```
/Users/zuzannafurtak/Library/Java/JavaVirtualMachines/
corretto-17.0.8/Contents/Home/bin/java -javaagent:/
Applications/IntelliJ IDEA.app/Contents/lib/idea_rt.
jar=60837:/Applications/IntelliJ IDEA.app/Contents/bin
 -Dfile.encoding=UTF-8 -classpath /Users/zuzannafurtak
/studia/las_palmas/big_data/big-data-tasks/assignment-
2/target/classes:/Users/zuzannafurtak/.m2/repository/
org/openjdk/jmh/jmh-core/1.32/jmh-core-1.32.jar:/Users
/zuzannafurtak/.m2/repository/net/sf/jopt-simple/jopt-
simple/4.6/jopt-simple-4.6.jar:/Users/zuzannafurtak/.
m2/repository/org/apache/commons/commons-math3/3.2/
commons-math3-3.2.jar:/Users/zuzannafurtak/.m2/
repository/org/openjdk/jmh/jmh-generator-annprocess/1.
32/jmh-generator-annprocess-1.32.jar:/Users/
zuzannafurtak/.m2/repository/org/tallison/jmatio/1.5/
jmatio-1.5.jar:/Users/zuzannafurtak/.m2/repository/org
/slf4j/slf4j-api/1.7.25/slf4j-api-1.7.25.jar com.
matrix.MatrixMultiplicationBenchmark
# JMH version: 1.32
# VM version: JDK 17.0.8, OpenJDK 64-Bit Server VM, 17
.0.8+7-LTS
# VM invoker: /Users/zuzannafurtak/Library/Java/
JavaVirtualMachines/corretto-17.0.8/Contents/Home/bin/
java
# VM options: -javaagent:/Applications/IntelliJ IDEA.
app/Contents/lib/idea_rt.jar=60837:/Applications/
IntelliJ IDEA.app/Contents/bin -Dfile.encoding=UTF-8
# Blackhole mode: full + dont-inline hint
# Warmup: 5 iterations, 1 s each
# Measurement: 10 iterations, 1 s each
# Timeout: 10 min per iteration
# Threads: 1 thread, will synchronize iterations
# Benchmark mode: Sampling time
# Benchmark: com.matrix.MatrixMultiplicationBenchmark.
multiplyMarkovMatrix
# Parameters: (n = 1)

# Run progress: 0.00% complete, ETA 00:00:15
# Fork: 1 of 1
# Warmup Iteration   1: SLF4J: Failed to load class "
org.slf4j.impl.StaticLoggerBinder".
```

```
SLF4J: Defaulting to no-operation (NOP) logger
implementation
SLF4J: See http://www.slf4j.org/codes.html#
StaticLoggerBinder for further details.
11223.958 ms/op
# Warmup Iteration   2: 12733.907 ms/op
# Warmup Iteration   3: 12532.580 ms/op
# Warmup Iteration   4: 12314.477 ms/op
# Warmup Iteration   5: 12280.922 ms/op
Iteration   1: 12499.026 ms/op
                multiplyMarkovMatrix·p0.00:    12499.
026 ms/op
                multiplyMarkovMatrix·p0.50:    12499.
026 ms/op
                multiplyMarkovMatrix·p0.90:    12499.
026 ms/op
                multiplyMarkovMatrix·p0.95:    12499.
026 ms/op
                multiplyMarkovMatrix·p0.99:    12499.
026 ms/op
                multiplyMarkovMatrix·p0.999:   12499.
026 ms/op
                multiplyMarkovMatrix·p0.9999: 12499.
026 ms/op
                multiplyMarkovMatrix·p1.00:    12499.
026 ms/op


Iteration   2: 12448.694 ms/op
                multiplyMarkovMatrix·p0.00:    12448.
694 ms/op
                multiplyMarkovMatrix·p0.50:    12448.
694 ms/op
                multiplyMarkovMatrix·p0.90:    12448.
694 ms/op
                multiplyMarkovMatrix·p0.95:    12448.
694 ms/op
                multiplyMarkovMatrix·p0.99:    12448.
694 ms/op
                multiplyMarkovMatrix·p0.999:   12448.
694 ms/op
                multiplyMarkovMatrix·p0.9999: 12448.
```

