

## Exercise 5

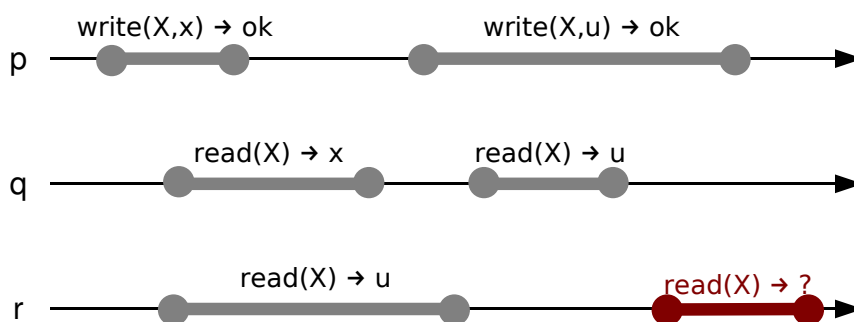
### 1 Regular Registers

Read Sections 4.1–4.2 in [CGR11]. Compare Algorithms 4.1 (“Read-One Write-All”) and 4.2 (“Majority Voting”).

- (a) Explain why in Algorithm 4.1 every process must store a copy of the register value. Does the same hold for Algorithm 4.2?
- (b) Can you modify Algorithm 4.2 (in the fail-silent model) such that it works even if  $f \geq N/2$ , that is, when less than half of the processes are correct?

### 2 $(1, N)$ Register

There are three processes  $p$ ,  $q$ , and  $r$  that access one  $(1, N)$  register instance  $X$  (with arbitrary domain  $\mathcal{D}$ ). The writer of  $x$  is  $p$ . Consider the following execution with  $x, u \in \mathcal{D}$ :



What return value(s) may  $r$  obtain from its second *read* operation, if the register has safe, regular, or atomic semantics? Justify your answer.