```
/Users/zuzannafurtak/Library/Java/JavaVirtualMachines/
corretto-17.0.8/Contents/Home/bin/java -javaagent:/
Applications/IntelliJ IDEA.app/Contents/lib/idea_rt.
jar=60505:/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=60505:/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.
multiplyMatricesBasic
# Parameters: (n = 10)

# Run progress: 0.00% complete, ETA 00:02:15
# Fork: 1 of 1
# Warmup Iteration   1: 0.001 ±(99.9%) 0.001 ms/op
# Warmup Iteration   2: ≈ 10⁻³ ms/op
```

```
# Warmup Iteration   3: ≈ 10⁻³ ms/op
# Warmup Iteration   4: ≈ 10⁻³ ms/op
# Warmup Iteration   5: ≈ 10⁻³ ms/op
Iteration   1: ≈ 10⁻³ ms/op
                 multiplyMatricesBasic·p0.00:   ≈ 10
⁻³ ms/op
                 multiplyMatricesBasic·p0.50:   ≈ 10
⁻³ ms/op
                 multiplyMatricesBasic·p0.90:   0.001
ms/op
                 multiplyMatricesBasic·p0.95:   0.001
ms/op
                 multiplyMatricesBasic·p0.99:   0.001
ms/op
                 multiplyMatricesBasic·p0.999:  0.001
ms/op
                 multiplyMatricesBasic·p0.9999: 0.013
ms/op
                 multiplyMatricesBasic·p1.00:   0.033
ms/op

Iteration   2: ≈ 10⁻³ ms/op
                 multiplyMatricesBasic·p0.00:   ≈ 10
⁻³ ms/op
                 multiplyMatricesBasic·p0.50:   ≈ 10
⁻³ ms/op
                 multiplyMatricesBasic·p0.90:   0.001
ms/op
                 multiplyMatricesBasic·p0.95:   0.001
ms/op
                 multiplyMatricesBasic·p0.99:   0.001
ms/op
                 multiplyMatricesBasic·p0.999:  0.001
ms/op
                 multiplyMatricesBasic·p0.9999: 0.010
ms/op
                 multiplyMatricesBasic·p1.00:   0.013
ms/op

Iteration   3: ≈ 10⁻³ ms/op
                 multiplyMatricesBasic·p0.00:   ≈ 10
```

```
⁻³ ms/op
                 multiplyMatricesBasic·p0.50:   ≈ 10
⁻³ ms/op
                 multiplyMatricesBasic·p0.90:   0.001
ms/op
                 multiplyMatricesBasic·p0.95:   0.001
ms/op
                 multiplyMatricesBasic·p0.99:   0.001
ms/op
                 multiplyMatricesBasic·p0.999:  0.001
ms/op
                 multiplyMatricesBasic·p0.9999: 0.014
ms/op
                 multiplyMatricesBasic·p1.00:   0.015
ms/op

Iteration   4: ≈ 10⁻³ ms/op
                 multiplyMatricesBasic·p0.00:   ≈ 10
⁻³ ms/op
                 multiplyMatricesBasic·p0.50:   ≈ 10
⁻³ ms/op
                 multiplyMatricesBasic·p0.90:   0.001
ms/op
                 multiplyMatricesBasic·p0.95:   0.001
ms/op
                 multiplyMatricesBasic·p0.99:   0.001
ms/op
                 multiplyMatricesBasic·p0.999:  0.001
ms/op
                 multiplyMatricesBasic·p0.9999: 0.012
ms/op
                 multiplyMatricesBasic·p1.00:   0.014
ms/op

Iteration   5: ≈ 10⁻³ ms/op
                 multiplyMatricesBasic·p0.00:   ≈ 10
⁻³ ms/op
                 multiplyMatricesBasic·p0.50:   ≈ 10
⁻³ ms/op
                 multiplyMatricesBasic·p0.90:   0.001
ms/op
```

```
                  multiplyMatricesBasic·p0.95:   0.001
ms/op
                  multiplyMatricesBasic·p0.99:   0.001
ms/op
                  multiplyMatricesBasic·p0.999:  0.001
ms/op
                  multiplyMatricesBasic·p0.9999: 0.013
ms/op
                  multiplyMatricesBasic·p1.00:   0.014
ms/op

Iteration   6: ≈ 10⁻³ ms/op
                  multiplyMatricesBasic·p0.00:   ≈ 10
⁻³ ms/op
                  multiplyMatricesBasic·p0.50:   ≈ 10
⁻³ ms/op
                  multiplyMatricesBasic·p0.90:   0.001
ms/op
                  multiplyMatricesBasic·p0.95:   0.001
ms/op
                  multiplyMatricesBasic·p0.99:   0.001
ms/op
                  multiplyMatricesBasic·p0.999:  0.002
ms/op
                  multiplyMatricesBasic·p0.9999: 0.012
ms/op
                  multiplyMatricesBasic·p1.00:   0.013
ms/op

Iteration   7: ≈ 10⁻³ ms/op
                  multiplyMatricesBasic·p0.00:   ≈ 10
⁻³ ms/op
                  multiplyMatricesBasic·p0.50:   ≈ 10
⁻³ ms/op
                  multiplyMatricesBasic·p0.90:   0.001
ms/op
                  multiplyMatricesBasic·p0.95:   0.001
ms/op
                  multiplyMatricesBasic·p0.99:   0.001
ms/op
                  multiplyMatricesBasic·p0.999:  0.001
```

```
ms/op
                 multiplyMatricesBasic·p0.9999: 0.012
ms/op
                 multiplyMatricesBasic·p1.00:   0.013
ms/op

Iteration   8: ≈ 10⁻³ ms/op
                 multiplyMatricesBasic·p0.00:   ≈ 10
⁻³ ms/op
                 multiplyMatricesBasic·p0.50:   ≈ 10
⁻³ ms/op
                 multiplyMatricesBasic·p0.90:   0.001
ms/op
                 multiplyMatricesBasic·p0.95:   0.001
ms/op
                 multiplyMatricesBasic·p0.99:   0.001
ms/op
                 multiplyMatricesBasic·p0.999:  0.001
ms/op
                 multiplyMatricesBasic·p0.9999: 0.013
ms/op
                 multiplyMatricesBasic·p1.00:   0.014
ms/op

Iteration   9: ≈ 10⁻³ ms/op
                 multiplyMatricesBasic·p0.00:   ≈ 10
⁻³ ms/op
                 multiplyMatricesBasic·p0.50:   ≈ 10
⁻³ ms/op
                 multiplyMatricesBasic·p0.90:   0.001
ms/op
                 multiplyMatricesBasic·p0.95:   0.001
ms/op
                 multiplyMatricesBasic·p0.99:   0.001
ms/op
                 multiplyMatricesBasic·p0.999:  0.001
ms/op
                 multiplyMatricesBasic·p0.9999: 0.008
ms/op
                 multiplyMatricesBasic·p1.00:   0.014
ms/op
```

```
Iteration  10: ≈ 10⁻³ ms/op
                 multiplyMatricesBasic·p0.00:   ≈ 10
⁻³ ms/op
                 multiplyMatricesBasic·p0.50:   ≈ 10
⁻³ ms/op
                 multiplyMatricesBasic·p0.90:   0.001
ms/op
                 multiplyMatricesBasic·p0.95:   0.001
ms/op
                 multiplyMatricesBasic·p0.99:   0.001
ms/op
                 multiplyMatricesBasic·p0.999:  0.001
ms/op
                 multiplyMatricesBasic·p0.9999: 0.007
ms/op
                 multiplyMatricesBasic·p1.00:   0.014
ms/op



Result "com.matrix.MatrixMultiplicationBenchmark.
multiplyMatricesBasic":
  N = 328983
  mean =     ≈ 10⁻³ ±(99.9%) 0.001 ms/op

  Histogram, ms/op:
    [0.000, 0.003) = 328769
    [0.003, 0.005) = 43
    [0.005, 0.008) = 76
    [0.008, 0.010) = 55
    [0.010, 0.013) = 13
    [0.013, 0.015) = 25
    [0.015, 0.018) = 1
    [0.018, 0.020) = 0
    [0.020, 0.023) = 0
    [0.023, 0.025) = 0
    [0.025, 0.028) = 0
    [0.028, 0.030) = 0
    [0.030, 0.033) = 0
    [0.033, 0.035) = 1
```

```
    [0.035, 0.038) = 0

  Percentiles, ms/op:
      p(0.0000) =     ≈ 10⁻³ ms/op
     p(50.0000) =     ≈ 10⁻³ ms/op
     p(90.0000) =      0.001 ms/op
     p(95.0000) =      0.001 ms/op
     p(99.0000) =      0.001 ms/op
     p(99.9000) =      0.001 ms/op
     p(99.9900) =      0.012 ms/op
     p(99.9990) =      0.014 ms/op
     p(99.9999) =      0.033 ms/op
    p(100.0000) =      0.033 ms/op


