

Homework 5

1. In section 4.4 of chapter 4, we established the correctness of the sliding window protocol over a lossy channel and over a LRD channel with maximum message lifetime. Part of the analysis for the LRD case was operational, i.e., the proof of invariance of A_3 and A_4 (in subsection “Achieving correct interpretation over LRD channel”). Give an assertional proof of this part. Specifically, do the following:
 - Let program `SwProtocolTimed` be the time-constrained version of `SwProtocol` obtained as follows:
 - Use `LrdChannelMaxLife` (section 4.3) for its unreliable channel.
 - In program Source, introduce an epoch variable, say `tNs`, to ensure that successive increments of `ns` are at least `minNs` seconds apart; i.e., include “`tNs > $\tau_{now} + \text{minNs}$` ” in `doTxDat.oc` and “`tNs = τ_{now}` ” in `doTxDat`’s input part.
 - Develop a set of predicates such that their conjunction, say C , satisfies the following with respect to the explicit-time version of program `SwProtocol`.
 - C holds initially.
 - $\{C, A_2, A_3, A_4\} \wedge \{C, A_3, A_4\}$ holds for every atomic step e of `SwProtocol` with LRD channel.

(Hint: The predicates in C will be similar to those developed for the lossy channel case (i.e., A_5 and A_6 in section 4.4 and the predicates in exercises 2 and 3 of chapter 4) and will involve the transmit times of data and ack messages. You may find it convenient to have an auxiliary variable that records the successive times of increments to `ns`.)
