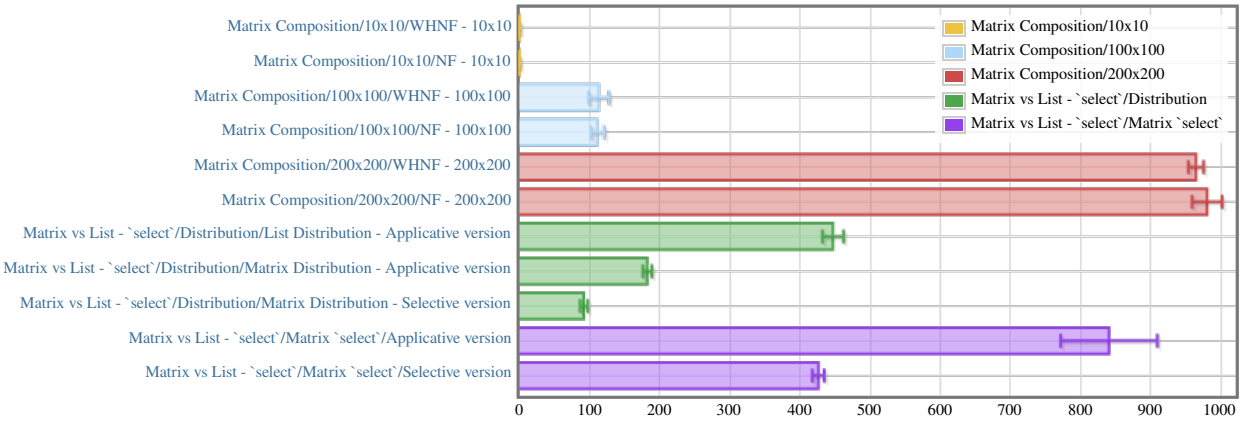
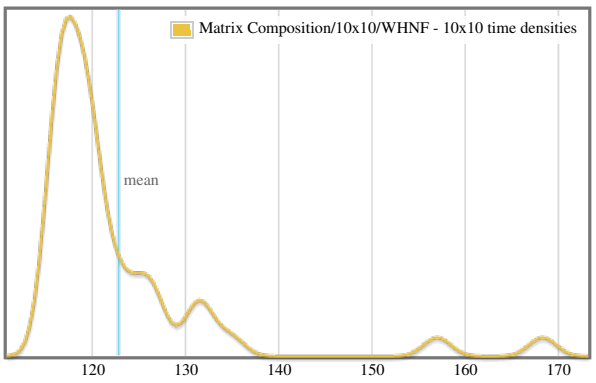
criterion performance measurements

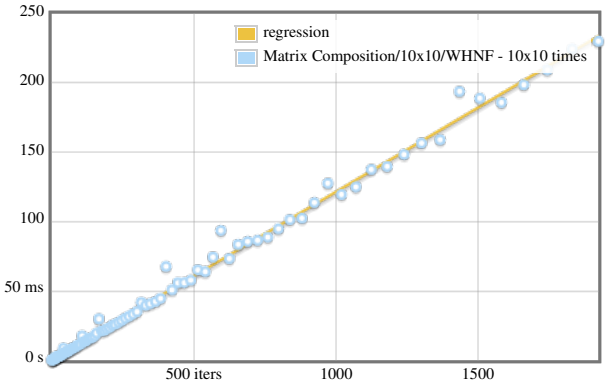
overview

want to understand this report?