694 ms/op

              multiplyMarkovMatrix·p1.00:   12448.
694 ms/op

Iteration   3: 12431.917 ms/op
              multiplyMarkovMatrix·p0.00:   12431.
917 ms/op

              multiplyMarkovMatrix·p0.50:   12431.
917 ms/op

              multiplyMarkovMatrix·p0.90:   12431.
917 ms/op

              multiplyMarkovMatrix·p0.95:   12431.
917 ms/op

              multiplyMarkovMatrix·p0.99:   12431.
917 ms/op

              multiplyMarkovMatrix·p0.999: 12431.
917 ms/op

              multiplyMarkovMatrix·p0.9999: 12431.
917 ms/op

              multiplyMarkovMatrix·p1.00:   12431.
917 ms/op

Iteration   4: 12398.363 ms/op
              multiplyMarkovMatrix·p0.00:   12398.
363 ms/op

              multiplyMarkovMatrix·p0.50:   12398.
363 ms/op

              multiplyMarkovMatrix·p0.90:   12398.
363 ms/op

              multiplyMarkovMatrix·p0.95:   12398.
363 ms/op

              multiplyMarkovMatrix·p0.99:   12398.
363 ms/op

              multiplyMarkovMatrix·p0.999: 12398.
363 ms/op

              multiplyMarkovMatrix·p0.9999: 12398.
363 ms/op

              multiplyMarkovMatrix·p1.00:   12398.
363 ms/op

Iteration   5: 12650.021 ms/op

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                   multiplyMarkovMatrix·p0.00:      12650.
021 ms/op
                   multiplyMarkovMatrix·p0.50:      12650.
021 ms/op
                   multiplyMarkovMatrix·p0.90:      12650.
021 ms/op
                   multiplyMarkovMatrix·p0.95:      12650.
021 ms/op
                   multiplyMarkovMatrix·p0.99:      12650.
021 ms/op
                   multiplyMarkovMatrix·p0.999:     12650.
021 ms/op
                   multiplyMarkovMatrix·p0.9999:    12650.
021 ms/op
                   multiplyMarkovMatrix·p1.00:      12650.
021 ms/op

Iteration    6: 12767.461 ms/op
                   multiplyMarkovMatrix·p0.00:      12767.
461 ms/op
                   multiplyMarkovMatrix·p0.50:      12767.
461 ms/op
                   multiplyMarkovMatrix·p0.90:      12767.
461 ms/op
                   multiplyMarkovMatrix·p0.95:      12767.
461 ms/op
                   multiplyMarkovMatrix·p0.99:      12767.
461 ms/op
                   multiplyMarkovMatrix·p0.999:     12767.
461 ms/op
                   multiplyMarkovMatrix·p0.9999:    12767.
461 ms/op
                   multiplyMarkovMatrix·p1.00:      12767.
461 ms/op

Iteration    7: 12398.363 ms/op
                   multiplyMarkovMatrix·p0.00:      12398.
363 ms/op
                   multiplyMarkovMatrix·p0.50:      12398.
363 ms/op
                   multiplyMarkovMatrix·p0.90:      12398.
```

```
363 ms/op
                multiplyMarkovMatrix·p0.95:     12398.
363 ms/op
                multiplyMarkovMatrix·p0.99:     12398.
363 ms/op
                multiplyMarkovMatrix·p0.999:    12398.
363 ms/op
                multiplyMarkovMatrix·p0.9999:   12398.
363 ms/op
                multiplyMarkovMatrix·p1.00:     12398.
363 ms/op

Iteration     8: 12616.466 ms/op
                multiplyMarkovMatrix·p0.00:     12616.
466 ms/op
                multiplyMarkovMatrix·p0.50:     12616.
466 ms/op
                multiplyMarkovMatrix·p0.90:     12616.
466 ms/op
                multiplyMarkovMatrix·p0.95:     12616.
466 ms/op
                multiplyMarkovMatrix·p0.99:     12616.
466 ms/op
                multiplyMarkovMatrix·p0.999:    12616.
466 ms/op
                multiplyMarkovMatrix·p0.9999:   12616.
466 ms/op
                multiplyMarkovMatrix·p1.00:     12616.
466 ms/op

