OSP Space Time Mapping Statistics

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To analyze the performance of each space time map, diagonals, reverse diagonals, triangles and reverse triangles, seven trials for each map were taken for nine different problem sizes. The problem sizes are 1000-5000 in steps of 500. The seven trials for each problem size were then averaged to construct a data set that shows the exact quadratic trend. A plot of the results is shown below.

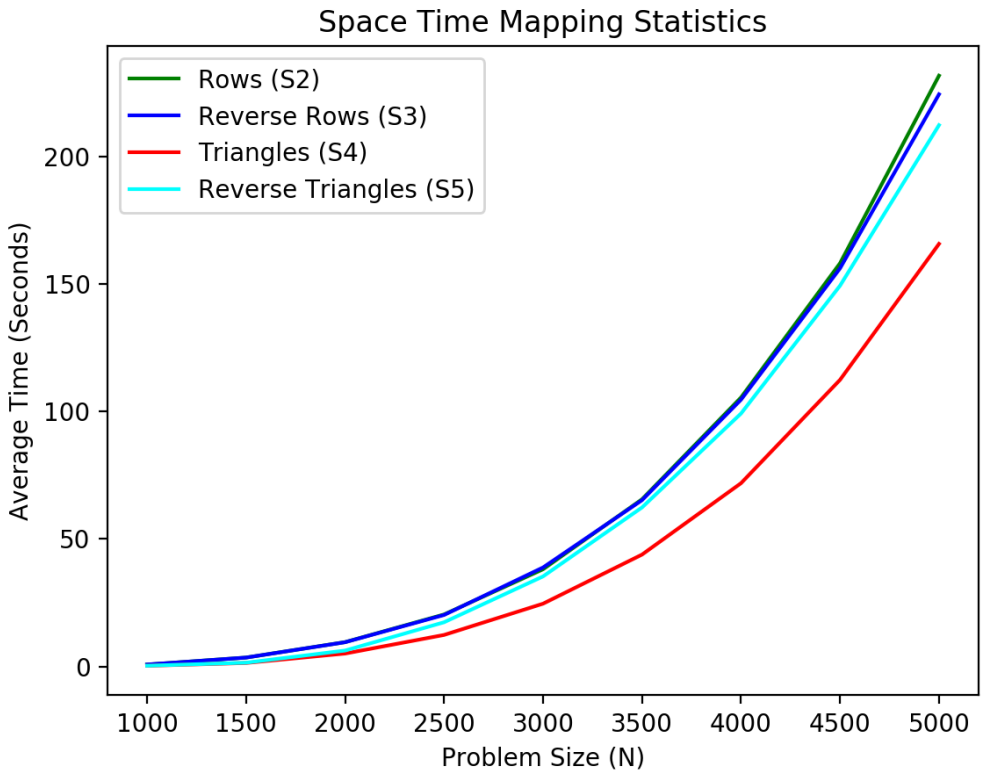

Figure 1: Graphical Representation of Different Space time Mappings' Execution Times Over Growing Problem Sizes.

The quadratic shape invites log scaling to deduce the exact exponential order. A log scaled plot is shown below.

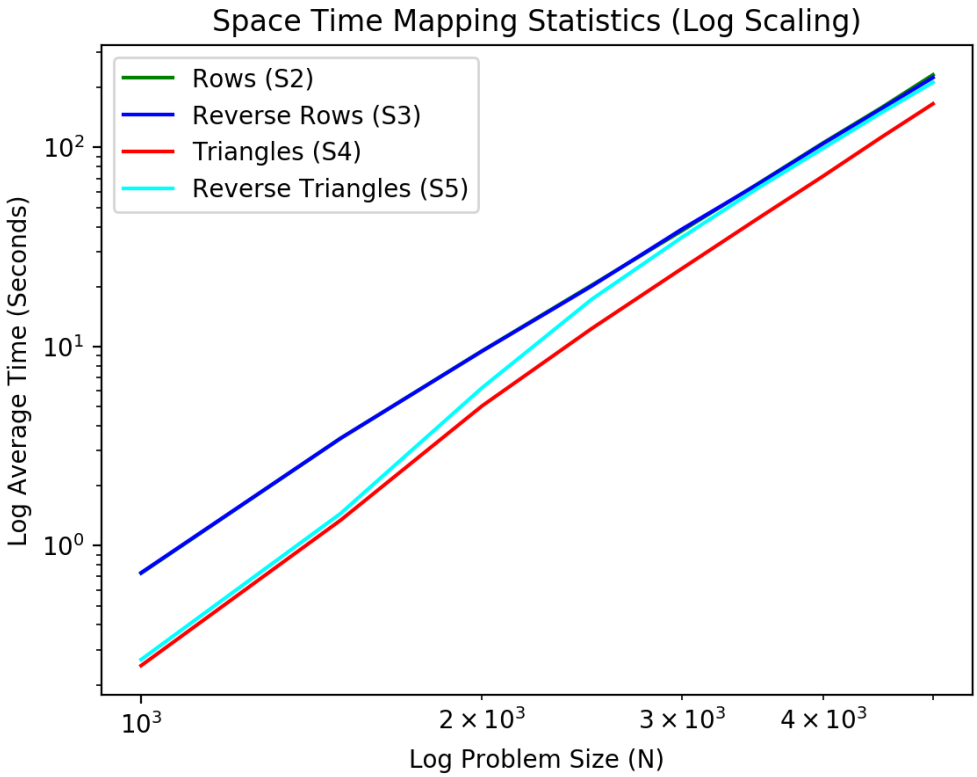

Figure 2: Graphical Representation of Different Space time Mappings' Execution Times Over Growing Problem Sizes with Log Scaling.

The data from the experiment outlined above is shown in the table below:

Problem Size (N)	Averaged Execution Times (Seconds)			
	Rows (S2)	Reverse Rows (S3)	Triangles (S4)	Reverse Triangles (S5)
1000	0.727	0.731	0.250	0.267
1500	3.461	3.463	1.343	1.451
2000	9.518	9.488	5.038	6.214
2500	20.365	20.127	12.338	17.310
3000	38.094	38.802	24.600	35.292
3500	65.542	65.196	43.855	62.343
4000	105.459	104.607	71.852	99.175
4500	158.099	156.105	112.375	149.301
5000	231.667	224.366	165.703	212.264

Figure 3: Condensed Experiment Data

It is observed that the performance of the diagonal schemes is nearly identical. The direction of memory structure population matters much more in the triangle mapping scheme.

The following equations are deduced from a linear fit to the log scaled data:

Rows (S2):

$$3.55 \times log(N) - 24.74$$

Reverse Rows (S3):

$$3.53 \times log(N) - 24.63$$

Triangles (S4):

$$4.03 \times log(N) - 29.16$$

Reverse Triangles (S5):

$$4.19 \times log(N) - 30.17$$

The negative intercepts are a result of not including problem sizes close to zero calibration. The execution time at low problem sizes would obviously not be negative, but these numbers tell us about performance differences within the range of tested problem sizes. Specifically, the difference at the initial starting problem size and how that difference becomes less of a factor as problem size grows.

Results

For this range of problem sizes, triangles (S4) is the fastest space time mapping. However, the log slopes suggest that as problem size continues to grow, reverse rows space time mapping (S3) will be the fastest.