

Exercise 5: Programming Distributed Systems (SS 2018)

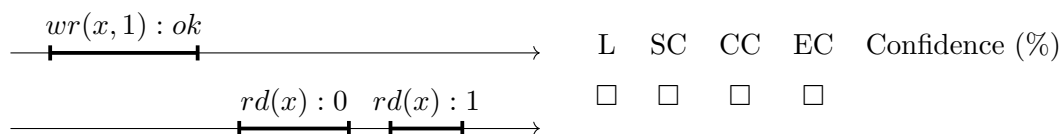
This sheet is discussed in the exercise on Thursday, June 14.

1 Consistency Models

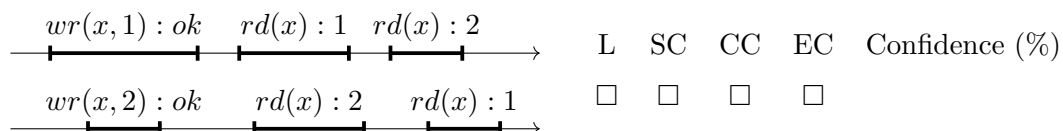
For the following executions, decide which of the consistency models Linearizability (L), SequentialConsistency (SC), CausalConsistency (CC), and BasicEventualConsistency (EC) would allow the execution. Multiple or no options might apply. Also state how confident you are in each answer by giving a value between 0% and 100%.

Each execution uses read (*rd*) and write (*wr*) operations on registers *x* and *y*. The initial value of registers is 0.

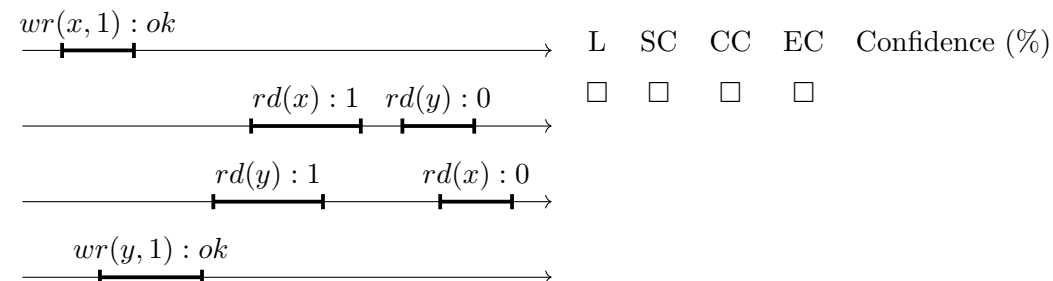
a)



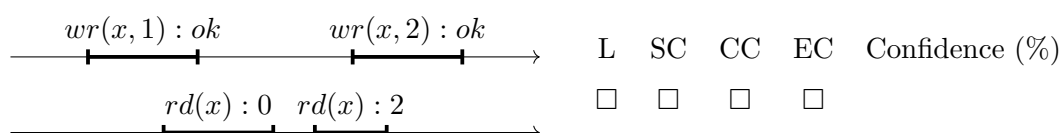
b)



c)



d)

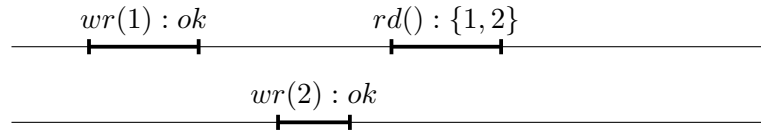


2 Concrete and abstract executions

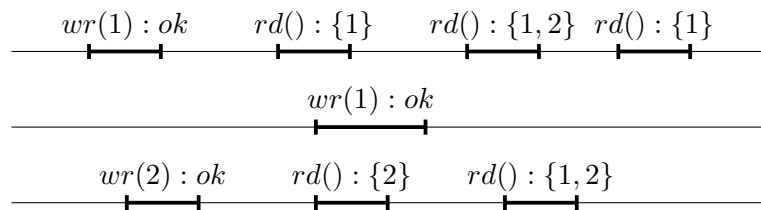
Consider the following concrete executions with operations on a Multi-Value Register object and provide an abstract execution that explains, why the execution is allowed under causal consistency.

Hint: To give an abstract execution, you need to specify the relation vis , which you can visualize in the pictures below by drawing arrows between operations.

a)



b)



3 CRDTs

Consider the Add-wins Set (Observed-remove Set, non-optimized version) presented in the lecture on CRDTs on slide 30. Prove that the downstream effect of an add-operation commutes with the effect of a concurrent remove-operation.