CSE 4351/5351 Name _____
Fall 1999
Test 1

Closed Book Questions - 5 Points Each

1. How many processors are used in the blocked CREW sum?
2. Why are barriers useful?
3. What value is returned by a fetch-and-add?
4. Explain how an SR program may use message-passing to dynamically create a process.
5. In the Euler tour technique for solving tree problems, what is a forward edge?
6. Give an example of an algorithm that is not oblivious.

Closed Book Questions - 10 Points Each

7. Compare the efficiency of pointer jumping and randomized list ranking.
8. Explain how semaphores may be used to implement a barrier for three processes.

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Test 1

Open Book Questions

1. Suppose that two pthreads have been created and there are two global integer tables `A` and `B`. `A` has `n` positive integer elements, `B` will have `k` elements, and `k` << `n`. Give a function `modmaxes()`, that when ran concurrently by the two threads, will store in each element `B[i]` the largest value `A[j]` such that `A[j] % k == i`. If no such values exist for some `i`, then `B[i]` is to be set to zero. Besides executing correctly, your code must also be efficient assuming that table `A` is randomly generated. 25 points
2. Suppose that table `A` with 1 million integers is partitioned (contiguously) over 4 MPI processes. Give a function that will compute the prefix sums for these integers. The result is to be stored in array `B` which is partitioned like table `A`. 25 points

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Test 2

Closed Book Questions - 5 Points Each

1. How is binary search used when merging ordered tables on a CREW PRAM?
2. What is the maximum number of α locks that may be held when inserting a new key into an AVL tree?
3. What is the bisection width of a 5 x 7 mesh?
4. What is the diameter of a 1024 processor hypercube?
5. Give the Gray code for 4 bits.
6. How many times will pivot search be performed during LU decomposition on an n x n matrix?

Closed Book Questions - 10 Points Each

7. How many rounds does all-to-all broadcast take on a k-d hypercube when all links may be used simultaneously?
8. Give the number of steps and the maximum amount of queueing (buffering) needed for greedy routing of a permutation on an n-by-n mesh.

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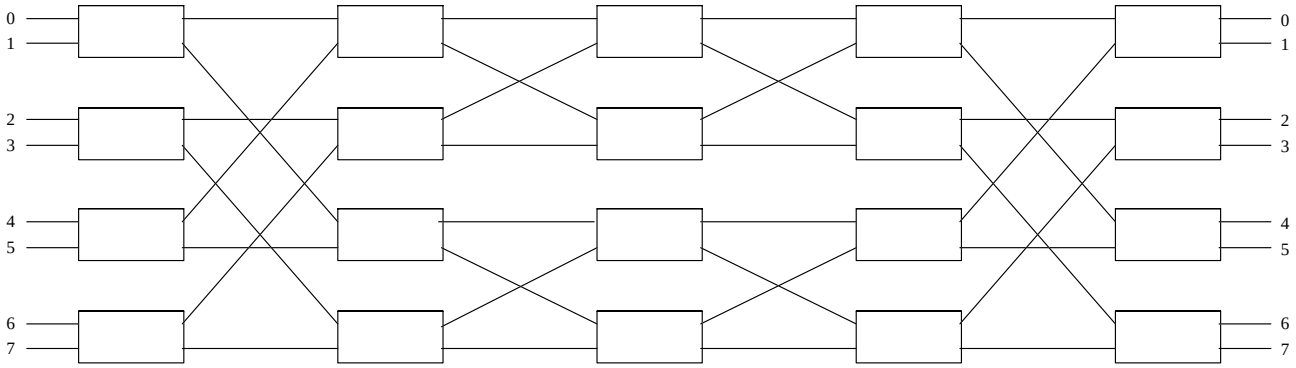
Test 2

Open Book Questions

1. How many necklaces are found in a 128 node shuffle-exchange? 10 points
2. What is the diameter of the butterfly with 2^k rows and k+1 columns? 10 points
3. Show how to route the following permutation on the Benes network. 10 points

$$\begin{pmatrix} 0\ 1\ 2\ 3\ 4\ 5\ 6\ 7 \\ 5\ 1\ 4\ 7\ 0\ 6\ 2\ 3 \end{pmatrix}$$



4. How many vertex equivalence classes does a 5x6 torus have? A 5x6 mesh? 10 points
5. For concurrent AVL trees, ξ locks are not compatible with any other type of lock. Why is it, then, that the C code for setting a ξ lock only checks for ρ and ξ locks on the node? 10 points

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Test 3

Closed Book Questions - 5 Points Each

1. How many processors are used in the hypercube matrix multiplication algorithm? Why is this number of processors used?
2. Is bitonic mergesort theoretically efficient? Why or why not?
3. How is the final output stored for shearsort?
4. What combination has the highest rank when the set of objects is {0, 1, 2, 3, 4, 5, 6, 7} and each generated combination has 4 elements?
5. What permutation has the highest rank when the set of objects is {0, 1, 2, 3, 4, 5, 6, 7} and each generated permutation has 4 elements?
6. Explain the GCD test.

Closed Book Questions - 10 Points Each

7. What is the goal of the OpenMP project?
8. Explain how matrix transpose may be implemented on a hypercube to minimize communication.

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Test 3

Open Book Questions

1. Which combination has rank 160 when combinations with 4 elements are being chosen from the set {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}? 12 points
2. Which permutation has rank 160 when permutations with 4 elements are being chosen from the set {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}? 12 points
3. Suppose that each processor in an n-node hypercube posesses its own number. Give a θ(lg n) time algorithm that will ensure that all processors will replace their number with the maximum of the n numbers. (Hint: Having a clear concept is much more important than low-level details.) 26 points