# 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=60505:/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.
multiplyMatricesBasic
# Parameters: (n = 20)

# Run progress: 11.11% complete, ETA 00:02:04
# Fork: 1 of 1
# Warmup Iteration   1: 0.004 ±(99.9%) 0.001 ms/op
# Warmup Iteration   2: 0.003 ±(99.9%) 0.001 ms/op
# Warmup Iteration   3: 0.003 ±(99.9%) 0.001 ms/op
# Warmup Iteration   4: 0.003 ±(99.9%) 0.001 ms/op
# Warmup Iteration   5: 0.003 ±(99.9%) 0.001 ms/op
```

```
Iteration   1: 0.003 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.003
ms/op
                 multiplyMatricesBasic·p0.50:   0.003
ms/op
                 multiplyMatricesBasic·p0.90:   0.003
ms/op
                 multiplyMatricesBasic·p0.95:   0.004
ms/op
                 multiplyMatricesBasic·p0.99:   0.004
ms/op
                 multiplyMatricesBasic·p0.999:  0.008
ms/op
                 multiplyMatricesBasic·p0.9999: 0.017
ms/op
                 multiplyMatricesBasic·p1.00:   0.017
ms/op

Iteration   2: 0.003 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.003
ms/op
                 multiplyMatricesBasic·p0.50:   0.003
ms/op
                 multiplyMatricesBasic·p0.90:   0.003
ms/op
                 multiplyMatricesBasic·p0.95:   0.004
ms/op
                 multiplyMatricesBasic·p0.99:   0.004
ms/op
                 multiplyMatricesBasic·p0.999:  0.011
ms/op
                 multiplyMatricesBasic·p0.9999: 0.020
ms/op
                 multiplyMatricesBasic·p1.00:   0.051
ms/op

Iteration   3: 0.003 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.003
ms/op
                 multiplyMatricesBasic·p0.50:   0.003
ms/op
```

```
                  multiplyMatricesBasic·p0.90:   0.003
ms/op
                  multiplyMatricesBasic·p0.95:   0.004
ms/op
                  multiplyMatricesBasic·p0.99:   0.004
ms/op
                  multiplyMatricesBasic·p0.999:  0.011
ms/op
                  multiplyMatricesBasic·p0.9999: 0.016
ms/op
                  multiplyMatricesBasic·p1.00:   0.016
ms/op

Iteration   4: 0.003 ±(99.9%) 0.001 ms/op
                  multiplyMatricesBasic·p0.00:   0.003
ms/op
                  multiplyMatricesBasic·p0.50:   0.003
ms/op
                  multiplyMatricesBasic·p0.90:   0.003
ms/op
                  multiplyMatricesBasic·p0.95:   0.004
ms/op
                  multiplyMatricesBasic·p0.99:   0.004
ms/op
                  multiplyMatricesBasic·p0.999:  0.010
ms/op
                  multiplyMatricesBasic·p0.9999: 0.016
ms/op
                  multiplyMatricesBasic·p1.00:   0.018
ms/op

Iteration   5: 0.003 ±(99.9%) 0.001 ms/op
                  multiplyMatricesBasic·p0.00:   0.003
ms/op
                  multiplyMatricesBasic·p0.50:   0.003
ms/op
                  multiplyMatricesBasic·p0.90:   0.003
ms/op
                  multiplyMatricesBasic·p0.95:   0.004
ms/op
                  multiplyMatricesBasic·p0.99:   0.004
```

```
ms/op
                 multiplyMatricesBasic·p0.999:  0.010
ms/op
                 multiplyMatricesBasic·p0.9999: 0.016
ms/op
                 multiplyMatricesBasic·p1.00:   0.017
ms/op

Iteration   6: 0.003 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.003
ms/op
                 multiplyMatricesBasic·p0.50:   0.003
ms/op
                 multiplyMatricesBasic·p0.90:   0.003
ms/op
                 multiplyMatricesBasic·p0.95:   0.004
ms/op
                 multiplyMatricesBasic·p0.99:   0.004
ms/op
                 multiplyMatricesBasic·p0.999:  0.010
ms/op
                 multiplyMatricesBasic·p0.9999: 0.016
ms/op
                 multiplyMatricesBasic·p1.00:   0.017
ms/op

Iteration   7: 0.003 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.003
ms/op
                 multiplyMatricesBasic·p0.50:   0.003
ms/op
                 multiplyMatricesBasic·p0.90:   0.003
ms/op
                 multiplyMatricesBasic·p0.95:   0.004
ms/op
                 multiplyMatricesBasic·p0.99:   0.004
ms/op
                 multiplyMatricesBasic·p0.999:  0.011
ms/op
                 multiplyMatricesBasic·p0.9999: 0.016
ms/op
```

```
                  multiplyMatricesBasic·p1.00:   0.017
ms/op

Iteration   8: 0.003 ±(99.9%) 0.001 ms/op
                  multiplyMatricesBasic·p0.00:   0.003
ms/op
                  multiplyMatricesBasic·p0.50:   0.003
ms/op
                  multiplyMatricesBasic·p0.90:   0.003
ms/op
                  multiplyMatricesBasic·p0.95:   0.004
ms/op
                  multiplyMatricesBasic·p0.99:   0.004
ms/op
                  multiplyMatricesBasic·p0.999:  0.011
ms/op
                  multiplyMatricesBasic·p0.9999: 0.016
ms/op
                  multiplyMatricesBasic·p1.00:   0.017
ms/op

Iteration   9: 0.003 ±(99.9%) 0.001 ms/op
                  multiplyMatricesBasic·p0.00:   0.003
ms/op
                  multiplyMatricesBasic·p0.50:   0.003
ms/op
                  multiplyMatricesBasic·p0.90:   0.003
ms/op
                  multiplyMatricesBasic·p0.95:   0.004
ms/op
                  multiplyMatricesBasic·p0.99:   0.004
ms/op
                  multiplyMatricesBasic·p0.999:  0.011
ms/op
                  multiplyMatricesBasic·p0.9999: 0.016
ms/op
                  multiplyMatricesBasic·p1.00:   0.028
ms/op

Iteration  10: 0.003 ±(99.9%) 0.001 ms/op
                  multiplyMatricesBasic·p0.00:   0.003
```

```
ms/op
                 multiplyMatricesBasic·p0.50:   0.003
ms/op
                 multiplyMatricesBasic·p0.90:   0.003
ms/op
                 multiplyMatricesBasic·p0.95:   0.004
ms/op
                 multiplyMatricesBasic·p0.99:   0.004
ms/op
                 multiplyMatricesBasic·p0.999:  0.010
ms/op
                 multiplyMatricesBasic·p0.9999: 0.016
ms/op
                 multiplyMatricesBasic·p1.00:   0.019
ms/op



Result "com.matrix.MatrixMultiplicationBenchmark.
multiplyMatricesBasic":
  N = 363258
  mean =      0.003 ±(99.9%) 0.001 ms/op

  Histogram, ms/op:
    [0.000, 0.005) = 362402
    [0.005, 0.010) = 465
    [0.010, 0.015) = 311
    [0.015, 0.020) = 75
    [0.020, 0.025) = 2
    [0.025, 0.030) = 1
    [0.030, 0.035) = 1
    [0.035, 0.040) = 0
    [0.040, 0.045) = 0
    [0.045, 0.050) = 0
    [0.050, 0.055) = 1

  Percentiles, ms/op:
      p(0.0000) =      0.003 ms/op
     p(50.0000) =      0.003 ms/op
     p(90.0000) =      0.003 ms/op
     p(95.0000) =      0.004 ms/op
```

```
     p(99.0000) =      0.004 ms/op
     p(99.9000) =      0.010 ms/op
     p(99.9900) =      0.016 ms/op
     p(99.9990) =      0.024 ms/op
     p(99.9999) =      0.051 ms/op
    p(100.0000) =      0.051 ms/op


