Knowledge Standards

Architecture

- I can explain distinguish between the architectural concepts of pipelined, shared memory (threaded), and distributed memory (message passing) architectures.

Efficiency

- I can use appropriate techniques to compute speedup and efficiency given timings for the execution of a parallel program.
- I can use appropriate techniques to compute the optimal speedup possible for a program and I can compare measured program performance against the optimal.
- I can compare and contrast the efficiency of alternative parallel algorithms and implementations of a program given code

Critical Sections

- I can determine critical sections within code and suggest how mutual exclusion techniques can be used to remove possible errors based on critical section conflicts.

Threading and Message Passing

- I can choose between point-to-point and collective communication functions within a message passing context and justify my choice.

Parallel Programming APIs

- For pthreads, I can read code using parallel programming primitives, explain what that code is doing, and reason about the contents of memory after operations have been performed.
- For MPI, I can read code using parallel programming primitives, explain what that code is doing, and reason about the contents of memory after operations have been performed.
- For OpenMP,I can read code using parallel programming primitives, explain what that code is doing, and reason about the contents of memory after operations have been performed.

Parallel Program Design

- I can suggest and provide a rationale for how to attack a problem via data parallelization, task parallelization, and pipelining approaches.
- I can suggest and justify distribution of parallel work under threading, message passing, loop iteration scheduling, and pipelining models.
- I can suggest when and where barriers should be used in designing a parallel programming solution to a problem and justify their use and placement in a program using parallel programming techniques.
- I can differentiate between block, cyclic, block-cyclic, work-queue, and other distributions of data and choose appropriate distributions to be used for a given problem.

Programming Problem Standards

- I can correctly implement solutions to simple-to-medium complexity problems using parallel programming with threads (pthreads).
- I can correctly implement solutions to simple-to-medium complexity problems using parallel programming with message passing (MPI).

- I can correctly implement solutions to simple-to-medium complexity problems using parallel programming with OpenMP.