CS 580 Specification of Software Systems

Homework 08: Zeros Elimination.

Consider a ring consisting of 2N+2 registers stored in a (N+1)-processor pipeline, which executes synchronously and circulates the values of the registers in clockwise direction. Each register may hold a positive value. Zero values are used to indicate garbage. Garbage must be eliminated from circulation in order to improve performance. This is accomplished by collecting pairs of zeros at the end of the pipe thus reducing the number of processors that must participate in the ring. Processor zero is of a special design; it always copies register A[0] into B[0]. Finally, the application guarantees that there are at least four nonzero values in the ring at all times.



You are required to perform the following design and verification tasks:

- 1. **Processor Design**. Explain how each processor is expected to work including all aspects of its internal state and all data interfaces. Please include a pictorial representation but no code.
- 2. Formal Specification. Provide a formal specification for a system consisting of N+1 processors. Completeness and elegance are of the essence.
- 3. **Programming Solution**. Write a <u>standard</u> UNITY program which models your architectural solution. Keep the program simple.
- 4. **Formal Verification**. Prove the principal progress property. List (without proof) all the safety properties needed to support the progress proof.