# 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=60505:/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.
multiplyMatricesBasic
# Parameters: (n = 50)

# Run progress: 22.22% complete, ETA 00:01:49
# Fork: 1 of 1
# Warmup Iteration   1: 0.051 ±(99.9%) 0.001 ms/op
# Warmup Iteration   2: 0.051 ±(99.9%) 0.001 ms/op
# Warmup Iteration   3: 0.051 ±(99.9%) 0.001 ms/op
# Warmup Iteration   4: 0.051 ±(99.9%) 0.001 ms/op
# Warmup Iteration   5: 0.051 ±(99.9%) 0.001 ms/op
Iteration   1: 0.051 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.049
ms/op
                 multiplyMatricesBasic·p0.50:   0.051
ms/op
                 multiplyMatricesBasic·p0.90:   0.051
ms/op
```

```
                  multiplyMatricesBasic·p0.95:   0.054
ms/op
                  multiplyMatricesBasic·p0.99:   0.061
ms/op
                  multiplyMatricesBasic·p0.999:  0.067
ms/op
                  multiplyMatricesBasic·p0.9999: 0.091
ms/op
                  multiplyMatricesBasic·p1.00:   0.115
ms/op

Iteration   2: 0.051 ±(99.9%) 0.001 ms/op
                  multiplyMatricesBasic·p0.00:   0.047
ms/op
                  multiplyMatricesBasic·p0.50:   0.051
ms/op
                  multiplyMatricesBasic·p0.90:   0.052
ms/op
                  multiplyMatricesBasic·p0.95:   0.055
ms/op
                  multiplyMatricesBasic·p0.99:   0.062
ms/op
                  multiplyMatricesBasic·p0.999:  0.066
ms/op
                  multiplyMatricesBasic·p0.9999: 0.070
ms/op
                  multiplyMatricesBasic·p1.00:   0.071
ms/op

Iteration   3: 0.051 ±(99.9%) 0.001 ms/op
                  multiplyMatricesBasic·p0.00:   0.047
ms/op
                  multiplyMatricesBasic·p0.50:   0.051
ms/op
                  multiplyMatricesBasic·p0.90:   0.052
ms/op
                  multiplyMatricesBasic·p0.95:   0.055
ms/op
                  multiplyMatricesBasic·p0.99:   0.062
ms/op
                  multiplyMatricesBasic·p0.999:  0.066
```

```
ms/op
                 multiplyMatricesBasic·p0.9999: 0.069
ms/op
                 multiplyMatricesBasic·p1.00:   0.070
ms/op

Iteration   4: 0.051 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.047
ms/op
                 multiplyMatricesBasic·p0.50:   0.051
ms/op
                 multiplyMatricesBasic·p0.90:   0.051
ms/op
                 multiplyMatricesBasic·p0.95:   0.055
ms/op
                 multiplyMatricesBasic·p0.99:   0.062
ms/op
                 multiplyMatricesBasic·p0.999:  0.066
ms/op
                 multiplyMatricesBasic·p0.9999: 0.073
ms/op
                 multiplyMatricesBasic·p1.00:   0.074
ms/op

Iteration   5: 0.051 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.046
ms/op
                 multiplyMatricesBasic·p0.50:   0.051
ms/op
                 multiplyMatricesBasic·p0.90:   0.051
ms/op
                 multiplyMatricesBasic·p0.95:   0.055
ms/op
                 multiplyMatricesBasic·p0.99:   0.062
ms/op
                 multiplyMatricesBasic·p0.999:  0.066
ms/op
                 multiplyMatricesBasic·p0.9999: 0.070
ms/op
                 multiplyMatricesBasic·p1.00:   0.089
ms/op
```

```
Iteration   6: 0.051 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.047
ms/op
                 multiplyMatricesBasic·p0.50:   0.051
ms/op
                 multiplyMatricesBasic·p0.90:   0.053
ms/op
                 multiplyMatricesBasic·p0.95:   0.055
ms/op
                 multiplyMatricesBasic·p0.99:   0.062
ms/op
                 multiplyMatricesBasic·p0.999:  0.066
ms/op
                 multiplyMatricesBasic·p0.9999: 0.072
ms/op
                 multiplyMatricesBasic·p1.00:   0.073
ms/op

Iteration   7: 0.051 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.048
ms/op
                 multiplyMatricesBasic·p0.50:   0.051
ms/op
                 multiplyMatricesBasic·p0.90:   0.052
ms/op
                 multiplyMatricesBasic·p0.95:   0.055
ms/op
                 multiplyMatricesBasic·p0.99:   0.062
ms/op
                 multiplyMatricesBasic·p0.999:  0.066
ms/op
                 multiplyMatricesBasic·p0.9999: 0.072
ms/op
                 multiplyMatricesBasic·p1.00:   0.075
ms/op

Iteration   8: 0.051 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.047
ms/op
                 multiplyMatricesBasic·p0.50:   0.051
```

```
ms/op
                 multiplyMatricesBasic·p0.90:   0.052
ms/op
                 multiplyMatricesBasic·p0.95:   0.055
ms/op
                 multiplyMatricesBasic·p0.99:   0.062
ms/op
                 multiplyMatricesBasic·p0.999:  0.066
ms/op
                 multiplyMatricesBasic·p0.9999: 0.071
ms/op
                 multiplyMatricesBasic·p1.00:   0.071
ms/op

Iteration   9: 0.051 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.047
ms/op
                 multiplyMatricesBasic·p0.50:   0.051
ms/op
                 multiplyMatricesBasic·p0.90:   0.052
ms/op
                 multiplyMatricesBasic·p0.95:   0.055
ms/op
                 multiplyMatricesBasic·p0.99:   0.062
ms/op
                 multiplyMatricesBasic·p0.999:  0.067
ms/op
                 multiplyMatricesBasic·p0.9999: 0.193
ms/op
                 multiplyMatricesBasic·p1.00:   0.242
ms/op

Iteration  10: 0.051 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.047
ms/op
                 multiplyMatricesBasic·p0.50:   0.051
ms/op
                 multiplyMatricesBasic·p0.90:   0.051
ms/op
                 multiplyMatricesBasic·p0.95:   0.055
ms/op
```

```
                  multiplyMatricesBasic·p0.99:   0.062
ms/op
                  multiplyMatricesBasic·p0.999:  0.067
ms/op
                  multiplyMatricesBasic·p0.9999: 0.079
ms/op
                  multiplyMatricesBasic·p1.00:   0.082
ms/op



Result "com.matrix.MatrixMultiplicationBenchmark.
multiplyMatricesBasic":
  N = 196014
  mean =      0.051 ±(99.9%) 0.001 ms/op

  Histogram, ms/op:
    [0.000, 0.025) = 0
    [0.025, 0.050) = 1386
    [0.050, 0.075) = 194602
    [0.075, 0.100) = 21
    [0.100, 0.125) = 2
    [0.125, 0.150) = 0
    [0.150, 0.175) = 1
    [0.175, 0.200) = 1
    [0.200, 0.225) = 0
    [0.225, 0.250) = 1
    [0.250, 0.275) = 0
    [0.275, 0.300) = 0

  Percentiles, ms/op:
      p(0.0000) =      0.046 ms/op
     p(50.0000) =      0.051 ms/op
     p(90.0000) =      0.052 ms/op
     p(95.0000) =      0.055 ms/op
     p(99.0000) =      0.062 ms/op
     p(99.9000) =      0.066 ms/op
     p(99.9900) =      0.082 ms/op
     p(99.9990) =      0.193 ms/op
     p(99.9999) =      0.242 ms/op
    p(100.0000) =      0.242 ms/op
```

```
# 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=60505:/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.
multiplyMatricesBasic
# Parameters: (n = 100)

# Run progress: 33.33% complete, ETA 00:01:33
# Fork: 1 of 1
# Warmup Iteration   1: 0.408 ±(99.9%) 0.008 ms/op
# Warmup Iteration   2: 0.405 ±(99.9%) 0.001 ms/op
# Warmup Iteration   3: 0.404 ±(99.9%) 0.001 ms/op
# Warmup Iteration   4: 0.404 ±(99.9%) 0.001 ms/op
# Warmup Iteration   5: 0.404 ±(99.9%) 0.001 ms/op
Iteration   1: 0.404 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.374
ms/op
                 multiplyMatricesBasic·p0.50:   0.401
ms/op
                 multiplyMatricesBasic·p0.90:   0.413
ms/op
                 multiplyMatricesBasic·p0.95:   0.417
ms/op
                 multiplyMatricesBasic·p0.99:   0.436
ms/op
                 multiplyMatricesBasic·p0.999:  0.504
ms/op
```

```
                  multiplyMatricesBasic·p0.9999: 0.509
ms/op
                  multiplyMatricesBasic·p1.00:   0.509
ms/op

Iteration   2: 0.405 ±(99.9%) 0.001 ms/op
                  multiplyMatricesBasic·p0.00:   0.373
ms/op
                  multiplyMatricesBasic·p0.50:   0.401
ms/op
                  multiplyMatricesBasic·p0.90:   0.414
ms/op
                  multiplyMatricesBasic·p0.95:   0.421
ms/op
                  multiplyMatricesBasic·p0.99:   0.448
ms/op
                  multiplyMatricesBasic·p0.999:  0.503
ms/op
                  multiplyMatricesBasic·p0.9999: 0.510
ms/op
                  multiplyMatricesBasic·p1.00:   0.510
ms/op

Iteration   3: 0.405 ±(99.9%) 0.001 ms/op
                  multiplyMatricesBasic·p0.00:   0.373
ms/op
                  multiplyMatricesBasic·p0.50:   0.401
ms/op
                  multiplyMatricesBasic·p0.90:   0.414
ms/op
                  multiplyMatricesBasic·p0.95:   0.421
ms/op
                  multiplyMatricesBasic·p0.99:   0.450
ms/op
                  multiplyMatricesBasic·p0.999:  0.508
ms/op
                  multiplyMatricesBasic·p0.9999: 0.512
ms/op
                  multiplyMatricesBasic·p1.00:   0.512
ms/op
```

```
Iteration   4: 0.405 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.383
ms/op
                 multiplyMatricesBasic·p0.50:   0.401
ms/op
                 multiplyMatricesBasic·p0.90:   0.414
ms/op
                 multiplyMatricesBasic·p0.95:   0.422
ms/op
                 multiplyMatricesBasic·p0.99:   0.449
ms/op
                 multiplyMatricesBasic·p0.999:  0.508
ms/op
                 multiplyMatricesBasic·p0.9999: 0.511
ms/op
                 multiplyMatricesBasic·p1.00:   0.511
ms/op

Iteration   5: 0.405 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.373
ms/op
                 multiplyMatricesBasic·p0.50:   0.401
ms/op
                 multiplyMatricesBasic·p0.90:   0.413
ms/op
                 multiplyMatricesBasic·p0.95:   0.421
ms/op
                 multiplyMatricesBasic·p0.99:   0.449
ms/op
                 multiplyMatricesBasic·p0.999:  0.499
ms/op
                 multiplyMatricesBasic·p0.9999: 0.506
ms/op
                 multiplyMatricesBasic·p1.00:   0.506
ms/op

Iteration   6: 0.405 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.373
ms/op
                 multiplyMatricesBasic·p0.50:   0.401
ms/op
```

```
                  multiplyMatricesBasic·p0.90:   0.414
ms/op
                  multiplyMatricesBasic·p0.95:   0.421
ms/op
                  multiplyMatricesBasic·p0.99:   0.449
ms/op
                  multiplyMatricesBasic·p0.999:  0.511
ms/op
                  multiplyMatricesBasic·p0.9999: 0.517
ms/op
                  multiplyMatricesBasic·p1.00:   0.517
ms/op

Iteration   7: 0.405 ±(99.9%) 0.001 ms/op
                  multiplyMatricesBasic·p0.00:   0.399
ms/op
                  multiplyMatricesBasic·p0.50:   0.401
ms/op
                  multiplyMatricesBasic·p0.90:   0.414
ms/op
                  multiplyMatricesBasic·p0.95:   0.422
ms/op
                  multiplyMatricesBasic·p0.99:   0.445
ms/op
                  multiplyMatricesBasic·p0.999:  0.498
ms/op
                  multiplyMatricesBasic·p0.9999: 0.510
ms/op
                  multiplyMatricesBasic·p1.00:   0.510
ms/op

Iteration   8: 0.405 ±(99.9%) 0.001 ms/op
                  multiplyMatricesBasic·p0.00:   0.377
ms/op
                  multiplyMatricesBasic·p0.50:   0.401
ms/op
                  multiplyMatricesBasic·p0.90:   0.414
ms/op
                  multiplyMatricesBasic·p0.95:   0.422
ms/op
                  multiplyMatricesBasic·p0.99:   0.450
```

```
ms/op
                 multiplyMatricesBasic·p0.999:  0.512
ms/op
                 multiplyMatricesBasic·p0.9999: 0.514
ms/op
                 multiplyMatricesBasic·p1.00:   0.514
ms/op

Iteration   9: 0.405 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.373
ms/op
                 multiplyMatricesBasic·p0.50:   0.401
ms/op
                 multiplyMatricesBasic·p0.90:   0.414
ms/op
                 multiplyMatricesBasic·p0.95:   0.422
ms/op
                 multiplyMatricesBasic·p0.99:   0.447
ms/op
                 multiplyMatricesBasic·p0.999:  0.506
ms/op
                 multiplyMatricesBasic·p0.9999: 0.509
ms/op
                 multiplyMatricesBasic·p1.00:   0.509
ms/op

Iteration  10: 0.405 ±(99.9%) 0.001 ms/op
                 multiplyMatricesBasic·p0.00:   0.399
ms/op
                 multiplyMatricesBasic·p0.50:   0.401
ms/op
                 multiplyMatricesBasic·p0.90:   0.414
ms/op
                 multiplyMatricesBasic·p0.95:   0.421
ms/op
                 multiplyMatricesBasic·p0.99:   0.447
ms/op
                 multiplyMatricesBasic·p0.999:  0.507
ms/op
                 multiplyMatricesBasic·p0.9999: 0.513
ms/op
```

```
                  multiplyMatricesBasic·p1.00:   0.513
ms/op



Result "com.matrix.MatrixMultiplicationBenchmark.
