Assignment 3
Automata & Model Checking

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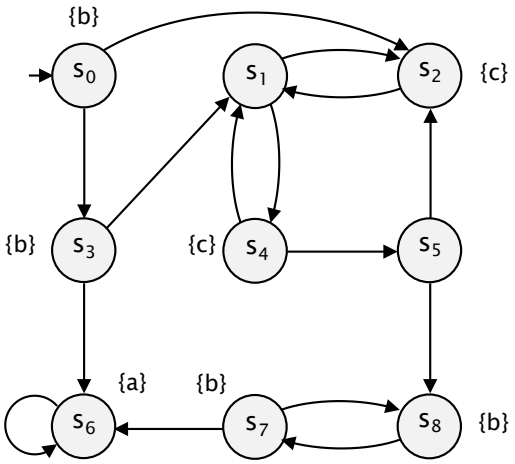
1. Illustrate the application of the CTL model checking algorithm to determine whether the LTS below satisfies the CTL formula $\phi = \forall\Diamond(a \vee \forall\bigcirc c)$, after first converting into existential normal form (ENF):



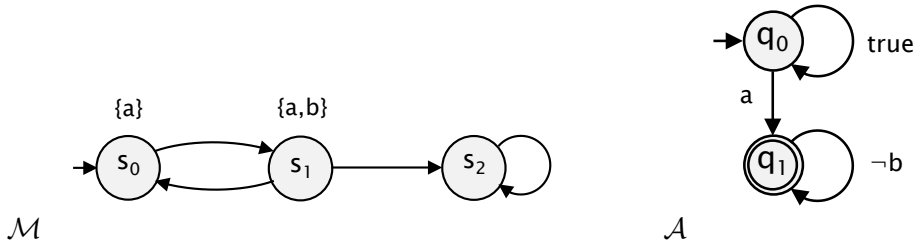
[10 marks]

2. In lectures, you saw nondeterministic finite automata (NFAs) for regular safety properties such as $\Box\neg \mathit{fail}$ and $\Box(a \rightarrow \bigcirc b)$. (Recall that the NFA should represent the bad prefixes for the safety property.) Draw an NFA for the regular safety property represented by each of the LTL formulae listed below.

   (i) $\Box\bigcirc a$
   (ii) $\Box(a \rightarrow \bigcirc\Box c)$

[14 marks]

3. Below are an LTS $\mathcal{M}$ and a nondeterministic Büchi automaton (NBA) $\mathcal{A}_{\neg\psi}$ representing the negation of an LTL formula ψ:



   (i) Illustrate the LTL model checking procedure for ψ on $\mathcal{M}$ by constructing and analysing an appropriate LTS-NBA product.

   (ii) Give a suitable LTL formula for ψ and an explanation, in terms of the original LTS $\mathcal{M}$, why ψ is or is not satisfied.

[16 marks]