Formal Models SS 2014: Assignment 9

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Exercise 33

- What are the unit literals of the following QBFs?
  - $\forall a \exists x \forall b \exists y \exists z \forall c((x) \wedge (x \vee \neg y \vee c) \wedge (a \vee x) \wedge (\neg y) \wedge (z \vee \neg c) \wedge (a))$
  - $\forall a \exists x \forall b \exists y((a \vee x) \wedge (\neg a \vee x) \wedge (x) \wedge (b \vee \neg y) \wedge (\neg b \vee y))$
- Eliminate the unit literals by BCP.

Exercise 34

- What are the pure literals in the following QBF?
  - $\forall u_1 \exists e_1 \forall u_2 \exists e_2 \forall u_3 \exists e_3 \forall u_4.(e_1 \vee u_1 \vee \neg u_2) \wedge (e_3 \vee \neg e_2 \vee u_3) \wedge (u_4 \vee u_3 \vee e_2) \wedge (\neg e_3 \vee u_4)$
  - $\forall a \exists x \forall b \exists y((a \vee x) \wedge (\neg a \vee x) \wedge (x) \wedge (b \vee \neg y) \wedge (\neg b \vee y))$
- Remove all pure literals in a satisfiability preserving manner.
- Is universal reduction possible?

Exercise 35

Let ϕ be a propositional matrix with $\phi = (u \vee \neg e) \wedge (\neg u \vee e)$. Further, let $F_1 = \forall u \exists e.\phi$ and $F_2 = \exists e \forall u.\phi$. Determine the truth values of F_1 and F_2 by applying the splitting algorithm (1) without possible simplifications, (2) with possible simplifications. Clearly label each rule/step that you apply.

Exercise 36

Use the splitting algorithm to determine the truth value of the following formula:

$$\forall a \exists x \forall b, c \exists y \exists z((x \vee \neg y \vee c) \wedge (a \vee x) \wedge (\neg y) \wedge (\neg c \vee y) \wedge (\neg z \vee \neg c))$$

Clearly label each rule/step that you apply.