multiplyMatricesBasic":
  N = 24789
  mean =      0.405 ±(99.9%) 0.001 ms/op

  Histogram, ms/op:
    [0.300, 0.325) = 0
    [0.325, 0.350) = 0
    [0.350, 0.375) = 32
    [0.375, 0.400) = 920
    [0.400, 0.425) = 22951
    [0.425, 0.450) = 677
    [0.450, 0.475) = 151
    [0.475, 0.500) = 24
    [0.500, 0.525) = 34
    [0.525, 0.550) = 0
    [0.550, 0.575) = 0
    [0.575, 0.600) = 0

  Percentiles, ms/op:
      p(0.0000) =      0.373 ms/op
     p(50.0000) =      0.401 ms/op
     p(90.0000) =      0.414 ms/op
     p(95.0000) =      0.421 ms/op
     p(99.0000) =      0.447 ms/op
     p(99.9000) =      0.505 ms/op
     p(99.9900) =      0.514 ms/op
     p(99.9990) =      0.517 ms/op
     p(99.9999) =      0.517 ms/op
    p(100.0000) =      0.517 ms/op


# 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=60505:/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.
multiplyMatricesBasic
# Parameters: (n = 200)

# Run progress: 44.44% complete, ETA 00:01:18
# Fork: 1 of 1
# Warmup Iteration   1: 3.428 ±(99.9%) 0.073 ms/op
# Warmup Iteration   2: 3.389 ±(99.9%) 0.007 ms/op
# Warmup Iteration   3: 3.388 ±(99.9%) 0.007 ms/op
# Warmup Iteration   4: 3.389 ±(99.9%) 0.007 ms/op
# Warmup Iteration   5: 3.389 ±(99.9%) 0.008 ms/op
Iteration   1: 3.388 ±(99.9%) 0.008 ms/op
                 multiplyMatricesBasic·p0.00:   3.359
ms/op
                 multiplyMatricesBasic·p0.50:   3.379
ms/op
                 multiplyMatricesBasic·p0.90:   3.412
ms/op
                 multiplyMatricesBasic·p0.95:   3.429
ms/op
                 multiplyMatricesBasic·p0.99:   3.638
ms/op
                 multiplyMatricesBasic·p0.999:  3.826
ms/op
                 multiplyMatricesBasic·p0.9999: 3.826
ms/op
                 multiplyMatricesBasic·p1.00:   3.826
ms/op

Iteration   2: 3.395 ±(99.9%) 0.009 ms/op
```

```
                  multiplyMatricesBasic·p0.00:   3.326
ms/op
                  multiplyMatricesBasic·p0.50:   3.383
ms/op
                  multiplyMatricesBasic·p0.90:   3.450
ms/op
                  multiplyMatricesBasic·p0.95:   3.482
ms/op
                  multiplyMatricesBasic·p0.99:   3.538
ms/op
                  multiplyMatricesBasic·p0.999:  3.850
ms/op
                  multiplyMatricesBasic·p0.9999: 3.850
ms/op
                  multiplyMatricesBasic·p1.00:   3.850
ms/op

Iteration   3: 3.396 ±(99.9%) 0.009 ms/op
                  multiplyMatricesBasic·p0.00:   3.359
ms/op
                  multiplyMatricesBasic·p0.50:   3.383
ms/op
                  multiplyMatricesBasic·p0.90:   3.442
ms/op
                  multiplyMatricesBasic·p0.95:   3.482
ms/op
                  multiplyMatricesBasic·p0.99:   3.642
ms/op
                  multiplyMatricesBasic·p0.999:  3.826
ms/op
                  multiplyMatricesBasic·p0.9999: 3.826
ms/op
                  multiplyMatricesBasic·p1.00:   3.826
ms/op

Iteration   4: 3.394 ±(99.9%) 0.010 ms/op
                  multiplyMatricesBasic·p0.00:   3.273
ms/op
                  multiplyMatricesBasic·p0.50:   3.379
ms/op
                  multiplyMatricesBasic·p0.90:   3.443
```

```
ms/op
                 multiplyMatricesBasic·p0.95:   3.474
ms/op
                 multiplyMatricesBasic·p0.99:   3.678
ms/op
                 multiplyMatricesBasic·p0.999:  3.899
ms/op
                 multiplyMatricesBasic·p0.9999: 3.899
ms/op
                 multiplyMatricesBasic·p1.00:   3.899
ms/op

Iteration   5: 3.395 ±(99.9%) 0.008 ms/op
                 multiplyMatricesBasic·p0.00:   3.359
ms/op
                 multiplyMatricesBasic·p0.50:   3.379
ms/op
                 multiplyMatricesBasic·p0.90:   3.445
ms/op
                 multiplyMatricesBasic·p0.95:   3.478
ms/op
                 multiplyMatricesBasic·p0.99:   3.578
ms/op
                 multiplyMatricesBasic·p0.999:  3.699
ms/op
                 multiplyMatricesBasic·p0.9999: 3.699
ms/op
                 multiplyMatricesBasic·p1.00:   3.699
ms/op

Iteration   6: 3.393 ±(99.9%) 0.009 ms/op
                 multiplyMatricesBasic·p0.00:   3.355
ms/op
                 multiplyMatricesBasic·p0.50:   3.379
ms/op
                 multiplyMatricesBasic·p0.90:   3.446
ms/op
                 multiplyMatricesBasic·p0.95:   3.479
ms/op
                 multiplyMatricesBasic·p0.99:   3.564
ms/op
```

```
                  multiplyMatricesBasic·p0.999:  3.830
ms/op
                  multiplyMatricesBasic·p0.9999: 3.830
ms/op
                  multiplyMatricesBasic·p1.00:   3.830
ms/op

Iteration   7: 3.394 ±(99.9%) 0.008 ms/op
                  multiplyMatricesBasic·p0.00:   3.359
ms/op
                  multiplyMatricesBasic·p0.50:   3.379
ms/op
                  multiplyMatricesBasic·p0.90:   3.453
ms/op
                  multiplyMatricesBasic·p0.95:   3.474
ms/op
                  multiplyMatricesBasic·p0.99:   3.551
ms/op
                  multiplyMatricesBasic·p0.999:  3.711
ms/op
                  multiplyMatricesBasic·p0.9999: 3.711
ms/op
                  multiplyMatricesBasic·p1.00:   3.711
ms/op

Iteration   8: 3.400 ±(99.9%) 0.013 ms/op
                  multiplyMatricesBasic·p0.00:   3.305
ms/op
                  multiplyMatricesBasic·p0.50:   3.379
ms/op
                  multiplyMatricesBasic·p0.90:   3.452
ms/op
                  multiplyMatricesBasic·p0.95:   3.492
ms/op
                  multiplyMatricesBasic·p0.99:   3.732
ms/op
                  multiplyMatricesBasic·p0.999:  4.035
ms/op
                  multiplyMatricesBasic·p0.9999: 4.035
ms/op
                  multiplyMatricesBasic·p1.00:   4.035
```

```
ms/op

Iteration   9: 3.394 ±(99.9%) 0.009 ms/op
                 multiplyMatricesBasic·p0.00:   3.285
ms/op
                 multiplyMatricesBasic·p0.50:   3.383
ms/op
                 multiplyMatricesBasic·p0.90:   3.442
ms/op
                 multiplyMatricesBasic·p0.95:   3.478
ms/op
                 multiplyMatricesBasic·p0.99:   3.603
ms/op
                 multiplyMatricesBasic·p0.999:  3.875
ms/op
                 multiplyMatricesBasic·p0.9999: 3.875
ms/op
                 multiplyMatricesBasic·p1.00:   3.875
ms/op

Iteration  10: 3.392 ±(99.9%) 0.009 ms/op
                 multiplyMatricesBasic·p0.00:   3.289
ms/op
                 multiplyMatricesBasic·p0.50:   3.379
ms/op
                 multiplyMatricesBasic·p0.90:   3.432
ms/op
                 multiplyMatricesBasic·p0.95:   3.466
ms/op
                 multiplyMatricesBasic·p0.99:   3.616
ms/op
                 multiplyMatricesBasic·p0.999:  3.834
ms/op
                 multiplyMatricesBasic·p0.9999: 3.834
ms/op
                 multiplyMatricesBasic·p1.00:   3.834
ms/op



Result "com.matrix.MatrixMultiplicationBenchmark.