Matrix Composition/10x10/WHNF - 10x10

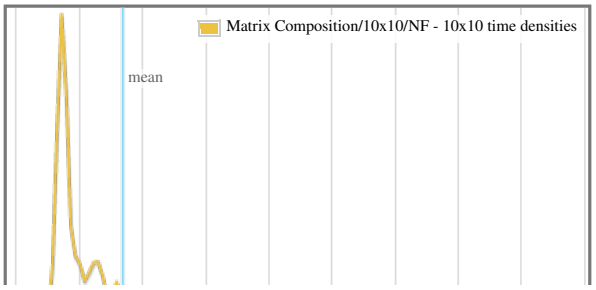


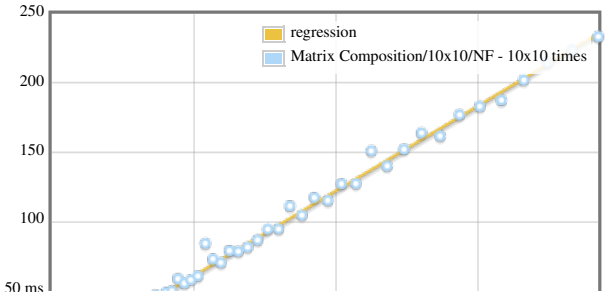


	lower bound	estimate	upper bound
OLS regression	119 µs	121 µs	124 µs
R² goodness-of-fit	0.991	0.995	0.998
Mean execution time	120 µs	123 µs	128 µs
Standard deviation	5.12 µs	10.3 µs	19.0 µs

Outlying measurements have severe (75.0%) effect on estimated standard deviation.

Matrix Composition/10x10/NF - 10x10

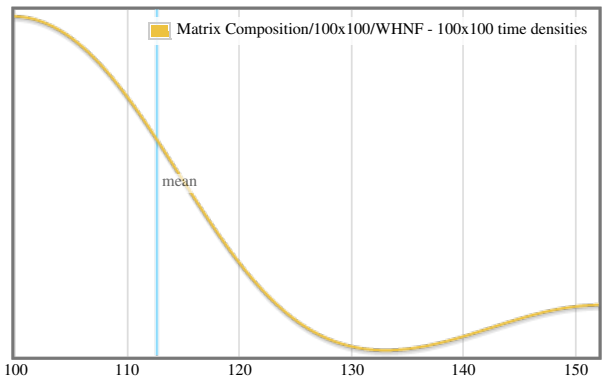


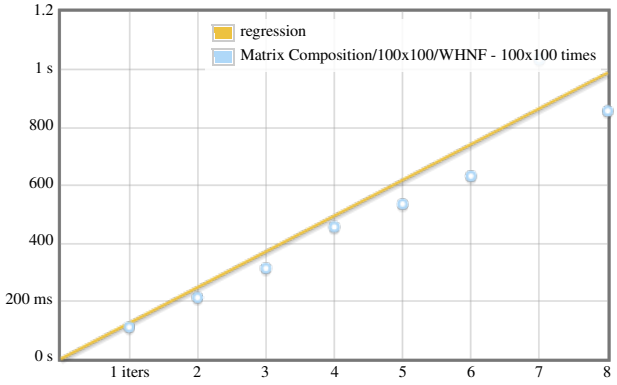


	lower bound	estimate	upper bound
OLS regression	121 µs	122 µs	124 µs
R² goodness-of-fit	0.995	0.997	0.999
Mean execution time	122 µs	123 µs	126 µs
Standard deviation	4.88 µs	7.50 µs	12.3 µs

Outlying measurements have severe (61.4%) effect on estimated standard deviation.

