ETH
Eidgenössische Technische Hochschule Zürich
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Distributed Computing

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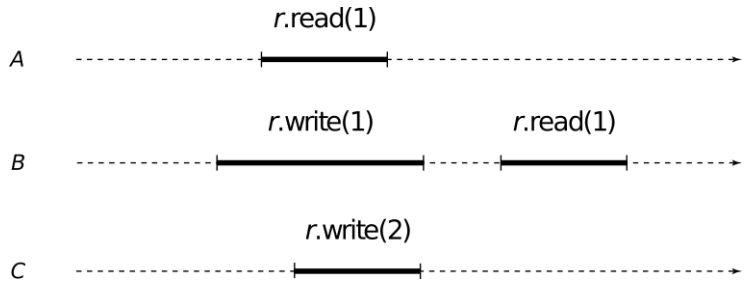
Distributed Systems Part II

Exercise Sheet 11

Quiz

1 Quiz

a) Is the following execution linearizable?



b) Is the following property equivalent to saying that object x is wait-free?
For every infinite history H of x, every thread that takes an infinite number of steps in H completes an infinite number of method calls.

c) If the size of a transaction is large, is HTM preferred or STM? Why?

Advanced

2 Sequential vs. Quiescent

Give an example of an execution that is quiescently consistent but not sequentially consistent, and another that is sequentially consistent but not quiescently consistent.

Hint: A single read-write register and two threads suffice.

3 Linearizability

The following is an implementation of a queue in Java. The queue is implemented as a maximum-sized array and the entries are initialized to null. Give an example execution which shows that the implementation is *not* linearizable.

```
class IQueue<T> {
  AtomicInteger head = new AtomicInteger(0);
  AtomicInteger tail = new AtomicInteger(0);
  T[] items = (T[]) new Object[Integer.MAX_VALUE];

  public void enqueue(T x) {
    int slot;
    do {
      slot = head.get();
    } while (! head.compareAndSet(slot, slot+1));
    items[slot] = x;
  }

  public T dequeue() throws EmptyException {
    T value;
    int slot;
    do {
      slot = tail.get();
      value = items[slot];
      if (value == null)
      throw new EmptyException();
    } while (! tail.compareAndSet(slot, slot+1));
    return value;
  }
}
```