Topics for Midterm 2

CS 220

Fall, 2015

Any of the following topics might be covered on the midterm this Friday (November 20).

• C
  - Bitwise operators
  - Unsigned ints
  - strtol
  - Long long ints
  - random and srandom
  - Issues with two-dimensional arrays: using one-dimensional arrays to simulate two-dimensional arrays
  - qsort library function
  - Function pointer arguments
  - memcpy

• Distributed-memory MIMD programming
  - SPMD
  - Data-parallel parallelization
  - Tree-structured global sum
  - Butterfly
  - Dot product, matrix-vector multiplication
  - Odd-even transposition sort
- Merge-split
- Parallel Bitonic Sort

• MPI
  - Collective communication vs point-to-point communication
  - MPI_Reduce, MPI_Allreduce
  - MPI_Bcast, MPI_Scatter, MPI_Gather
  - MPI_Allgather
  - MPI_Ssendrecv
  - MPI Safety

• Data distributions
  - Block distribution
  - Cyclic distribution
  - Block-cyclic distribution
  - Row and column distributions
  - Submatrix distribution
  - Converting between local and global indexes and subscripts

• Dijkstra’s Algorithm
  - Graph, digraph
  - Adjacency matrix

• Shared-memory MIMD programming
  - Shared variables and global variables
  - Threads vs processes
  - Static vs dynamic creation of threads
  - Atomic operation
  - Race condition
  - Critical section
- Producer-consumer synchronization
- Busy-waiting
- Mutexes
- Semaphores, binary semaphores
- Matrix-vector multiplication

- **Pthreads API**
  - `lpthread`, `pthread.h`
  - `pthread_t`
  - `pthread_create`
  - `pthread_join`
  - Rank kludge
  - `pthread_mutex_t`
  - Mutex functions

- **Semaphore API**
  - `sem_t`
  - Semaphore functions

- **Cache**
  - Speed of Processors vs speed of memory access
  - Temporal and spatial locality
  - Cache line
  - Cache hit, miss
  - Write-through vs write-back cache

- **Cache and Shared Memory**
  - Cache coherence problem
  - Snoopy cache coherence
  - False sharing