Matrix Composition/100x100/WHNF - 100x100

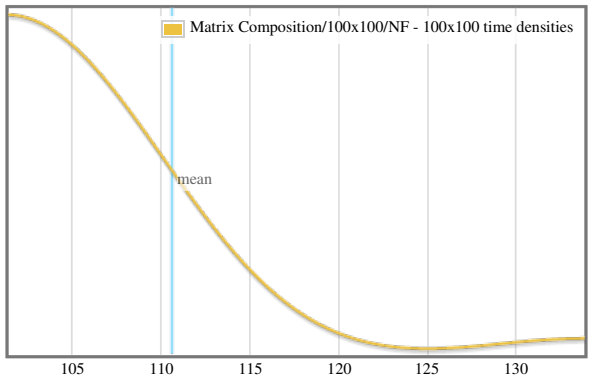


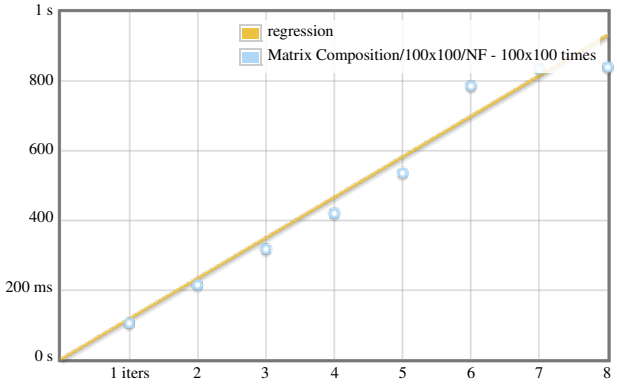


	lower bound	estimate	upper bound
OLS regression	104 ms	124 ms	165 ms
R² goodness-of-fit	0.815	0.915	1.000
Mean execution time	107 ms	113 ms	128 ms
Standard deviation	2.79 ms	14.5 ms	22.8 ms

Outlying measurements have moderate (35.8%) effect on estimated standard deviation.

Matrix Composition/100x100/NF - 100x100

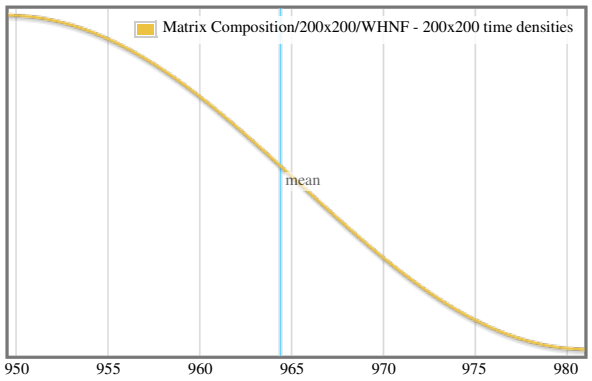


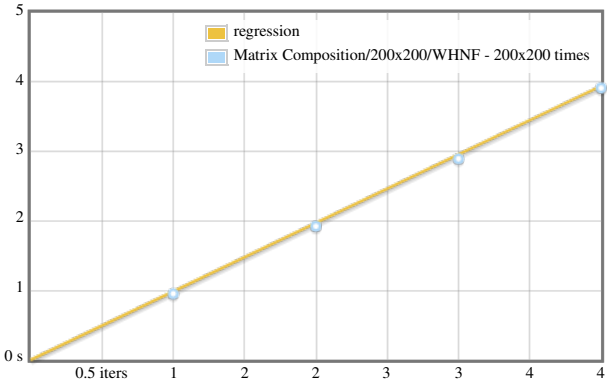


	lower bound	estimate	upper bound
OLS regression	105 ms	117 ms	139 ms
R² goodness-of-fit	0.889	0.967	1.000
Mean execution time	106 ms	111 ms	119 ms
Standard deviation	1.54 ms	9.63 ms	13.8 ms

Outlying measurements have moderate (23.4%) effect on estimated standard deviation.

Matrix Composition/200x200/WHNF - 200x200

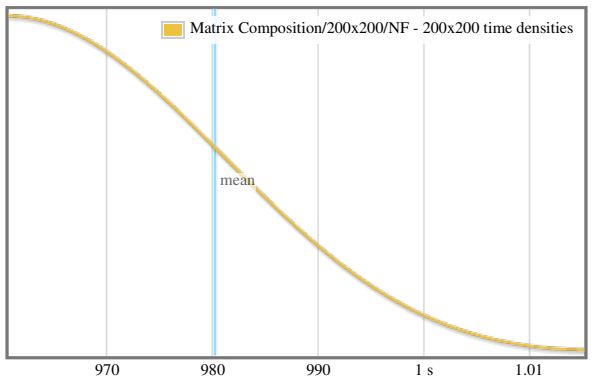


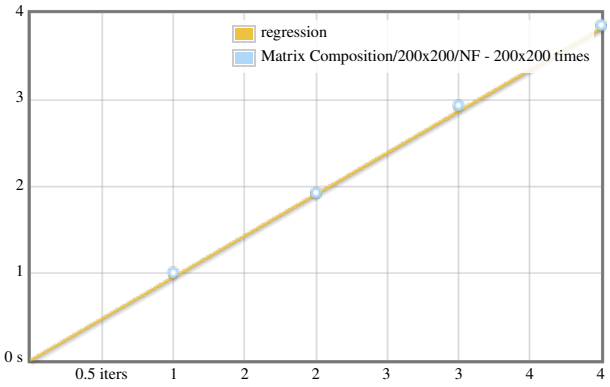


	lower bound	estimate	upper bound
OLS regression	971 ms	986 ms	1.02 s
R² goodness-of-fit	1.000	1.000	1.000
Mean execution time	955 ms	964 ms	974 ms
Standard deviation	4.80 ms	10.8 ms	15.1 ms

Outlying measurements have moderate (18.7%) effect on estimated standard deviation.

