

## CMU 15-418/618 Exercise 3

### Miscellaneous Short Answer

The answers to these questions can be as brief as possible.

A. Imagine you are designing a parallel machine with  $P$  processors to execute convolutions in parallel on a 2D array. (Recall each array element is updated to be a weighed combination of all neighboring values). Do you advocate for a mesh or torus interconnect for this system? Why? (Hint: think about performance/cost trade-offs)

B. What common networking problem do virtual channels solve?

C. Describe the steps involved in an atomic test-and-set. What coherence state(s) are required for executing this atomic? Why?

## Locking and Transactions

A. Use LL/SC to implement atomic compare-and-exchange.

B. What is the ABA problem that can occur unless care is taken when implementing lock-free data-structures?

C. Instead of using atomic compare-and-exchange, some architectures support LL/SC. Would a lock-free data-structure using LL/SC be susceptible to the ABA problem? Why or why not?

## Miscellaneous Questions

A. What is the motivation for a content distribution network (CDN)? Why do Facebook images get served to your browser by a CDN but your main news feed is not?

B. Give two reasons why an implementation of a web server might spawn more worker threads than cores present in the machine it is running on?