Concurrent Algorithms and Data Structures – Theory Assignment 2

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<u>**Deadline: 2024–12–15.**</u>
<u>**Please, submit your solutions in .pdf format.**</u>

Problem Consider the linearizable register we discussed in the lectures. We use n such registers to design a concurrent counter shared by n threads. We refer to the threads as $\theta_1, \ldots, \theta_n$. The counter library allows the following three operations:

- $\texttt{inc}(i)$ that increments the value of the counter by one.

- $\texttt{dec}(i)$ that decrements the value of the counter of by one.

- $\texttt{rd}()$ that returns one of three values, namely

  - $\texttt{p}$, if the current counter value is positive.
  - $\texttt{n}$, if the current counter value is negative.
  - $\texttt{z}$, if the current counter value is zero.

The threads share n registers $\texttt{R}_1, \ldots, \texttt{R}_n$. The registers can be *read* by all threads; however, only thread θ_i can *write* to register R_i. Assume that each $\texttt{R}_i$ is atomic, i.e., calls to $\texttt{R}_i$ cannot overlap.

- Give the abstract data type for the counter.

- Write the pseudo-codes for the three operations similarly to the exercise on the website.

- Describe the linearization policy to justify the correctness of your code.