1 Week 9 revision

1. [Source: Sipser 1.16] Convert the following nondeterministic FSM (NFSM) to an equivalent deterministic finite automata (DFSM).

2. [Source: Sipser 1.16] Convert the following nondeterministic FSM (NFSM) to an equivalent deterministic finite automata (DFSM).

2 Regular expressions and languages

1. Give a regular expression for the following sets:
a) all strings of 0s and 1s beginning with 1 and ending with 1
b) strings containing exactly two 1s
c) strings of 0s and 1s having an odd number of 1s
d) the set of all strings of 0s and 1s containing at least one 0
e) the set of all strings of 0s and 1s where each 0 is followed by two 1s
f) the set of all strings of 0s and 1s containing exactly three 0s

2. Find a regular expression for the language \( L \) consisting of all strings over \{0, 1\} with no consecutive zeros (that is, any string containing 00 is not in the language).

3. Does the string 01110111 belong to the regular set \((1^*01)^*(11 + 0^*)\)? Justify your answer.

4. Does the string 011100101 belong to the regular set 01^*10^*(11*0)^*? Justify your answer.

5. Prove that if \( A \) is a regular set with alphabet \( I \), then the language defined by taking the set difference \( I^* - A \) is also regular.

6. Simplify the following regular expression as much as possible

\[ (((a^*)^*)(\epsilon + b)c(c + (\epsilon + \epsilon)))^* \]

Explain your reasons for each simplification step.