SC205- Discrete Mathematics

Home Work 3

Tutorial Discussion Week: February 3, 2020

(1) Let $A = (Q, \Sigma, \delta, q_0, F)$ be the DFA, where $Q = \{q_0, q_1, q_2, q_3\}, \Sigma = \{0, 1\}, F = \{q_1, q_2\}$ and the transition function δ is defined by the following table:

δ	0	1
q_0	q_1	q_3
q_1	q_2	q_3
q_2	q_2	q_2
q_3	q_3	q_3

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Give the state digram of this machine. Also determine if A accepts the strings 000 and 010 ?

(2) Give state diagrams of $DFAs$ recognizing the following languages. In all cases the alphabet $\Sigma = \{0, 1\}$.

- (i) $\{w \mid$ every odd position of w is 1$\}$.
- (ii) $\{w \mid w$ has 010 as a substring $\}$.
- (iii) $\{w \mid w$ has odd number of $0's$ and even number of $1's\}$.
- (iv) $\{w \mid$ the length of w is at most 5$\}$.
- (v) $\{w \mid w$ does not contain the substring 110$\}$.
- (vi) $\{w \mid w$ is any string except 11 and 111$\}$.
- (vii) $\{\epsilon, 0\}$.
- (viii) The empty set.
- (ix) All strings except the empty string.

(3) Give NFAs (or ϵ-NFAs) with the specified number of states recognizing each of the following languages. Convert the NFAs (or ϵ-NFAs) to DFAs.

- (i) The language $\{0\}$ with two states.
- (ii) The language $\{0\}^\star$ with one state.

(4) An ϵ-NFA is given by $A = (Q, \Sigma, \delta, q_0, F)$, where $Q = \{q_0, q_1, q_2, q_3, q_4, q_5\}, \Sigma = \{0, 1\}$, $F = \{q_3, q_4\}$ and the transition function δ is defined by the following table:

δ	0	1	ϵ
q_0	$\{q_0\}$	$\{q_0, q_2\}$	$\{q_1\}$
q_1	$\{q_5\}$	$\{q_2\}$	ϕ
q_2	$\{q_3\}$	ϕ	ϕ
q_3	ϕ	ϕ	$\{q_4\}$
q_4	$\{q_3\}$	ϕ	ϕ
q_5	ϕ	$\{q_4\}$	ϕ

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Find a *DFA* equivalent to the ϵ-NFA A.