Practice Questions

1. Given shared memory array D of size n+1 and a scalar value x, provide an efficient EREW PRAM algorithm to compute $\sum_{0}^{n} D[i]x^i$. Derive the time and work complexity. (Higher credit for lower constant.)

2. Given array B with n elements, provide an O(1)-time O(n)-work CRCW algorithm to find the smallest index i such that $B[i]$ is `TRUE`. What type of CRCW do you need?

3. Show that for every Arbitrary-CRCW PRAM algorithm with time complexity O(**T**(n)), there is a Common-CRCW PRAM algorithm (solving the same problem) in time O(p **T**(n)). Does an O(log p **T**(n)) Common-CRCW algorithm always exist? p stands for the number of processors used. [Extra credit for full proof of the 2nd part.]

4. Recall MPI one-sided memory Read (Get) and Write (Put) operations. These are like shared memory operations where variables are not addressed by a name but by a `<window, rank, offset>` triple. Assume these operation are implemented by the owner process of the window receiving Read/Write requests using MPI_Recv (in a separate dedicated MPI thread), and returning the read data or write acknowledgement after completing the operation locally. What memory consistency model does that imply? Explain.

5. You are asked to implement Hash tables on GPU using CUDA. You must allow concurrent queries, insertions and deletions to be made from any thread in any block independent of each other. Explain in detail the trade-offs between using separate chaining (all colliding entries are put in a separate list) and open addressing (on collision, a new index is found for the given entry). Suggest solutions.