7. (a) Let $N = (Q, \Sigma, \delta, q_0, F)$ be an NFA, and let $L = L(N)$ be the language accepted by $N$. Is it true that the language accepted by $N = (Q, \Sigma, \delta, q_0, Q \setminus F)$ is $\overline{L}$? Explain your answer.

(b) We define a new type of NFA called co-NFA: A co-NFA, $C$, accepts a string $x$ if and only if every run of $C$ on $x$ terminates in an accepting state (in contrast, an NFA, $M$, accepts a string $x$ if and only if there exists a run of $M$ on $x$ that terminates in an accepting state). Show that a language $L$ is acceptable by a co-NFA if and only if $L$ is regular.