Model Checking – Exercise sheet 6

Exercise 6.1: What is syntactic sugar ?

CTL operators are defined as QT where Q is A or E and T is any LTL modality $(\mathbf{X}, \mathbf{F}, \mathbf{G}, \mathcal{U}, \mathcal{W}, \mathcal{R})$. So many operators means a lot of cases to handle for inductively proving results on CTL.

1. Show that any operator can be written by means of the three operators $E\mathbf{X}, E\mathbf{G}, E\mathcal{U}$ (and also with the boolean connectives).
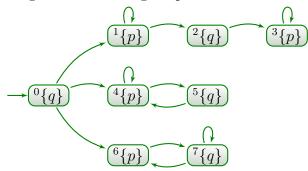
2. Informally, why is $E\mathbf{G}$ necessary ?

Exercise 6.2: Composition of unary operators

We are interested in the following operators: $E\mathbf{F}, E\mathbf{G}, A\mathbf{F}, A\mathbf{G}$.

1. What can we say about $E\mathbf{F}E\mathbf{F}, E\mathbf{G}E\mathbf{G}, A\mathbf{F}A\mathbf{F}, A\mathbf{G}A\mathbf{G}$?

2. What about $A\mathbf{F}E\mathbf{F}$ and $E\mathbf{F}A\mathbf{F}$?

Exercise 6.3: Fixpoint computations

We give the following Kripke structure:

1. Compute $E\mathbf{G}q$ and $E\mathbf{F}q$.

2. Compute $A\mathbf{G}A\mathbf{F}p$ and $A\mathbf{F}A\mathbf{G}p$.

3. Does $K \models \mathbf{F}\mathbf{G}p$? Does $K \models \mathbf{G}\mathbf{F}p$?