Iteration     9: 12331.254 ms/op
                multiplyMarkovMatrix·p0.00:     12331.
254 ms/op
                multiplyMarkovMatrix·p0.50:     12331.
254 ms/op
                multiplyMarkovMatrix·p0.90:     12331.
254 ms/op
                multiplyMarkovMatrix·p0.95:     12331.
254 ms/op
                multiplyMarkovMatrix·p0.99:     12331.
254 ms/op
```

```
                    multiplyMarkovMatrix·p0.999:   12331.
254 ms/op
                    multiplyMarkovMatrix·p0.9999: 12331.
254 ms/op
                    multiplyMarkovMatrix·p1.00:    12331.
254 ms/op


Iteration  10: 12784.239 ms/op
                    multiplyMarkovMatrix·p0.00:    12784.
239 ms/op
                    multiplyMarkovMatrix·p0.50:    12784.
239 ms/op
                    multiplyMarkovMatrix·p0.90:    12784.
239 ms/op
                    multiplyMarkovMatrix·p0.95:    12784.
239 ms/op
                    multiplyMarkovMatrix·p0.99:    12784.
239 ms/op
                    multiplyMarkovMatrix·p0.999:   12784.
239 ms/op
                    multiplyMarkovMatrix·p0.9999: 12784.
239 ms/op
                    multiplyMarkovMatrix·p1.00:    12784.
239 ms/op




Result "com.matrix.MatrixMultiplicationBenchmark.
multiplyMarkovMatrix":
  N = 10
  mean =  12532.580 ±(99.9%) 243.877 ms/op

  Histogram, ms/op:
    [12300.000, 12350.000) = 1
    [12350.000, 12400.000) = 2
    [12400.000, 12450.000) = 2
    [12450.000, 12500.000) = 1
    [12500.000, 12550.000) = 0
    [12550.000, 12600.000) = 0
    [12600.000, 12650.000) = 1
    [12650.000, 12700.000) = 1
```

```
     [12700.000, 12750.000) = 0


  Percentiles, ms/op:
      p(0.0000) =  12331.254 ms/op
     p(50.0000) =  12473.860 ms/op
     p(90.0000) =  12782.561 ms/op
     p(95.0000) =  12784.239 ms/op
     p(99.0000) =  12784.239 ms/op
     p(99.9000) =  12784.239 ms/op
     p(99.9900) =  12784.239 ms/op
     p(99.9990) =  12784.239 ms/op
     p(99.9999) =  12784.239 ms/op
    p(100.0000) =  12784.239 ms/op



# Run complete. Total time: 00:03:43

REMEMBER: The numbers below are just data. To gain
reusable insights, you need to follow up on
why the numbers are the way they are. Use profilers (
see -prof, -lprof), design factorial
experiments, perform baseline and negative tests that
provide experimental control, make sure
the benchmarking environment is safe on JVM/OS/HW
level, ask for reviews from the domain experts.
Do not assume the numbers tell you what you want them
to tell.

Benchmark

                   (n)     Mode   Cnt      Score
Error  Units
MatrixMultiplicationBenchmark.multiplyMarkovMatrix
                            1   sample    10   12532
.580 ± 243.877  ms/op
MatrixMultiplicationBenchmark.multiplyMarkovMatrix:
multiplyMarkovMatrix·p0.00     1   sample         12331.
254             ms/op
MatrixMultiplicationBenchmark.multiplyMarkovMatrix:
multiplyMarkovMatrix·p0.50     1   sample         12473.
860             ms/op
```

```
MatrixMultiplicationBenchmark.multiplyMarkovMatrix:
multiplyMarkovMatrix·p0.90      1  sample        12782.
561           ms/op
MatrixMultiplicationBenchmark.multiplyMarkovMatrix:
multiplyMarkovMatrix·p0.95      1  sample        12784.
239           ms/op
MatrixMultiplicationBenchmark.multiplyMarkovMatrix:
multiplyMarkovMatrix·p0.99      1  sample        12784.
239           ms/op
MatrixMultiplicationBenchmark.multiplyMarkovMatrix:
multiplyMarkovMatrix·p0.999     1  sample        12784.
239           ms/op
MatrixMultiplicationBenchmark.multiplyMarkovMatrix:
multiplyMarkovMatrix·p0.9999    1  sample        12784.
239           ms/op
MatrixMultiplicationBenchmark.multiplyMarkovMatrix:
multiplyMarkovMatrix·p1.00      1  sample        12784.
239           ms/op

Process finished with exit code 0
```