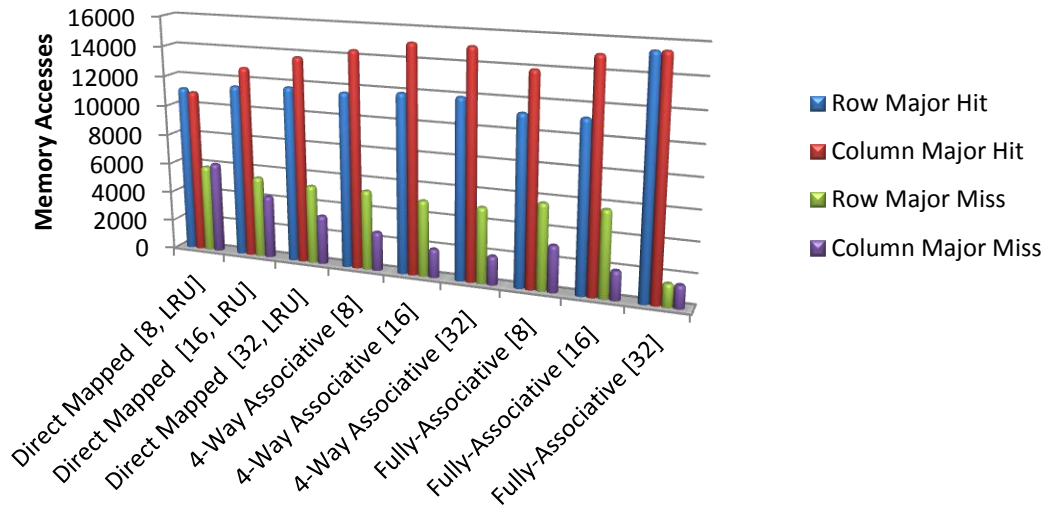


TCSS 372 B - Computer Architecture

# Matrix Multiplication Metrics

Speed tests comparing the differences between storing the second matrix in row-major versus column-major.

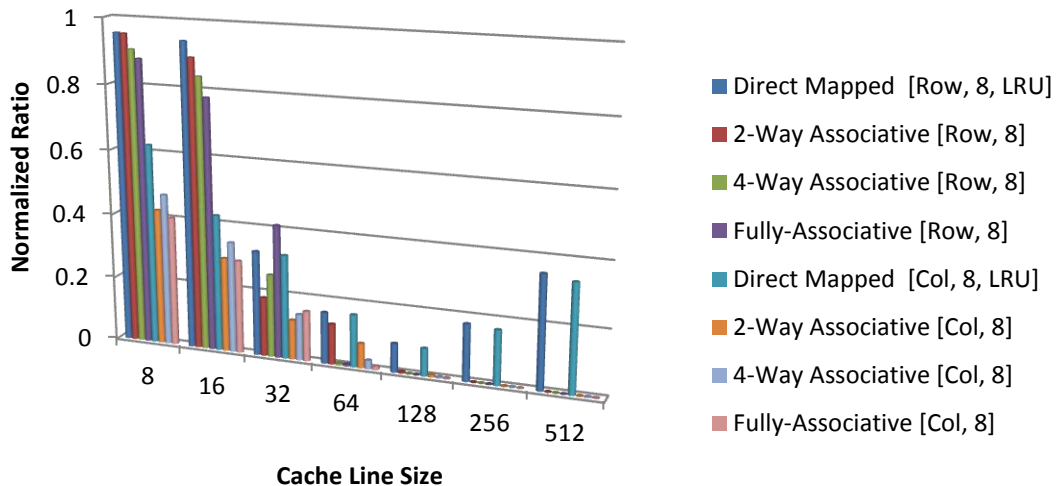
## Cache Organization Comparisions



The column major code is faster than row major for every cache organization besides Direct Mapped with a cache size of 8 blocks. The fastest cache organization for both matrix multiplication programs was Fully-Associative at 32 blocks. All of these metrics were done with a 4-word cache line size.

