

CPS 5401 Shirley Moore, Instructor

Review Guide for Qualifying Exam 2016

Microprocessor Architecture:

- Sketch and describe the architecture of a multicore processor.
- Explain the concept of pipelining and work a problem to find pipeline result rates.
- Sketch and describe the cache and memory hierarchy. Explain how a memory reference is resolved in a virtual memory system.
- Explain the concept of vectorization and how it can improve code performance.
- Model performance of a code on a multicore processor using the Roofline model.

Parallel Programming:

- Compare and contrast shared memory and distributed memory parallel architectures. Explain what type of parallel programming paradigm(s) will work on each.
- Given an MPI point-to-point communication example code, evaluate whether or not the code is safe (i.e., no possibility of deadlock).
- Given an OpenMP code example, evaluate whether a race condition exists and if so, rewrite the code to be correct.
- Use MPI collective communications calls correctly to carry out a given communication task.
- Given the portion of a code that can be parallelized, calculate the maximum possible speedup of the entire code using Amdahl's law.
- Given the runtimes for serial and parallel versions of a code, calculate parallel speedup and efficiency.

Mathematical Libraries:

- Given that you are writing a program where the major portion of the computation involves solving a dense linear algebra problem, describe what mathematical software library you would use and how you would use it. Would you need to rewrite your program if you moved it to a different machine and/or compiler? Why or why not?
- Given that you are writing a program where the major portion of the computation involves solving a large sparse linear algebra problem, describe what mathematical software library you would use and how you would use it. Would you need to rewrite your program if you moved it to a different machine and/or compiler? Why or why not?