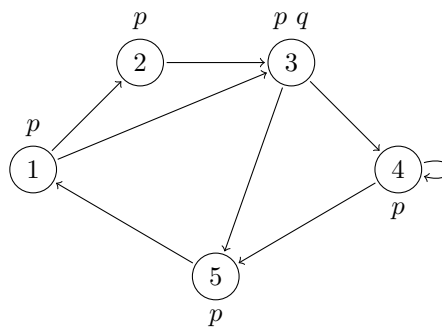Solved exercises must be marked and solutions (as a single PDF file) uploaded in OLAT. The (strict) deadline is 7 am on June 6.

Exercises

⟨3⟩ 1. Recall the hidden weighted bit function HWB_n for $n \geqslant 1$.

(a) Compute the algebraic normal form of HWB_3.

(b) Is HWB_3 monotone? Is HWB_3 self-dual?

(c) Determine all minimal adequate subsets of $\{\oplus, \mathrm{HWB}_2, \rightarrow, \mathrm{HWB}_3, {}^{-}\}$. Here $x \rightarrow y = \overline{x} + y$.

⟨3⟩ 2. Consider the model $\mathcal{M}$:

(a) Use the CTL model checking algorithm to determine in which states of $\mathcal{M}$ the CTL formula $\varphi = \mathsf{EX}\,\mathsf{A}[\neg q\,\mathsf{U}\,\mathsf{EX}\,q]$ holds.

(b) Determine in which states of $\mathcal{M}$ the LTL formula $\psi = (\mathsf{X}\,\neg p)\,\mathsf{U}\,(\mathsf{X}\,q)$ holds.

(c) For each $1 \leqslant i \leqslant 5$ find a CTL formula χ_i which holds only in state i of $\mathcal{M}$.

⟨1⟩ 3. Consider the sequent

$$\forall x\,(P(x) \vee Q(x)), \exists x\,\neg Q(x), \forall x\,(R(x) \rightarrow \neg P(x)) \vdash \exists x\,\neg R(x)$$

Either give a natural deduction proof or find a model which does not satisfy it.

⟨3⟩ 4. Consider the LTL formula $\chi = p\,\mathsf{U}\,(\neg\,\mathsf{X}\,p)$.

(a) Construct the labelled Büchi automaton $A_{\neg\chi}$.

(b) Which of the following traces are accepted by $A_{\neg\chi}$?

   i. $\{p\}^\omega$

   ii. $\{p\}\varnothing\{p\}^\omega$

   iii. $\varnothing\{p\}\varnothing\{p\}^\omega$