```

```
multiplyMatricesBasic":
  N = 2961
  mean =      3.394 ±(99.9%) 0.003 ms/op

  Histogram, ms/op:
    [3.200, 3.250) = 0
    [3.250, 3.300) = 3
    [3.300, 3.350) = 4
    [3.350, 3.400) = 2278
    [3.400, 3.450) = 426
    [3.450, 3.500) = 173
    [3.500, 3.550) = 45
    [3.550, 3.600) = 4
    [3.600, 3.650) = 6
    [3.650, 3.700) = 8
    [3.700, 3.750) = 4
    [3.750, 3.800) = 2
    [3.800, 3.850) = 4
    [3.850, 3.900) = 3
    [3.900, 3.950) = 0
    [3.950, 4.000) = 0
    [4.000, 4.050) = 1
    [4.050, 4.100) = 0

  Percentiles, ms/op:
      p(0.0000) =      3.273 ms/op
     p(50.0000) =      3.379 ms/op
     p(90.0000) =      3.437 ms/op
     p(95.0000) =      3.477 ms/op
     p(99.0000) =      3.576 ms/op
     p(99.9000) =      3.876 ms/op
     p(99.9900) =      4.035 ms/op
     p(99.9990) =      4.035 ms/op
     p(99.9999) =      4.035 ms/op
    p(100.0000) =      4.035 ms/op


# 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=60505:/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.
multiplyMatricesBasic
# Parameters: (n = 500)

# Run progress: 55.56% complete, ETA 00:01:02
# Fork: 1 of 1
# Warmup Iteration   1: 61.939 ±(99.9%) 3.512 ms/op
# Warmup Iteration   2: 60.821 ±(99.9%) 0.526 ms/op
# Warmup Iteration   3: 60.694 ±(99.9%) 0.392 ms/op
# Warmup Iteration   4: 60.806 ±(99.9%) 0.557 ms/op
# Warmup Iteration   5: 60.709 ±(99.9%) 0.396 ms/op
Iteration   1: 60.671 ±(99.9%) 0.379 ms/op
                 multiplyMatricesBasic·p0.00:   60.162
 ms/op
                 multiplyMatricesBasic·p0.50:   60.424
 ms/op
                 multiplyMatricesBasic·p0.90:   61.355
 ms/op
                 multiplyMatricesBasic·p0.95:   61.407
 ms/op
                 multiplyMatricesBasic·p0.99:   61.407
 ms/op
                 multiplyMatricesBasic·p0.999:  61.407
 ms/op
                 multiplyMatricesBasic·p0.9999: 61.407
 ms/op
                 multiplyMatricesBasic·p1.00:   61.407
 ms/op

Iteration   2: 60.841 ±(99.9%) 0.546 ms/op
```

```
                  multiplyMatricesBasic·p0.00:   60.293
 ms/op
                  multiplyMatricesBasic·p0.50:   60.621
 ms/op
                  multiplyMatricesBasic·p0.90:   61.997
 ms/op
                  multiplyMatricesBasic·p0.95:   61.997
 ms/op
                  multiplyMatricesBasic·p0.99:   61.997
 ms/op
                  multiplyMatricesBasic·p0.999:  61.997
 ms/op
                  multiplyMatricesBasic·p0.9999: 61.997
 ms/op
                  multiplyMatricesBasic·p1.00:   61.997
 ms/op

Iteration   3: 61.072 ±(99.9%) 1.204 ms/op
                  multiplyMatricesBasic·p0.00:   60.031
 ms/op
                  multiplyMatricesBasic·p0.50:   60.686
 ms/op
                  multiplyMatricesBasic·p0.90:   63.006
 ms/op
                  multiplyMatricesBasic·p0.95:   65.208
 ms/op
                  multiplyMatricesBasic·p0.99:   65.208
 ms/op
                  multiplyMatricesBasic·p0.999:  65.208
 ms/op
                  multiplyMatricesBasic·p0.9999: 65.208
 ms/op
                  multiplyMatricesBasic·p1.00:   65.208
 ms/op

Iteration   4: 60.906 ±(99.9%) 0.659 ms/op
                  multiplyMatricesBasic·p0.00:   60.293
 ms/op
                  multiplyMatricesBasic·p0.50:   60.621
 ms/op
                  multiplyMatricesBasic·p0.90:   62.089
```

```
 ms/op
                 multiplyMatricesBasic·p0.95:   62.718
 ms/op
                 multiplyMatricesBasic·p0.99:   62.718
 ms/op
                 multiplyMatricesBasic·p0.999:  62.718
 ms/op
                 multiplyMatricesBasic·p0.9999: 62.718
 ms/op
                 multiplyMatricesBasic·p1.00:   62.718
 ms/op

Iteration   5: 61.126 ±(99.9%) 0.934 ms/op
                 multiplyMatricesBasic·p0.00:   60.228
 ms/op
                 multiplyMatricesBasic·p0.50:   60.752
 ms/op
                 multiplyMatricesBasic·p0.90:   62.587
 ms/op
                 multiplyMatricesBasic·p0.95:   63.898
 ms/op
                 multiplyMatricesBasic·p0.99:   63.898
 ms/op
                 multiplyMatricesBasic·p0.999:  63.898
 ms/op
                 multiplyMatricesBasic·p0.9999: 63.898
 ms/op
                 multiplyMatricesBasic·p1.00:   63.898
 ms/op

Iteration   6: 60.902 ±(99.9%) 0.564 ms/op
                 multiplyMatricesBasic·p0.00:   60.293
 ms/op
                 multiplyMatricesBasic·p0.50:   60.621
 ms/op
                 multiplyMatricesBasic·p0.90:   61.932
 ms/op
                 multiplyMatricesBasic·p0.95:   62.194
 ms/op
                 multiplyMatricesBasic·p0.99:   62.194
 ms/op
```

```
                  multiplyMatricesBasic·p0.999:  62.194
 ms/op
                  multiplyMatricesBasic·p0.9999: 62.194
 ms/op
                  multiplyMatricesBasic·p1.00:   62.194
 ms/op

Iteration   7: 60.825 ±(99.9%) 0.628 ms/op
                  multiplyMatricesBasic·p0.00:   60.162
 ms/op
                  multiplyMatricesBasic·p0.50:   60.621
 ms/op
                  multiplyMatricesBasic·p0.90:   62.167
 ms/op
                  multiplyMatricesBasic·p0.95:   62.325
 ms/op
                  multiplyMatricesBasic·p0.99:   62.325
 ms/op
                  multiplyMatricesBasic·p0.999:  62.325
 ms/op
                  multiplyMatricesBasic·p0.9999: 62.325
 ms/op
                  multiplyMatricesBasic·p1.00:   62.325
 ms/op

Iteration   8: 60.902 ±(99.9%) 0.789 ms/op
                  multiplyMatricesBasic·p0.00:   60.228
 ms/op
                  multiplyMatricesBasic·p0.50:   60.555
 ms/op
                  multiplyMatricesBasic·p0.90:   62.692
 ms/op
                  multiplyMatricesBasic·p0.95:   63.111
 ms/op
                  multiplyMatricesBasic·p0.99:   63.111
 ms/op
                  multiplyMatricesBasic·p0.999:  63.111
 ms/op
                  multiplyMatricesBasic·p0.9999: 63.111
 ms/op
                  multiplyMatricesBasic·p1.00:   63.111
```

```
 ms/op

Iteration   9: 60.706 ±(99.9%) 0.590 ms/op
                 multiplyMatricesBasic·p0.00:   60.162
 ms/op
                 multiplyMatricesBasic·p0.50:   60.424
 ms/op
                 multiplyMatricesBasic·p0.90:   61.787
 ms/op
                 multiplyMatricesBasic·p0.95:   62.521
 ms/op
                 multiplyMatricesBasic·p0.99:   62.521
 ms/op
                 multiplyMatricesBasic·p0.999:  62.521
 ms/op
                 multiplyMatricesBasic·p0.9999: 62.521
 ms/op
                 multiplyMatricesBasic·p1.00:   62.521
 ms/op

Iteration  10: 60.779 ±(99.9%) 0.751 ms/op
                 multiplyMatricesBasic·p0.00:   60.162
 ms/op
                 multiplyMatricesBasic·p0.50:   60.621
 ms/op
                 multiplyMatricesBasic·p0.90:   62.102
 ms/op
                 multiplyMatricesBasic·p0.95:   63.308
 ms/op
                 multiplyMatricesBasic·p0.99:   63.308
 ms/op
                 multiplyMatricesBasic·p0.999:  63.308
 ms/op
                 multiplyMatricesBasic·p0.9999: 63.308
 ms/op
                 multiplyMatricesBasic·p1.00:   63.308
 ms/op



Result "com.matrix.MatrixMultiplicationBenchmark.
