NAME:_____Student Number:_____

CSE4/529 **MidTerm I** Fall, 2015

This exam is *closed book/notes/neighbors/etc.* Answer all questions on these exam pages. No code or pseudo-code is necessary – just a precise and concise explanation and justification. *Unsupported work will receive no credit.*

Q1 of 5 (5 pts) Prove that $\sum_{k=1}^{n} k^{1/7} = \Theta(n^{8/7})$.

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Q2 of 5 (4 pts) Draw and label a hypercube of size 16.

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Q3 of 5 (11 pts) Given *n* integers arbitrarily and evenly distributed amongst the processors of the following architectures, determine the sum of these *n* values. Discuss the quality of each of your solutions in terms of running time, the number of processors, and the data requirements per processor. (Consider cost-effective solutions, not just optimizing for running time.) Efficiency counts!

i) RAM
ii) CREW PRAM
iii) Linear Array
iv) Hypercube

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Q4 of 5 (6 pts) Given a tree of base size *n*, with a 0 or 1 stored in every base processor, give an algorithm that will determine for every processor, the number of base processors in its subtree that have a 1 in it. Note that this is equivalent to each processor knowing the sum of the 1's in the base of its subtree. Discuss the optimality of the running time of your algorithm.

Q5 of 5 (4 pts) Fill in the following table using Θ notation. While no explanation is required, if you feel it necessary to include an explanation or comment, please provide such information in the space provided below the table.

Model [1] *n* processors [2] *n* base processors	Communication Diameter	Bisection Width	Degree of Network
[1] Mesh			
[2] Pyramid			
[2] Mesh-of-Trees			
[1] Hypercube			

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Extra Credit (1 pt) What is the name of Prof. Miller's project in X-Ray Crystallography (molecular structure determination)?

Extra Credit (1 pt) Prof. Miller's musical project operates under what band name?