Technische Universität München **Summer Semester 2015**
I7
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Model Checking – Exercise sheet 5.1

Exercise 5.1: Special cases for F and G

1. Is $\mathbf{F}\neg p$ in negative normal form ? What about $\mathbf{G}\varphi$?
2. Assume φ is in negative normal form, give the negative normal form of $\mathbf{G}\neg\varphi$
3. Extend the set of rules of the LTL to Büchi translation so as to deal with **F** and **G** operators.
4. Prove that when building an automaton for a formula φ of the form $\mathbf{G}\psi$, it is not necesary to build states not containing φ.

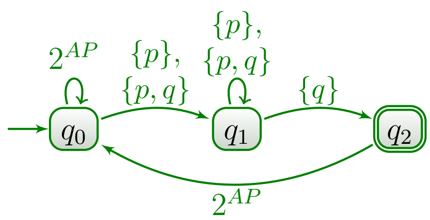
Exercise 5.2: LTL to Büchi translation

We consider the following LTL formula:
$\varphi = \mathbf{G}((X(p\,\mathcal{U}\,q)) \rightarrow ((\neg p \wedge \mathbf{F}q) \vee (q\,\mathcal{U}\,\mathbf{X}q)))$

1. Give the subformulas of φ
2. How many (consistent) states does the LTL to Büchi translation of φ have ?
3. How many of sets of accepting states are there ?
4. Is $\{\varphi\}$ an accepting state of the LTL to Büchi translation?
5. Give a reachable state that admits not successor
6. Give a sucessor state of $\{\varphi, p, q, q\,\mathcal{U}\,\mathbf{X}q, \mathbf{F}q\}$
7. Give a predecessor of $\{\varphi, q, q\,\mathcal{U}\,\mathbf{X}q, \mathbf{F}q\}$

Exercise 5.3: From Büchi to LTL

We give the following automaton $\mathcal{B}$:



1. Propose an LTL formula describing the language of $\mathcal{B}$
2. How to build a Büchi automaton that accepts the complement of $L_{\mathcal{B}}$?
3. Build the Büchi automaton for the formula $\mathbf{G}(\neg p \vee (\neg p\,\mathcal{R}(p \vee \neg q)))$
4. Deduce an automaton accepting the complement of the language of $\mathcal{B}$