Technische Universität München **Summer Semester 2014**
I7
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Model Checking – Exercise sheet 3

Exercise 3.1

Given the LTL formula $\mathbf{G}((Q \wedge \neg R \wedge \mathbf{F}R) \rightarrow (P \rightarrow (\neg R\,\mathbf{U}(S \wedge \neg R)))\,\mathbf{U}\,R)$, which of the following sequences validate this formula:

- $PPPPPPPP^\omega$, $QQQQQQQQ^\omega$, $RRRRRRRR^\omega$ and $SSSSSSSS^\omega$
- $RRRQQQ(RRRQQQ)^\omega$, $RSRQQQ(RRRQQQ)^\omega$ and $RRRQSQ(RRRQQQ)^\omega$
- $RPRQQQ(RRRQQQ)^\omega$ and $RPRQQQS(RRRQQQ)^\omega$
- $RRPQQQS(RRRQQQ)^\omega$,$RRPQQSQ(RRRQQQ)^\omega$ and $RRPQQQRSR(QQRR)^\omega$
- $QQQRRPQQQQSQQQ^\omega$ and $QQQRRPQPQPQQSQQRQ^\omega$

Exercise 3.2

Fill cell with either $\iff$ $\implies$ $\impliedby$, depending whether the row-labeling formula is always (that is for any LTL formula φ) equivalent to, always implies or is always implied by the column labeling formula. Leave empty if none apply.

	$\mathbf{GFG}\varphi$	$\mathbf{FGF}\varphi$	$\mathbf{GG}\varphi$	$\mathbf{GF}\varphi$	$\mathbf{FG}\varphi$	$\mathbf{FF}\varphi$	$\mathbf{G}\varphi$
$\mathbf{F}\varphi$							
$\mathbf{G}\varphi$							
$\mathbf{FF}\varphi$							
$\mathbf{FG}\varphi$							
$\mathbf{GF}\varphi$							
$\mathbf{GG}\varphi$							
$\mathbf{FGF}\varphi$							

Exercise 3.3

For each of the following LTL properties give an an algorithm who take as input finite Kripke Structure $(S, \to, r, \{p, q, r\}, v)$ and outputs whether it satisfies the LTL formula:

1. $\mathbf{F}p$
2. $\mathbf{G}p$
3. $\mathbf{FG}p$
4. $q \,\mathbf{U}\, r$
5. $\mathbf{F}p \wedge \mathbf{X}(q \,\mathbf{U}\, r)$