Concurrency

What is meant by a strong bisimulation on CCS agents? How are strong bisimulations used to show that two agents are strongly equivalent? [5 marks]

Suppose that $M = (Q, \Sigma, \Delta, i, F)$ is a finite non-deterministic automaton with set of states $Q$, input alphabet $\Sigma$, transition relation $\Delta \subseteq Q \times \Sigma \times Q$, initial state $i$, and set of accepting states $F$. Show how to define CCS agents $A_q$ (for each state $q \in Q$) and $\text{Stop}$ with the properties

$$
A_{q_1} \xrightarrow{a} A_{q_2} \quad \text{if and only if} \quad (q_1, a, q_2) \in \Delta
$$
$$
A_q \xrightarrow{\tau} B \quad \text{if and only if} \quad B = \text{Stop} \quad \text{and} \quad q \in F
$$

for all $q_1, q_2, q \in Q$, all $a \in \Sigma$, and all agents $B$. [5 marks]

Suppose that $M' = (Q', \Sigma, \Delta', i', F')$ is another finite non-deterministic automaton (over the same input alphabet) and corresponding CCS agents $A'_{q'}$ ($q' \in Q'$) and $\text{Stop}'$ are defined for $M'$ as above. Show that the languages accepted by $M$ and $M'$ are equal if $A_i$ and $A'_i$ are strongly equivalent CCS agents. [6 marks]

Is the converse true? [4 marks]