Programming Assignment 2: Stale Example for Read Only Commands in Paxos

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In this document, we provide an example where the read only implementation in the van Renesse "Paxos Made Complex" paper gives stale results.

Consider the following execution with 2 replicas R1 and R2, 1 leader L and 3 acceptors A1–A3, in the bank application setting: The client sends 2 commands, a deposit (D) for $10 and an inquiry (I) to both replicas. I is a read only command. The client's balance is $0 initially.

- R1 and R2 propose D and I to both leaders. Both propose D in slot 1. I is read only and is not assigned a slot.

- L is adopted by all acceptors. It has an appropriately long lease time which will not expire during this execution.

- Since L is adopted and has a valid lease, it instructs R1 to reply to I. This message is m11.

- L proposes D for slot 1, and is accepted. L sends this final decision for slot 1 to R1 and R2 through messages m21 and m22 respectively.

- m22 arrives at R2. R2 updates its state to $10.

- Then, m11 arrives at R1. R1 responds to the client giving a balance as 0. This state is stale as R2 has already overwritten this value.

- Finally, m12 arrives at R1 and R1 updates the balance to $10.

Thus, R1 returns stale state to the client.