Matrix Composition/200x200/NF - 200x200

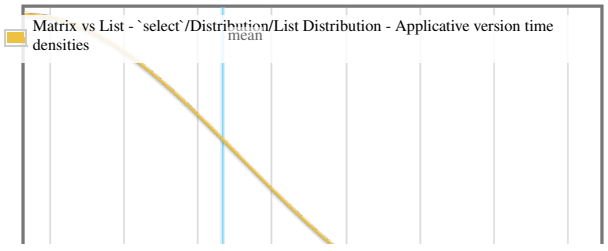


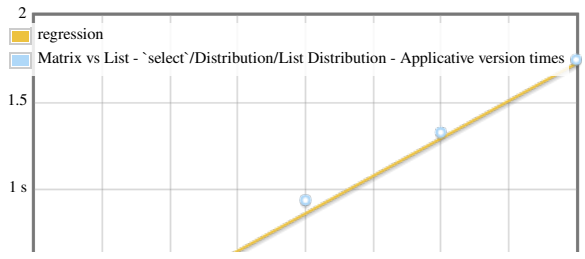


	lower bound	estimate	upper bound
OLS regression	921 ms	956 ms	1.01 s
R² goodness-of-fit	1.000	1.000	1.000
Mean execution time	965 ms	980 ms	999 ms
Standard deviation	235 µs	21.3 ms	26.2 ms

Outlying measurements have moderate (18.8%) effect on estimated standard deviation.

Matrix vs List - `select`/Distribution/List Distribution - Applicative version

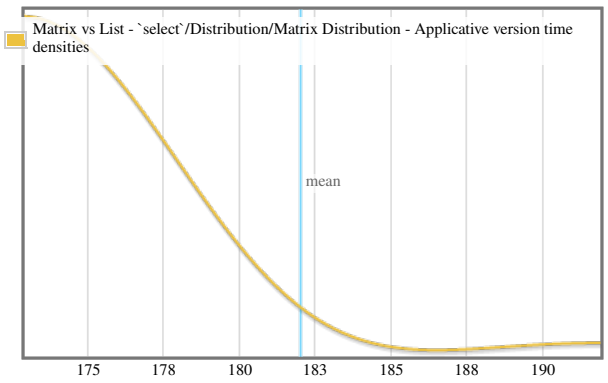


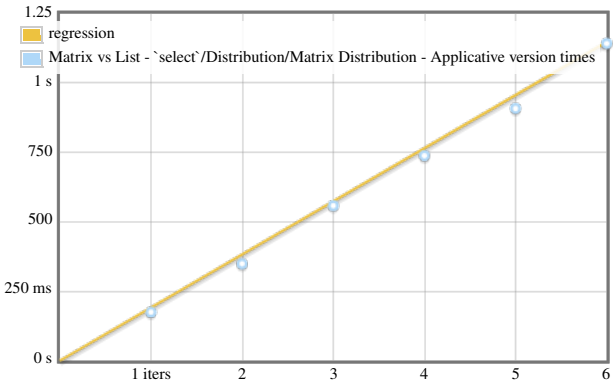


	lower bound	estimate	upper bound
OLS regression	390 ms	431 ms	499 ms
R² goodness-of-fit	0.992	0.997	1.000
Mean execution time	438 ms	447 ms	462 ms
Standard deviation	1.36 ms	15.0 ms	18.7 ms

Outlying measurements have moderate (18.8%) effect on estimated standard deviation.

