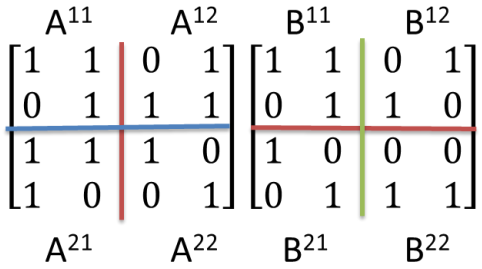
Name: _____ USC ID: _____

Quiz 3: Blocked-Based Matrix Multiplication (10 points), **15 minutes**

Consider multiplying matrices A and B below using the block-based **1-phase** approach. Note that A and B are each divided into four blocks as shown. Each matrix is stored in a file in a format similar to that in the homework. For example, the file for matrix A has a line "(1,1),[(1,1,1),(1,2,1),(2,2,1)]" for block A^{11}.



1. [5 points] State the input and output for each call to the Map function.

   A^{11}: (1,1), [(1,1,1),(1,2,1),(2,2,1)] A^{12}: (1,2),[(1,2,1),(2,1,1),(2,2,1)]
   A^{21}: (2,1),[(1,1,1),(1,2,1),(2,1,1)] A^{22}: (2,2),[(1,1,1), (2,2,1)]
   B^{11}: (1,1),[(1,1,1),(1,2,1),(2,2,1)] B^{12}:(1,2),[(1,2,1),(2,1,1)] B^{21}:(2,1),[(1,1,1),(2,2,1)]
   B^{22}: (2,2),[(2,1,1), (2,2,1)]

   A^{11} => ((1,1)('A', 1, A^{11}), (1,2)('A', 1, A^{11})) A^{12} => ((1,1)('A', 2, A^{12}), (1,2)('A', 2, A^{12}))
   A^{21} => ((2,1)('A', 1, A^{21}), (2,2)('A', 1, A^{21})) A^{22} => ((2,1)('A', 2, A^{22}), (2,2)('A', 2, A^{22}))
   B^{11} => ((1,1)('B', 1, B^{11}), (2,1)('B', 1, B^{11})) B^{12} => ((1,2)('B', 1, B^{12}), (2,2)('B', 1, B^{12}))
   B^{21} => ((1,1)('B', 2, B^{21}), (2,1)('B', 2, B^{21})) B^{22} => ((1,2)('B', 2, B^{22}), (2,2)('B', 2, B^{22}))

   2 points for input, 2 for output.
   (key, value-list) format 1 point

2. [5 points] State the input and output for each call to the Reduce function.

   Input: ((1,1), [('A', 1, A^{11}) , ('B', 1, B^{11}), ('A', 2, A^{12}), ('B', 2, B^{21})])
   ((1,2), [('A', 1, A^{11}) , ('B', 1, B^{12}), ('A', 2, A^{12}), ('B', 2, B^{22})])
   ((2,1), [('A', 1, A^{21}) , ('B', 1, B^{11}), ('A', 2, A^{22}), ('B', 2, B^{21})])
   ((2,2), [('A', 1, A^{21}) , ('B', 1, B^{12}), ('A', 2, A^{22}), ('B', 2, B^{22})])

   Output: ((1,1), A^{11}* B^{11} + A^{12}* B^{21}) ((1,2), A^{11}* B^{12} + A^{12} * B^{22}) ((2,1), A^{21} * B^{11} + A^{22}* B^{21}) ((2,2), A^{21} * B^{12} + A^{22}* B^{22})

   2 points for input, 2 points for output (0.5 point each)
   (key, value-list) format 1 point