```
/Users/zuzannafurtak/Library/Java/
JavaVirtualMachines/corretto-17.0.8/Contents/Home/
bin/java -javaagent:/Applications/IntelliJ IDEA.app
/Contents/lib/idea_rt.jar=51433:/Applications/
IntelliJ IDEA.app/Contents/bin -Dfile.encoding=UTF-
8 -classpath /Users/zuzannafurtak/studia/las_palmas
/big_data/benchmarking/java_project/target/classes
:/Users/zuzannafurtak/.m2/repository/org/
springframework/boot/spring-boot-starter/3.3.4/
spring-boot-starter-3.3.4.jar:/Users/zuzannafurtak
/.m2/repository/org/springframework/boot/spring-
boot/3.3.4/spring-boot-3.3.4.jar:/Users/
zuzannafurtak/.m2/repository/org/springframework/
spring-context/6.1.13/spring-context-6.1.13.jar:/
Users/zuzannafurtak/.m2/repository/org/
springframework/spring-aop/6.1.13/spring-aop-6.1.13
.jar:/Users/zuzannafurtak/.m2/repository/org/
springframework/spring-beans/6.1.13/spring-beans-6.
1.13.jar:/Users/zuzannafurtak/.m2/repository/org/
springframework/spring-expression/6.1.13/spring-
expression-6.1.13.jar:/Users/zuzannafurtak/.m2/
repository/io/micrometer/micrometer-observation/1.
13.4/micrometer-observation-1.13.4.jar:/Users/
zuzannafurtak/.m2/repository/io/micrometer/
micrometer-commons/1.13.4/micrometer-commons-1.13.4
.jar:/Users/zuzannafurtak/.m2/repository/org/
springframework/boot/spring-boot-autoconfigure/3.3.
4/spring-boot-autoconfigure-3.3.4.jar:/Users/
zuzannafurtak/.m2/repository/org/springframework/
boot/spring-boot-starter-logging/3.3.4/spring-boot-
starter-logging-3.3.4.jar:/Users/zuzannafurtak/.m2/
repository/ch/qos/logback/logback-classic/1.5.8/
logback-classic-1.5.8.jar:/Users/zuzannafurtak/.m2/
repository/ch/qos/logback/logback-core/1.5.8/
logback-core-1.5.8.jar:/Users/zuzannafurtak/.m2/
repository/org/apache/logging/log4j/log4j-to-slf4j/
2.23.1/log4j-to-slf4j-2.23.1.jar:/Users/
zuzannafurtak/.m2/repository/org/apache/logging/
log4j/log4j-api/2.23.1/log4j-api-2.23.1.jar:/Users/
zuzannafurtak/.m2/repository/org/slf4j/jul-to-slf4j
/2.0.16/jul-to-slf4j-2.0.16.jar:/Users/
```

```
zuzannafurtak/.m2/repository/jakarta/annotation/jakarta.annotation-api/2.1.1/jakarta.annotation-api-2.1.1.jar:/Users/zuzannafurtak/.m2/repository/org/springframework/spring-core/6.1.13/spring-core-6.1.13.jar:/Users/zuzannafurtak/.m2/repository/org/springframework/spring-jcl/6.1.13/spring-jcl-6.1.13.jar:/Users/zuzannafurtak/.m2/repository/org/yaml/snakeyaml/2.2/snakeyaml-2.2.jar:/Users/zuzannafurtak/.m2/repository/org/slf4j/slf4j-api/2.0.16/slf4j-api-2.0.16.jar:/Users/zuzannafurtak/.m2/repository/org/openjdk/jmh/jmh-core/1.36/jmh-core-1.36.jar:/Users/zuzannafurtak/.m2/repository/net/sf/jopt-simple/jopt-simple/5.0.4/jopt-simple-5.0.4.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/1.36/jmh-generator-annprocess-1.36.jar com.big_data.java_project.MatrixMultiplicationBenchmark
# JMH version: 1.36
# 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=51433:/Applications/IntelliJ IDEA.app/Contents/bin -Dfile.encoding=UTF-8
# Blackhole mode: compiler (auto-detected, use -Djmh.blackhole.autoDetect=false to disable)
# Warmup: 9 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.big_data.java_project.MatrixMultiplicationBenchmark.multiplyMatrices
# Parameters: (size = 5)

# Run progress: 0.00% complete, ETA 00:01:54
```

```
# Fork: 1 of 1
# Warmup Iteration   1: ≈ 10⁻⁴ ms/op
# Warmup Iteration   2: ≈ 10⁻⁴ ms/op
# Warmup Iteration   3: ≈ 10⁻⁴ ms/op
# Warmup Iteration   4: ≈ 10⁻⁴ ms/op
# Warmup Iteration   5: ≈ 10⁻⁴ ms/op
# Warmup Iteration   6: ≈ 10⁻⁴ ms/op
# Warmup Iteration   7: ≈ 10⁻⁴ ms/op
# Warmup Iteration   8: ≈ 10⁻⁴ ms/op
# Warmup Iteration   9: ≈ 10⁻⁴ ms/op
Iteration   1: ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.00:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.50:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.90:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.95:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.99:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.999:  ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.9999: 0.006 ms/op
                 multiplyMatrices·p1.00:   0.012 ms/op

Iteration   2: ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.00:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.50:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.90:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.95:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.99:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.999:  ≈ 10⁻⁴ ms/op