Matrix vs List - `select`/Distribution/Matrix Distribution - Applicative version

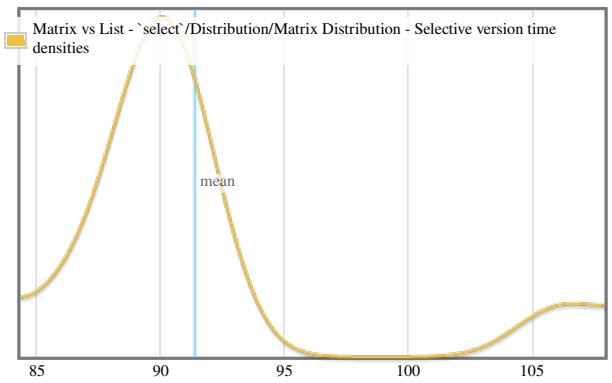


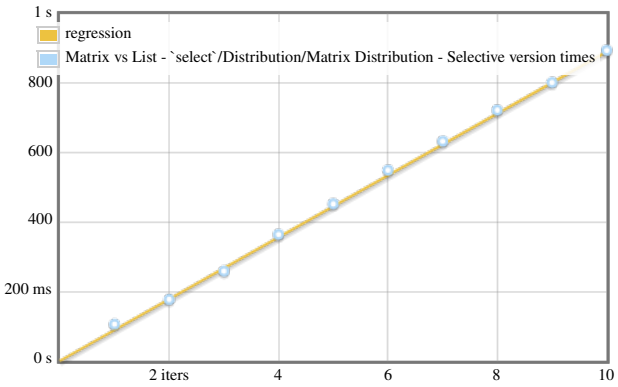


	lower bound	estimate	upper bound
OLS regression	175 ms	191 ms	198 ms
R² goodness-of-fit	0.995	0.998	1.000
Mean execution time	177 ms	182 ms	186 ms
Standard deviation	4.25 ms	6.30 ms	8.49 ms

Outlying measurements have moderate (13.9%) effect on estimated standard deviation.

Matrix vs List - `select`/Distribution/Matrix Distribution - Selective version

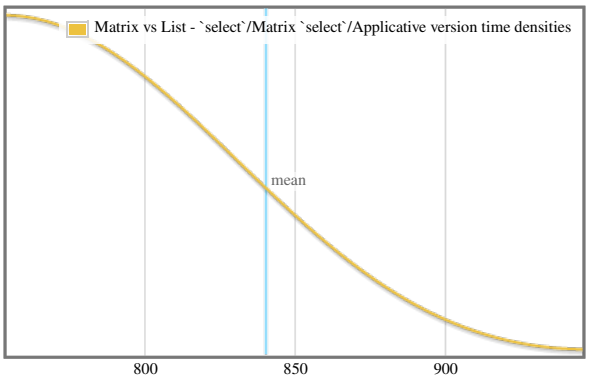


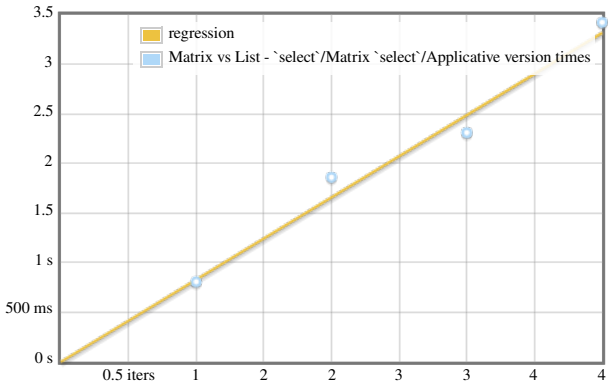


	lower bound	estimate	upper bound
OLS regression	87.5 ms	89.1 ms	91.4 ms
R² goodness-of-fit	0.998	0.999	1.000
Mean execution time	89.3 ms	91.4 ms	96.8 ms
Standard deviation	1.43 ms	5.34 ms	9.30 ms

Outlying measurements have moderate (18.2%) effect on estimated standard deviation.

