

## Verification

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### Problem 1: The CSMA/CD Protocol (cont'd) [10 Points]

This exercise build upon the yesterdays model of the CSMA/CD protocol. You model so far only captures discrete events, now we are going to introduce timed behavior. We modify the sender to send a message of fixed length **length**, which is the time between the beginning and the end of a message. Additionally, the medium has a transmission delay **delay**, which is the time between the beginning (or end) of a message is sent and the beginning (or end) of a message is received. For example, if the beginning of a message is sent at time  $t$ , it will be received by the receiver at time  $t + delay$ .

- a) Model/modify the system with the assumption  $length > delay$ . Verify that the system is correct in the sense that all sent messages are indeed received. [5 Points]
- b) Refine the medium to allow messages of length  $length \leq delay$ . Verify that the refined system is correct in the sense that all sent messages are indeed received. [5 Points]

**You may present your solution in the morning session on Thursday.**