

## Work and span of buySell algorithm

Assuming input of length  $N$ .

Our algorithm has 3 steps:

- **buildMatrix**: builds a matrix of all possible buy and sell dates
  - work:  $N^2$
  - span: 1, there are no dependencies between elements of the matrix
- **getSell**: computes the best sell date for each buy date  
A **fold** has work  $N$  and span  $\log N$ . We have  $N$  folds folding over  $N$  elements:
  - work:  $N^2$
  - span:  $\log N$ , it is possible to run all  $N$  folds in parallel.
- **getBuy**: computes the best buy date
  - work:  $N$
  - span:  $\log N$

In total we have

- work:  $2N^2 + N$  and
- span:  $2\log N + 1$

## Speedup of parallelism!

Running the same algorithm sequentially and in parallel (with 2 HECs) we get a speedup of almost 2, which is pretty good.

An example run

```
% ./Stock +RTS -N2
benchmarking sequential
time                22.66 ms    (22.18 ms .. 23.14 ms)
                    0.998 R²    (0.997 R² .. 0.999 R²)
mean                23.41 ms    (22.99 ms .. 24.61 ms)
std dev             1.470 ms    (436.5 us .. 2.567 ms)
variance introduced by outliers: 24% (moderately inflated)

benchmarking parallel
time                12.19 ms    (11.92 ms .. 12.67 ms)
                    0.992 R²    (0.982 R² .. 0.998 R²)
mean                12.69 ms    (12.38 ms .. 13.49 ms)
std dev             1.222 ms    (610.9 us .. 2.055 ms)
variance introduced by outliers: 50% (severely inflated)
```

The code is compiled with `-OdpH -rtsopts -threaded -fno-liberate-case -funfolding-use-threshold1000 -funfolding-keenness-factor1000 -fllvm -optlo-03` as is recommended in the Repa documentation.