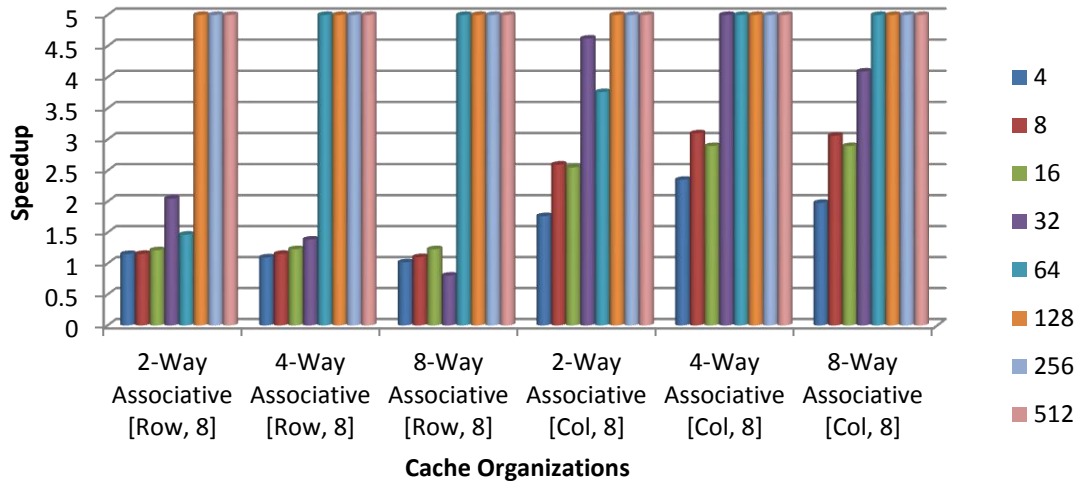
## Cache Misses

*Normalized to 4-Word Cache Line Size*

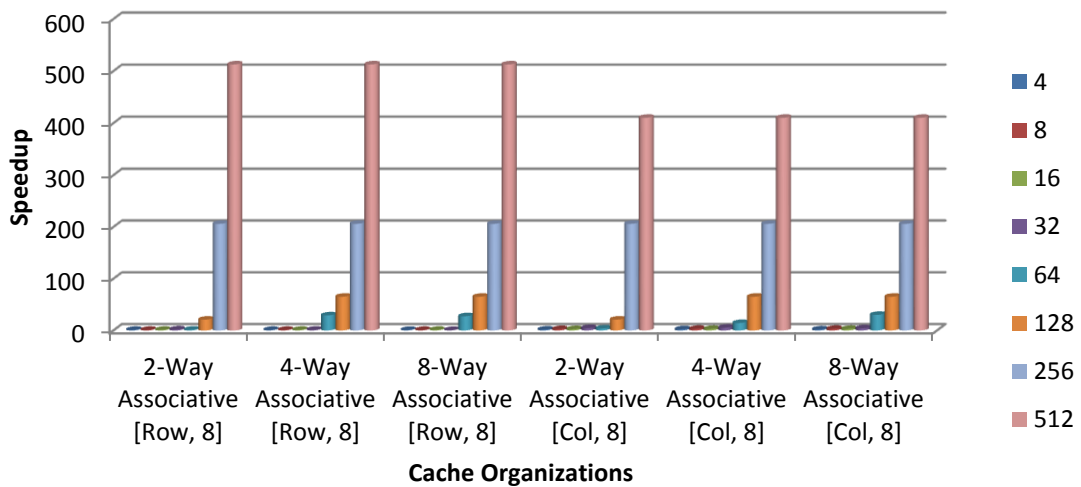


The cache organization with the highest speed up relative to the 4-word cache line size is the Column-Major Fully-Associative. The first entry of the Column-FA (8-word) has the lowest ratio of 0.402.

## N-Way Associative Speed-Up Relative to 1-Way Associative [0,5]



## N-Way Associative Speed-Up Relative to 1-Way Associative [0,520]



The speedups contain outliers for cache-line sizes 64 and higher because of the high amount of misses for the 1-way Associative Cache at 256 and 512 cache-line sizes (1030 and 2051 misses). Of all the cache organizations tested, 1-way A is the only one that increases miss frequency for higher the cache-line sizes ( $64 > 128 < 256 < 512$ ).

## **Direct Mapped [8, LRU] vs Direct Mapped [8, RAND]**

For both Row-Major and Column-Major codes, both the Direct Mapped [8, LRU] and Direct Mapped [8, RAND] have equal values. The miss count for Row-Major is 5838 and for Column-Major is 6092.

## **Lowest-Time Cache Organization**

Of all the cache organizations, the 2-way, 4-way, and 8-way Associative organizations at both 256 and 512-word cache line size yielded the fastest completion time at 500 cycles (5 misses \* 100 cycles). Both the Row-Major and Column-Major codes have these values for these organizations.

Between the two codes, the Column-Major is faster in most cases than the Row-Major code.