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 $D$). The writer of $x$ is $p$. Consider the following execution with $x, u \in D$:

```
write(X,x) → ok
p
q
read(X) → x
write(X,u) → ok
read(X) → u
read(X) → u
read(X) → ?
```

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