Matrix vs List - `select`/Matrix `select`/Applicative version

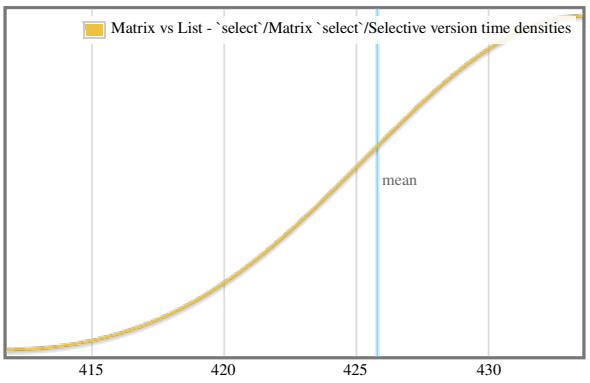


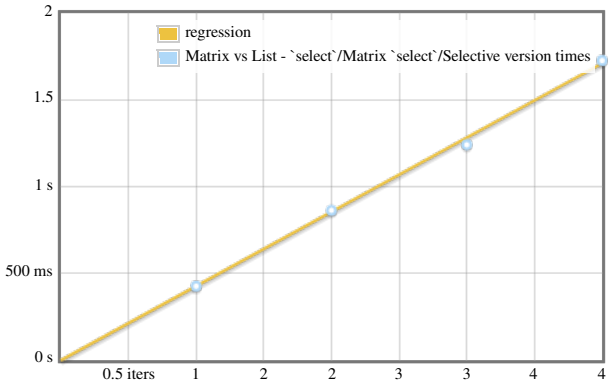


	lower bound	estimate	upper bound
OLS regression	450 ms	829 ms	1.11 s
R² goodness-of-fit	0.918	0.977	1.000
Mean execution time	779 ms	840 ms	892 ms
Standard deviation	27.7 ms	69.0 ms	92.3 ms

Outlying measurements have moderate (21.4%) effect on estimated standard deviation.

Matrix vs List - `select`/Matrix `select`/Selective version





	lower bound	estimate	upper bound
OLS regression	377 ms	428 ms	485 ms
R² goodness-of-fit	0.992	0.998	1.000
Mean execution time	414 ms	426 ms	430 ms
Standard deviation	159 µs	8.50 ms	10.5 ms

Outlying measurements have moderate (18.8%) effect on estimated standard deviation.

understanding this report

In this report, each function benchmarked by criterion is assigned a section of its own. The charts in each section are active; if you hover your mouse over data points and annotations, you will see more details.

- The chart on the left is a kernel density estimate (also known as a KDE) of time measurements. This graphs the probability of any given time measurement occurring. A spike indicates that a measurement of a particular time occurred; its height indicates how often that measurement was repeated.
- The chart on the right is the raw data from which the kernel density estimate is built. The *x* axis indicates the number of loop iterations, while the *y* axis shows measured execution time for the given number of loop iterations. The line behind the values is the linear regression prediction of execution time for a given number of iterations. Ideally, all measurements will be on (or very near) this line.

Under the charts is a small table. The first two rows are the results of a linear regression run on the measurements displayed in the right-hand chart.

- *OLS regression* indicates the time estimated for a single loop iteration using an ordinary least-squares regression model. This number is more accurate than the *mean* estimate below it, as it more effectively eliminates measurement overhead and other constant factors.
- R^2 *goodness-of-fit* is a measure of how accurately the linear regression model fits the observed measurements. If the measurements are not too noisy, R^2 should lie between 0.99 and 1, indicating an excellent fit. If the number is below 0.99, something is confounding the accuracy of the linear model.
- *Mean execution time* and *standard deviation* are statistics calculated from execution time divided by number of iterations.

We use a statistical technique called the bootstrap to provide confidence intervals on our estimates. The bootstrap-derived upper and lower bounds on estimates let you see how accurate we believe those estimates to be. (Hover the mouse over the table headers to see the confidence levels.)

A noisy benchmarking environment can cause some or many measurements to fall far from the mean. These outlying measurements can have a significant inflationary effect on the estimate of the standard deviation. We calculate and display an estimate of the extent to which the standard deviation has been inflated by outliers.

colophon

This report was created using the criterion benchmark execution and performance analysis tool.

Criterion is developed and maintained by Bryan O'Sullivan.