

## Exercise 4

### 1 Unreliable Causal Broadcast

Consider the causal-order reliable broadcast abstraction (Module 3.9 [CGR11]). Can one devise a best-effort broadcast algorithm (see Module 3.1) that satisfies the *causal delivery* property without being a reliable broadcast algorithm, that is, without satisfying the *agreement* property of a reliable broadcast? Justify your answer.

### 2 Cost of Byzantine Broadcast

Review the three algorithms given of Sections 3.10–3.11 [CGR11] that implement Byzantine consistent broadcast and Byzantine reliable broadcast abstractions, that is, Algorithms 3.16, 3.17, and 3.18. Consider a correct process that broadcasts a message  $m$  of length  $L$ . Compare the cost of the three algorithms in terms of the *number* of point-to-point messages and *total length* of the communicated point-to-point messages.