```

```
multiplyMatricesBasic":
  N = 170
  mean =     60.873 ±(99.9%) 0.193 ms/op

  Histogram, ms/op:
    [60.000, 60.500) = 71
    [60.500, 61.000) = 51
    [61.000, 61.500) = 20
    [61.500, 62.000) = 16
    [62.000, 62.500) = 5
    [62.500, 63.000) = 3
    [63.000, 63.500) = 2
    [63.500, 64.000) = 1
    [64.000, 64.500) = 0
    [64.500, 65.000) = 0
    [65.000, 65.500) = 1

  Percentiles, ms/op:
      p(0.0000) =     60.031 ms/op
     p(50.0000) =     60.621 ms/op
     p(90.0000) =     61.866 ms/op
     p(95.0000) =     62.384 ms/op
     p(99.0000) =     64.278 ms/op
     p(99.9000) =     65.208 ms/op
     p(99.9900) =     65.208 ms/op
     p(99.9990) =     65.208 ms/op
     p(99.9999) =     65.208 ms/op
    p(100.0000) =     65.208 ms/op


# 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=60505:/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.
multiplyMatricesBasic
# Parameters: (n = 1000)

# Run progress: 66.67% complete, ETA 00:00:47
# Fork: 1 of 1
# Warmup Iteration   1: 952.631 ms/op
# Warmup Iteration   2: 949.486 ms/op
# Warmup Iteration   3: 963.117 ms/op
# Warmup Iteration   4: 958.398 ms/op
# Warmup Iteration   5: 961.544 ms/op
Iteration   1: 958.398 ms/op
                 multiplyMatricesBasic·p0.00:   955.
253 ms/op
                 multiplyMatricesBasic·p0.50:   958.
398 ms/op
                 multiplyMatricesBasic·p0.90:   961.
544 ms/op
                 multiplyMatricesBasic·p0.95:   961.
544 ms/op
                 multiplyMatricesBasic·p0.99:   961.
544 ms/op
                 multiplyMatricesBasic·p0.999:  961.
544 ms/op
                 multiplyMatricesBasic·p0.9999: 961.
544 ms/op
                 multiplyMatricesBasic·p1.00:   961.
544 ms/op

Iteration   2: 966.263 ms/op
                 multiplyMatricesBasic·p0.00:   955.
253 ms/op
                 multiplyMatricesBasic·p0.50:   966.
263 ms/op
                 multiplyMatricesBasic·p0.90:   977.
273 ms/op
                 multiplyMatricesBasic·p0.95:   977.
```

```
273 ms/op
                 multiplyMatricesBasic·p0.99:   977.
273 ms/op
                 multiplyMatricesBasic·p0.999:  977.
273 ms/op
                 multiplyMatricesBasic·p0.9999: 977.
273 ms/op
                 multiplyMatricesBasic·p1.00:   977.
273 ms/op

Iteration   3: 956.301 ms/op
                 multiplyMatricesBasic·p0.00:   954.
204 ms/op
                 multiplyMatricesBasic·p0.50:   956.
301 ms/op
                 multiplyMatricesBasic·p0.90:   958.
398 ms/op
                 multiplyMatricesBasic·p0.95:   958.
398 ms/op
                 multiplyMatricesBasic·p0.99:   958.
398 ms/op
                 multiplyMatricesBasic·p0.999:  958.
398 ms/op
                 multiplyMatricesBasic·p0.9999: 958.
398 ms/op
                 multiplyMatricesBasic·p1.00:   958.
398 ms/op

Iteration   4: 957.874 ms/op
                 multiplyMatricesBasic·p0.00:   953.
156 ms/op
                 multiplyMatricesBasic·p0.50:   957.
874 ms/op
                 multiplyMatricesBasic·p0.90:   962.
593 ms/op
                 multiplyMatricesBasic·p0.95:   962.
593 ms/op
                 multiplyMatricesBasic·p0.99:   962.
593 ms/op
                 multiplyMatricesBasic·p0.999:  962.
593 ms/op
```

```
                 multiplyMatricesBasic·p0.9999: 962.
593 ms/op
                 multiplyMatricesBasic·p1.00:   962.
593 ms/op

Iteration   5: 964.690 ms/op
                 multiplyMatricesBasic·p0.00:   963.
641 ms/op
                 multiplyMatricesBasic·p0.50:   964.
690 ms/op
                 multiplyMatricesBasic·p0.90:   965.
738 ms/op
                 multiplyMatricesBasic·p0.95:   965.
738 ms/op
                 multiplyMatricesBasic·p0.99:   965.
738 ms/op
                 multiplyMatricesBasic·p0.999:  965.
738 ms/op
                 multiplyMatricesBasic·p0.9999: 965.
738 ms/op
                 multiplyMatricesBasic·p1.00:   965.
738 ms/op

Iteration   6: 966.787 ms/op
                 multiplyMatricesBasic·p0.00:   955.
253 ms/op
                 multiplyMatricesBasic·p0.50:   966.
787 ms/op
                 multiplyMatricesBasic·p0.90:   978.
321 ms/op
                 multiplyMatricesBasic·p0.95:   978.
321 ms/op
                 multiplyMatricesBasic·p0.99:   978.
321 ms/op
                 multiplyMatricesBasic·p0.999:  978.
321 ms/op
                 multiplyMatricesBasic·p0.9999: 978.
321 ms/op
                 multiplyMatricesBasic·p1.00:   978.
321 ms/op
```

```
Iteration   7: 973.079 ms/op
                 multiplyMatricesBasic·p0.00:   953.
156 ms/op
                 multiplyMatricesBasic·p0.50:   973.
079 ms/op
                 multiplyMatricesBasic·p0.90:   993.
001 ms/op
                 multiplyMatricesBasic·p0.95:   993.
001 ms/op
                 multiplyMatricesBasic·p0.99:   993.
001 ms/op
                 multiplyMatricesBasic·p0.999:  993.
001 ms/op
                 multiplyMatricesBasic·p0.9999: 993.
001 ms/op
                 multiplyMatricesBasic·p1.00:   993.
001 ms/op

Iteration   8: 1005.584 ms/op
                 multiplyMatricesBasic·p0.00:   1005.
584 ms/op
                 multiplyMatricesBasic·p0.50:   1005.
584 ms/op
                 multiplyMatricesBasic·p0.90:   1005.
584 ms/op
                 multiplyMatricesBasic·p0.95:   1005.
584 ms/op
                 multiplyMatricesBasic·p0.99:   1005.
584 ms/op
                 multiplyMatricesBasic·p0.999:  1005.
584 ms/op
                 multiplyMatricesBasic·p0.9999: 1005.
584 ms/op
                 multiplyMatricesBasic·p1.00:   1005.
584 ms/op

Iteration   9: 969.409 ms/op
                 multiplyMatricesBasic·p0.00:   962.
593 ms/op
                 multiplyMatricesBasic·p0.50:   969.
409 ms/op
```

```
                 multiplyMatricesBasic·p0.90:   976.
224 ms/op
                 multiplyMatricesBasic·p0.95:   976.
224 ms/op
                 multiplyMatricesBasic·p0.99:   976.
224 ms/op
                 multiplyMatricesBasic·p0.999:  976.
224 ms/op
                 multiplyMatricesBasic·p0.9999: 976.
224 ms/op
                 multiplyMatricesBasic·p1.00:   976.
224 ms/op

Iteration  10: 968.884 ms/op
                 multiplyMatricesBasic·p0.00:   961.
544 ms/op
                 multiplyMatricesBasic·p0.50:   968.
884 ms/op
                 multiplyMatricesBasic·p0.90:   976.
224 ms/op
                 multiplyMatricesBasic·p0.95:   976.
224 ms/op
                 multiplyMatricesBasic·p0.99:   976.
224 ms/op
                 multiplyMatricesBasic·p0.999:  976.
224 ms/op
                 multiplyMatricesBasic·p0.9999: 976.
224 ms/op
                 multiplyMatricesBasic·p1.00:   976.
224 ms/op



Result "com.matrix.MatrixMultiplicationBenchmark.
multiplyMatricesBasic":
  N = 19
  mean =    966.787 ±(99.9%) 12.924 ms/op

  Histogram, ms/op:
    [ 950.000,  955.000) = 3
    [ 955.000,  960.000) = 4
```

```
    [ 960.000,  965.000) = 5
    [ 965.000,  970.000) = 1
    [ 970.000,  975.000) = 0
    [ 975.000,  980.000) = 4
    [ 980.000,  985.000) = 0
    [ 985.000,  990.000) = 0
    [ 990.000,  995.000) = 1
    [ 995.000, 1000.000) = 0
    [1000.000, 1005.000) = 0

  Percentiles, ms/op:
      p(0.0000) =    953.156 ms/op
     p(50.0000) =    962.593 ms/op
     p(90.0000) =    993.001 ms/op
     p(95.0000) =   1005.584 ms/op
     p(99.0000) =   1005.584 ms/op
     p(99.9000) =   1005.584 ms/op
     p(99.9900) =   1005.584 ms/op
     p(99.9990) =   1005.584 ms/op
     p(99.9999) =   1005.584 ms/op
    p(100.0000) =   1005.584 ms/op


# 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=60505:/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.
multiplyMatricesBasic
# Parameters: (n = 1500)
```

```
# Run progress: 77.78% complete, ETA 00:00:35
# Fork: 1 of 1
# Warmup Iteration   1: 3640.656 ms/op
# Warmup Iteration   2: 3623.879 ms/op
# Warmup Iteration   3: 3611.296 ms/op
# Warmup Iteration   4: 3615.490 ms/op
# Warmup Iteration   5: 3607.101 ms/op
Iteration   1: 3602.907 ms/op
                 multiplyMatricesBasic·p0.00:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.50:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.90:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.95:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.99:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.999:  3602.
