Homework 2

To hand in on September 28th at 14:00, during the exercise session or by mail at `marie.fortin@lsv.fr`.

Exercise 1 (Equivalences)**.** We fix a set of atomic propositions including $\{p, q\}$. Which of the following equivalences are correct for the time flow $(\mathbb{N}, <)$? for $(\mathbb{R}, <)$? for finite trees? Give a proof or a counter-example.

1. $(\mathsf{X}\, p) \wedge (\mathsf{X}\, q) \equiv \mathsf{X}(p \wedge q)$
2. $\mathsf{F}\, p \equiv p \vee \mathsf{X}\, \mathsf{F}\, p$
3. $\mathsf{G}\, p \wedge \mathsf{X}\, \mathsf{F}\, p \equiv \mathsf{G}\, p$
4. $\mathsf{X}(p\, \mathsf{U}\, q) \equiv (\mathsf{X}\, p)\, \mathsf{U}\, (\mathsf{X}\, q)$
5. $\mathsf{G}(p\, \mathsf{U}\, q) \equiv (\mathsf{G}\, p)\, \mathsf{U}\, (\mathsf{G}\, q)$

Exercise 2 (Specification)**.** We fix a set of propositions $\mathrm{AP} = \{\mathrm{ok}, \mathrm{crash}, \mathrm{alarm}, \mathrm{reset}\}$ and the time flow $(\mathbb{N}, <)$. Provide formulæ for the following properties (a) in $\mathrm{FO}(\mathrm{AP}, <)$, (b) in $\mathrm{TL}(\mathrm{AP}, \mathsf{SU}, \mathsf{SS})$ (your formula should use past modalities), and (c) in $\mathrm{TL}(\mathrm{AP}, \mathsf{SU})$.

1. "Whenever the alarm rings, there has been a crash immediately before."
2. "Whenever the alarm rings, there has been a crash some time before, and no reset in the meantime."