7. Prove:

$$\Box\Box A \leftrightarrow \Box A, \tag{4.9}$$
$$\Diamond\Diamond A \leftrightarrow \Diamond A, \tag{4.10}$$
$$\Diamond\Box\Diamond A \leftrightarrow \Box\Diamond A, \tag{4.11}$$
$$\Box\Diamond\Box A \leftrightarrow \Diamond\Box A. \tag{4.12}$$

It follows that strings of unary temporal operators "collapse" to a single operator or to a pair of distinct operators.

8. Using the operator $\mathcal{U}$, modify Equation 4.1 (page 79) so that it also specifies freedom from starvation for process p.

9. The temporal operator *leads to*, denoted $\leadsto$, is defined as: $A \leadsto B$ is true in a state s_i if and only if for all states s_j, $j \geq i$, if A is true s_j, then B is true in some state s_k, $k \geq j$. Express $\leadsto$ in terms of the other temporal operators.

10. Prove the correctness of Peterson's algorithm, repeated here for convenience:

Algorithm 4.3: Peterson's algorithm			
boolean wantp ← false, wantq ← false integer last ← 1			
p		**q**	
	loop forever		loop forever
p1:	non-critical section	q1:	non-critical section
p2:	wantp ← true	q2:	wantq ← true
p3:	last ← 1	q3:	last ← 2
p4:	await wantq = false or last = 2	q4:	await wantp = false or last = 1
p5:	critical section	q5:	critical section
p6:	wantp ← false	q6:	wantq ← false

First show that

$$(p4 \wedge q5) \rightarrow (wantq \wedge last = 1), \tag{4.13}$$
$$(p5 \wedge q4) \rightarrow (wantp \wedge last = 2) \tag{4.14}$$

are invariant, and then use them to prove that mutual exclusion holds. To prove liveness for process p, prove the following formulas:

$$p4 \wedge \Box\neg p5 \rightarrow \Box\Diamond(wantq \wedge (last \neq 2)), \tag{4.15}$$
$$\Diamond\Box(\neg wantq) \vee \Diamond(last = 2), \tag{4.16}$$
$$p4 \wedge \Box\neg p5 \wedge \Diamond(last = 2) \rightarrow \Diamond\Box(last = 2), \tag{4.17}$$

and deduce a contradiction.