907 ms/op
                 multiplyMatricesBasic·p0.9999: 3602.
907 ms/op
                 multiplyMatricesBasic·p1.00:   3602.
907 ms/op

Iteration   2: 3619.684 ms/op
                 multiplyMatricesBasic·p0.00:   3619.
684 ms/op
                 multiplyMatricesBasic·p0.50:   3619.
684 ms/op
                 multiplyMatricesBasic·p0.90:   3619.
684 ms/op
                 multiplyMatricesBasic·p0.95:   3619.
684 ms/op
                 multiplyMatricesBasic·p0.99:   3619.
684 ms/op
                 multiplyMatricesBasic·p0.999:  3619.
684 ms/op
                 multiplyMatricesBasic·p0.9999: 3619.
684 ms/op
```

```
                 multiplyMatricesBasic·p1.00:   3619.
684 ms/op

Iteration   3: 3628.073 ms/op
                 multiplyMatricesBasic·p0.00:   3628.
073 ms/op
                 multiplyMatricesBasic·p0.50:   3628.
073 ms/op
                 multiplyMatricesBasic·p0.90:   3628.
073 ms/op
                 multiplyMatricesBasic·p0.95:   3628.
073 ms/op
                 multiplyMatricesBasic·p0.99:   3628.
073 ms/op
                 multiplyMatricesBasic·p0.999:  3628.
073 ms/op
                 multiplyMatricesBasic·p0.9999: 3628.
073 ms/op
                 multiplyMatricesBasic·p1.00:   3628.
073 ms/op

Iteration   4: 3619.684 ms/op
                 multiplyMatricesBasic·p0.00:   3619.
684 ms/op
                 multiplyMatricesBasic·p0.50:   3619.
684 ms/op
                 multiplyMatricesBasic·p0.90:   3619.
684 ms/op
                 multiplyMatricesBasic·p0.95:   3619.
684 ms/op
                 multiplyMatricesBasic·p0.99:   3619.
684 ms/op
                 multiplyMatricesBasic·p0.999:  3619.
684 ms/op
                 multiplyMatricesBasic·p0.9999: 3619.
684 ms/op
                 multiplyMatricesBasic·p1.00:   3619.
684 ms/op

Iteration   5: 3607.101 ms/op
                 multiplyMatricesBasic·p0.00:   3607.
```

```
101 ms/op
                 multiplyMatricesBasic·p0.50:   3607.
101 ms/op
                 multiplyMatricesBasic·p0.90:   3607.
101 ms/op
                 multiplyMatricesBasic·p0.95:   3607.
101 ms/op
                 multiplyMatricesBasic·p0.99:   3607.
101 ms/op
                 multiplyMatricesBasic·p0.999:  3607.
101 ms/op
                 multiplyMatricesBasic·p0.9999: 3607.
101 ms/op
                 multiplyMatricesBasic·p1.00:   3607.
101 ms/op

Iteration   6: 3602.907 ms/op
                 multiplyMatricesBasic·p0.00:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.50:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.90:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.95:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.99:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.999:  3602.
907 ms/op
                 multiplyMatricesBasic·p0.9999: 3602.
907 ms/op
                 multiplyMatricesBasic·p1.00:   3602.
907 ms/op

Iteration   7: 3607.101 ms/op
                 multiplyMatricesBasic·p0.00:   3607.
101 ms/op
                 multiplyMatricesBasic·p0.50:   3607.
101 ms/op
                 multiplyMatricesBasic·p0.90:   3607.
101 ms/op
```

```
                 multiplyMatricesBasic·p0.95:   3607.
101 ms/op
                 multiplyMatricesBasic·p0.99:   3607.
101 ms/op
                 multiplyMatricesBasic·p0.999:  3607.
101 ms/op
                 multiplyMatricesBasic·p0.9999: 3607.
101 ms/op
                 multiplyMatricesBasic·p1.00:   3607.
101 ms/op

Iteration   8: 3615.490 ms/op
                 multiplyMatricesBasic·p0.00:   3615.
490 ms/op
                 multiplyMatricesBasic·p0.50:   3615.
490 ms/op
                 multiplyMatricesBasic·p0.90:   3615.
490 ms/op
                 multiplyMatricesBasic·p0.95:   3615.
490 ms/op
                 multiplyMatricesBasic·p0.99:   3615.
490 ms/op
                 multiplyMatricesBasic·p0.999:  3615.
490 ms/op
                 multiplyMatricesBasic·p0.9999: 3615.
490 ms/op
                 multiplyMatricesBasic·p1.00:   3615.
490 ms/op

Iteration   9: 3602.907 ms/op
                 multiplyMatricesBasic·p0.00:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.50:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.90:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.95:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.99:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.999:  3602.
```

```
907 ms/op
                 multiplyMatricesBasic·p0.9999: 3602.
907 ms/op
                 multiplyMatricesBasic·p1.00:   3602.
907 ms/op

Iteration  10: 3602.907 ms/op
                 multiplyMatricesBasic·p0.00:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.50:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.90:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.95:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.99:   3602.
907 ms/op
                 multiplyMatricesBasic·p0.999:  3602.
907 ms/op
                 multiplyMatricesBasic·p0.9999: 3602.
907 ms/op
                 multiplyMatricesBasic·p1.00:   3602.
907 ms/op



Result "com.matrix.MatrixMultiplicationBenchmark.
multiplyMatricesBasic":
  N = 10
  mean =   3610.876 ±(99.9%) 13.845 ms/op

  Histogram, ms/op:
    [3600.000, 3602.500) = 0
    [3602.500, 3605.000) = 4
    [3605.000, 3607.500) = 2
    [3607.500, 3610.000) = 0
    [3610.000, 3612.500) = 0
    [3612.500, 3615.000) = 0
    [3615.000, 3617.500) = 1
    [3617.500, 3620.000) = 2
    [3620.000, 3622.500) = 0
```

```
    [3622.500, 3625.000) = 0
    [3625.000, 3627.500) = 0

  Percentiles, ms/op:
      p(0.0000) =   3602.907 ms/op
     p(50.0000) =   3607.101 ms/op
     p(90.0000) =   3627.234 ms/op
     p(95.0000) =   3628.073 ms/op
     p(99.0000) =   3628.073 ms/op
     p(99.9000) =   3628.073 ms/op
     p(99.9900) =   3628.073 ms/op
     p(99.9990) =   3628.073 ms/op
     p(99.9999) =   3628.073 ms/op
    p(100.0000) =   3628.073 ms/op


# 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=60505:/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.
multiplyMatricesBasic
# Parameters: (n = 2000)

# Run progress: 88.89% complete, ETA 00:00:22
# Fork: 1 of 1
# Warmup Iteration   1: 8959.033 ms/op
# Warmup Iteration   2: 8992.588 ms/op
# Warmup Iteration   3: 8975.811 ms/op
# Warmup Iteration   4: 8959.033 ms/op
```

```
# Warmup Iteration   5: 9042.919 ms/op
Iteration   1: 8975.811 ms/op
                 multiplyMatricesBasic·p0.00:   8975.
811 ms/op
                 multiplyMatricesBasic·p0.50:   8975.
811 ms/op
                 multiplyMatricesBasic·p0.90:   8975.
811 ms/op
                 multiplyMatricesBasic·p0.95:   8975.
811 ms/op
                 multiplyMatricesBasic·p0.99:   8975.
811 ms/op
                 multiplyMatricesBasic·p0.999:  8975.
811 ms/op
                 multiplyMatricesBasic·p0.9999: 8975.
811 ms/op
                 multiplyMatricesBasic·p1.00:   8975.
811 ms/op

Iteration   2: 9026.142 ms/op
                 multiplyMatricesBasic·p0.00:   9026.
142 ms/op
                 multiplyMatricesBasic·p0.50:   9026.
142 ms/op
                 multiplyMatricesBasic·p0.90:   9026.
142 ms/op
                 multiplyMatricesBasic·p0.95:   9026.
142 ms/op
                 multiplyMatricesBasic·p0.99:   9026.
142 ms/op
                 multiplyMatricesBasic·p0.999:  9026.
142 ms/op
                 multiplyMatricesBasic·p0.9999: 9026.
142 ms/op
                 multiplyMatricesBasic·p1.00:   9026.
142 ms/op

Iteration   3: 8959.033 ms/op
                 multiplyMatricesBasic·p0.00:   8959.
033 ms/op
                 multiplyMatricesBasic·p0.50:   8959.
```

```
033 ms/op
                 multiplyMatricesBasic·p0.90:   8959.
033 ms/op
                 multiplyMatricesBasic·p0.95:   8959.
033 ms/op
                 multiplyMatricesBasic·p0.99:   8959.
033 ms/op
                 multiplyMatricesBasic·p0.999:  8959.
033 ms/op
                 multiplyMatricesBasic·p0.9999: 8959.
033 ms/op
                 multiplyMatricesBasic·p1.00:   8959.
033 ms/op

Iteration   4: 8959.033 ms/op
                 multiplyMatricesBasic·p0.00:   8959.
