

# UC Berkeley Computer Science

**Subject:** Flow Through a FIFO  
**Date:** January 18, 2006  
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**UCIES** #2006-is17

## A FIRST SIMULATION ASSIGNMENT

With ArchSim you should be able to simulate a linear FIFO. You will need to make the HTML files that connect a set of elements into a linear string with a source at one end and a sink at the other.

- 1) Make a structure with at least five identical stages in a linear array. Simulate its operation long enough to observe a dozen or more data items passing through it. Send problems or comments to Igor at [igor.benko@sun.com](mailto:igor.benko@sun.com).
- 2) The throughput of such a FIFO is the number of data items that pass a given point per unit of time. It can be expressed as data items per second. The throughput is related to the forward and reverse delay of each of the stages, the "stage delays." Set the forward and reverse stage delays to values longer than the delays in your source and sink so that the FIFO itself limits throughput rather than the source or sink.
- 3) From the values of forward and reverse delay that you use in your simulation, calculate and measure the throughput. Do several experiments with different delays if necessary to discover the relationship between these delays and the throughput. Alternately, you may prefer to work from an algebraic model, but measure at least one case to confirm your algebra.
- 4) The average "occupancy" of the FIFO running at maximum throughput is set by the forward and reverse stage delays. What is the average occupancy of your FIFO? How can you measure it? Your answer will be in units of data items per stage and need not be an integer. How is occupancy related to the stage delays?

## EXTRA CREDIT FOR THE AMBITIOUS

- 5) Simulate a ring of not fewer than 10 identical elements whose forward and reverse stage delays different by at least a factor of two. Make some of

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the elements initially full and some empty. Measure and graph the throughput of your ring for various occupancies. In problem 4 throughput was the independent variable; here occupancy is the independent variable. What is the relationship between the measurement of throughput for problem 4 and the values you observe in the ring?

- 6) Real FIFO rings exhibit “slipstreaming,” named after the bunching behavior of cyclists, truckers, and geese. The data items pile up into a single bunch and subsequently progress around the ring together. Your simulation should not exhibit this behavior. Why not? What causes “slipstreaming”.