Exercises for seminar

1) Consider the NFA M of Figure 2.26.

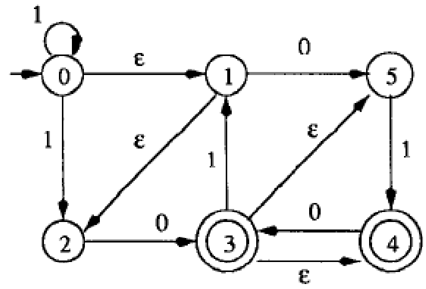

Figure 2.26: The NFA of Exercise 1.

(a) What are ε-closure $(\{q_0\})$ and ε-closure $(\{q_1, q_2, q_3\})$?
(b) What are $\delta(\{q_0\}, 0)$ and $\delta(\{q_2, q_3\}, 1)$?
(c) Draw the computation trees of M on strings $x = 011$ and $y = 101$. Does M accept or reject x and y?

2) For each NFA M shown in Figure 2.27, determine what $L(M)$ is.

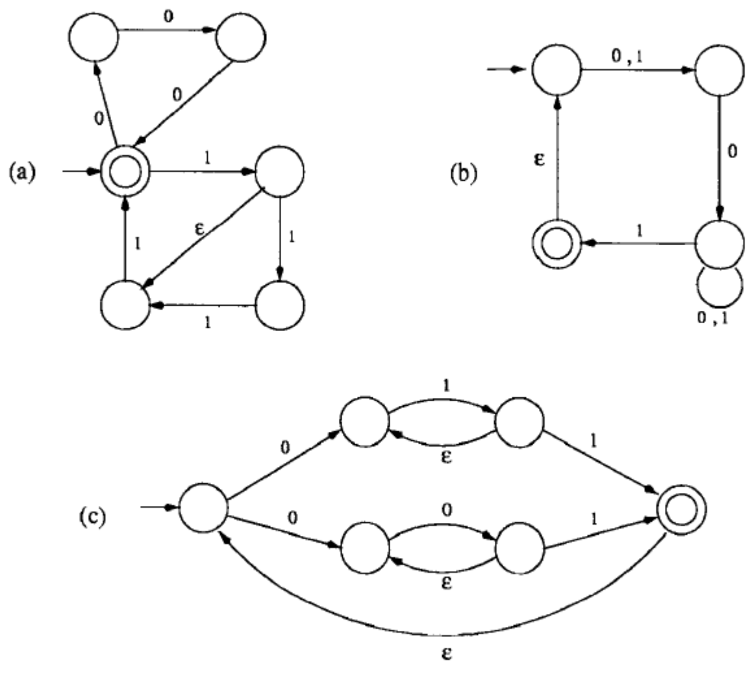

Figure 2.27: Three NFA's of Exercise 2.

3) For each of the following languages, construct an NFA that accepts the languages:
(a) The set of binary strings that contain at least three occurrences of substring 010.
(b) The set of binary strings that contain both substrings 010 and 101. [Hint: This is equivalent to the set of binary strings that contain either a substring

0101 or a substring 1010 or a substring 010 followed by 101 or a substring 101 followed by 010].

(c) The set of binary strings that contain either a substring 010 or a substring 101, and end with 111 or 000.

(d) The set of binary strings of which the $(3n)$th symbol is 0 for each $n \geq 1$.

(e) The set of binary strings x of length $3n$ for some $n \geq 1$, such that, for each $1 \leq k \leq n$, at least one of the $(3k-2)$nd, $(3k-1)$st and $(3k)$th symbols of x is 0.

(f) The set $\{0^n 10^m 10^q \mid q \equiv nm \ (mod\ 5)\}$.