033 ms/op
                 multiplyMatricesBasic·p0.50:   8959.
033 ms/op
                 multiplyMatricesBasic·p0.90:   8959.
033 ms/op
                 multiplyMatricesBasic·p0.95:   8959.
033 ms/op
                 multiplyMatricesBasic·p0.99:   8959.
033 ms/op
                 multiplyMatricesBasic·p0.999:  8959.
033 ms/op
                 multiplyMatricesBasic·p0.9999: 8959.
033 ms/op
                 multiplyMatricesBasic·p1.00:   8959.
033 ms/op

Iteration   5: 8942.256 ms/op
                 multiplyMatricesBasic·p0.00:   8942.
256 ms/op
                 multiplyMatricesBasic·p0.50:   8942.
256 ms/op
                 multiplyMatricesBasic·p0.90:   8942.
256 ms/op
                 multiplyMatricesBasic·p0.95:   8942.
256 ms/op
```

```
                  multiplyMatricesBasic·p0.99:   8942.
256 ms/op
                  multiplyMatricesBasic·p0.999:  8942.
256 ms/op
                  multiplyMatricesBasic·p0.9999: 8942.
256 ms/op
                  multiplyMatricesBasic·p1.00:   8942.
256 ms/op

Iteration   6: 8959.033 ms/op
                  multiplyMatricesBasic·p0.00:   8959.
033 ms/op
                  multiplyMatricesBasic·p0.50:   8959.
033 ms/op
                  multiplyMatricesBasic·p0.90:   8959.
033 ms/op
                  multiplyMatricesBasic·p0.95:   8959.
033 ms/op
                  multiplyMatricesBasic·p0.99:   8959.
033 ms/op
                  multiplyMatricesBasic·p0.999:  8959.
033 ms/op
                  multiplyMatricesBasic·p0.9999: 8959.
033 ms/op
                  multiplyMatricesBasic·p1.00:   8959.
033 ms/op

Iteration   7: 8959.033 ms/op
                  multiplyMatricesBasic·p0.00:   8959.
033 ms/op
                  multiplyMatricesBasic·p0.50:   8959.
033 ms/op
                  multiplyMatricesBasic·p0.90:   8959.
033 ms/op
                  multiplyMatricesBasic·p0.95:   8959.
033 ms/op
                  multiplyMatricesBasic·p0.99:   8959.
033 ms/op
                  multiplyMatricesBasic·p0.999:  8959.
033 ms/op
                  multiplyMatricesBasic·p0.9999: 8959.
```

```
033 ms/op
                 multiplyMatricesBasic·p1.00:   8959.
033 ms/op

Iteration   8: 8908.702 ms/op
                 multiplyMatricesBasic·p0.00:   8908.
702 ms/op
                 multiplyMatricesBasic·p0.50:   8908.
702 ms/op
                 multiplyMatricesBasic·p0.90:   8908.
702 ms/op
                 multiplyMatricesBasic·p0.95:   8908.
702 ms/op
                 multiplyMatricesBasic·p0.99:   8908.
702 ms/op
                 multiplyMatricesBasic·p0.999:  8908.
702 ms/op
                 multiplyMatricesBasic·p0.9999: 8908.
702 ms/op
                 multiplyMatricesBasic·p1.00:   8908.
702 ms/op

Iteration   9: 8992.588 ms/op
                 multiplyMatricesBasic·p0.00:   8992.
588 ms/op
                 multiplyMatricesBasic·p0.50:   8992.
588 ms/op
                 multiplyMatricesBasic·p0.90:   8992.
588 ms/op
                 multiplyMatricesBasic·p0.95:   8992.
588 ms/op
                 multiplyMatricesBasic·p0.99:   8992.
588 ms/op
                 multiplyMatricesBasic·p0.999:  8992.
588 ms/op
                 multiplyMatricesBasic·p0.9999: 8992.
588 ms/op
                 multiplyMatricesBasic·p1.00:   8992.
588 ms/op

Iteration  10: 8925.479 ms/op
```

```
                  multiplyMatricesBasic·p0.00:   8925.
479 ms/op
                  multiplyMatricesBasic·p0.50:   8925.
479 ms/op
                  multiplyMatricesBasic·p0.90:   8925.
479 ms/op
                  multiplyMatricesBasic·p0.95:   8925.
479 ms/op
                  multiplyMatricesBasic·p0.99:   8925.
479 ms/op
                  multiplyMatricesBasic·p0.999:  8925.
479 ms/op
                  multiplyMatricesBasic·p0.9999: 8925.
479 ms/op
                  multiplyMatricesBasic·p1.00:   8925.
479 ms/op



Result "com.matrix.MatrixMultiplicationBenchmark.
multiplyMatricesBasic":
  N = 10
  mean =   8960.711 ±(99.9%) 49.948 ms/op

  Histogram, ms/op:
    [8900.000, 8912.500) = 1
    [8912.500, 8925.000) = 0
    [8925.000, 8937.500) = 1
    [8937.500, 8950.000) = 1
    [8950.000, 8962.500) = 4
    [8962.500, 8975.000) = 0
    [8975.000, 8987.500) = 1
    [8987.500, 9000.000) = 1
    [9000.000, 9012.500) = 0
    [9012.500, 9025.000) = 0
    [9025.000, 9037.500) = 1
    [9037.500, 9050.000) = 0
    [9050.000, 9062.500) = 0
    [9062.500, 9075.000) = 0
    [9075.000, 9087.500) = 0
```

```
  Percentiles, ms/op:
      p(0.0000) =   8908.702 ms/op
     p(50.0000) =   8959.033 ms/op
     p(90.0000) =   9022.787 ms/op
     p(95.0000) =   9026.142 ms/op
     p(99.0000) =   9026.142 ms/op
     p(99.9000) =   9026.142 ms/op
     p(99.9900) =   9026.142 ms/op
     p(99.9990) =   9026.142 ms/op
     p(99.9999) =   9026.142 ms/op
    p(100.0000) =   9026.142 ms/op


# Run complete. Total time: 00:05:13

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.multiplyMatricesBasic
                                  10  sample  328983
    ≈ 10⁻³           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.00      10  sample
            ≈ 10⁻³           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.50      10  sample
            ≈ 10⁻³           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.90      10  sample
```

```
              0.001           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.95      10  sample
              0.001           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.99      10  sample
              0.001           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.999     10  sample
              0.001           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.9999    10  sample
              0.012           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p1.00      10  sample
              0.033           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic
                                  20  sample  363258
     0.003 ±  0.001  ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.00      20  sample
              0.003           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.50      20  sample
              0.003           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.90      20  sample
              0.003           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.95      20  sample
              0.004           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.99      20  sample
              0.004           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.999     20  sample
              0.010           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.9999    20  sample
              0.016           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
```

```
multiplyMatricesBasic·p1.00      20  sample
             0.051           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic
                                 50  sample  196014
     0.051 ±  0.001  ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.00      50  sample
             0.046           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.50      50  sample
             0.051           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.90      50  sample
             0.052           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.95      50  sample
             0.055           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.99      50  sample
             0.062           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.999     50  sample
             0.066           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.9999    50  sample
             0.082           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p1.00      50  sample
             0.242           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic
                                 100  sample   24789
     0.405 ±  0.001  ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.00     100  sample
             0.373           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.50     100  sample
             0.401           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.90     100  sample
             0.414           ms/op
```

```
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.95     100  sample
             0.421           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.99     100  sample
             0.447           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.999    100  sample
             0.505           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.9999   100  sample
             0.514           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p1.00     100  sample
             0.517           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic
                                 200  sample    2961
     3.394 ±  0.003  ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.00     200  sample
             3.273           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.50     200  sample
             3.379           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.90     200  sample
             3.437           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.95     200  sample
             3.477           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.99     200  sample
             3.576           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.999    200  sample
             3.876           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.9999   200  sample
             4.035           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p1.00     200  sample
```

```
              4.035           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic
                                  500  sample     170
    60.873 ±  0.193  ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.00     500  sample
            60.031           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.50     500  sample
            60.621           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.90     500  sample
            61.866           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.95     500  sample
            62.384           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.99     500  sample
            64.278           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.999    500  sample
            65.208           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.9999   500  sample
            65.208           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p1.00     500  sample
            65.208           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic
                                 1000  sample      19
   966.787 ± 12.924  ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.00    1000  sample
953.156           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.50    1000  sample
962.593           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.90    1000  sample
993.001           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
```

```
multiplyMatricesBasic·p0.95    1000  sample
1005.584           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.99    1000  sample
1005.584           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.999   1000  sample
1005.584           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.9999  1000  sample
1005.584           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p1.00    1000  sample
1005.584           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic
                                1500  sample      10
3610.876 ± 13.845  ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.00    1500  sample
3602.907           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.50    1500  sample
3607.101           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.90    1500  sample
3627.234           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.95    1500  sample
3628.073           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.99    1500  sample
3628.073           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.999   1500  sample
3628.073           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.9999  1500  sample
3628.073           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p1.00    1500  sample
3628.073           ms/op
```

```
MatrixMultiplicationBenchmark.multiplyMatricesBasic
                                 2000  sample      10
8960.711 ± 49.948  ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.00    2000  sample
8908.702           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.50    2000  sample
8959.033           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.90    2000  sample
9022.787           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.95    2000  sample
9026.142           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.99    2000  sample
9026.142           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.999   2000  sample
9026.142           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p0.9999  2000  sample
9026.142           ms/op
MatrixMultiplicationBenchmark.multiplyMatricesBasic:
multiplyMatricesBasic·p1.00    2000  sample
9026.142           ms/op

Process finished with exit code 0
```