```

```
                 multiplyMatrices·p0.9999: ≈ 10⁻³ ms/op
                 multiplyMatrices·p1.00:   0.001 ms/op

Iteration   3: ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.00:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.50:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.90:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.95:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.99:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.999:  ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.9999: 0.004 ms/op
                 multiplyMatrices·p1.00:   0.008 ms/op

Iteration   4: ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.00:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.50:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.90:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.95:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.99:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.999:  ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.9999: 0.008 ms/op
                 multiplyMatrices·p1.00:   0.011 ms/op

```

```
Iteration   5: ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.00:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.50:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.90:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.95:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.99:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.999:  ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.9999: ≈ 10⁻³ ms/op
                 multiplyMatrices·p1.00:   0.002 ms/op

Iteration   6: ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.00:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.50:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.90:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.95:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.99:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.999:  ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.9999: 0.005 ms/op
                 multiplyMatrices·p1.00:   0.008 ms/op

Iteration   7: ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.00:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.50:   ≈ 10⁻⁴ ms/op
```

```
                    multiplyMatrices·p0.90:   ≈ 10⁻⁴ ms/op
                    multiplyMatrices·p0.95:   ≈ 10⁻⁴ ms/op
                    multiplyMatrices·p0.99:   ≈ 10⁻⁴ ms/op
                    multiplyMatrices·p0.999:  ≈ 10⁻⁴ ms/op
                    multiplyMatrices·p0.9999: 0.010 ms/op
                    multiplyMatrices·p1.00:   0.014 ms/op

Iteration   8: ≈ 10⁻⁴ ms/op
                    multiplyMatrices·p0.00:   ≈ 10⁻⁴ ms/op
                    multiplyMatrices·p0.50:   ≈ 10⁻⁴ ms/op
                    multiplyMatrices·p0.90:   ≈ 10⁻⁴ ms/op
                    multiplyMatrices·p0.95:   ≈ 10⁻⁴ ms/op
                    multiplyMatrices·p0.99:   ≈ 10⁻⁴ ms/op
                    multiplyMatrices·p0.999:  ≈ 10⁻⁴ ms/op
                    multiplyMatrices·p0.9999: 0.002 ms/op
                    multiplyMatrices·p1.00:   0.002 ms/op

Iteration   9: ≈ 10⁻⁴ ms/op
                    multiplyMatrices·p0.00:   ≈ 10⁻⁴ ms/op
                    multiplyMatrices·p0.50:   ≈ 10⁻⁴ ms/op
                    multiplyMatrices·p0.90:   ≈ 10⁻⁴ ms/op
                    multiplyMatrices·p0.95:   ≈ 10⁻⁴ ms/op
                    multiplyMatrices·p0.99:   ≈ 10⁻⁴
```

```
ms/op
                 multiplyMatrices·p0.999:  ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.9999: 0.005 ms/op
                 multiplyMatrices·p1.00:   0.007 ms/op

Iteration  10: ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.00:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.50:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.90:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.95:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.99:   ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.999:  ≈ 10⁻⁴ ms/op
                 multiplyMatrices·p0.9999: 0.004 ms/op
                 multiplyMatrices·p1.00:   0.007 ms/op



Result "com.big_data.java_project.MatrixMultiplicationBenchmark.multiplyMatrices":
  N = 225776
  mean =     ≈ 10⁻⁴ ±(99.9%) 0.001 ms/op

  Histogram, ms/op:
    [0.000, 0.001) = 225742
    [0.001, 0.003) = 6
    [0.003, 0.004) = 1
    [0.004, 0.005) = 3
    [0.005, 0.006) = 8
    [0.006, 0.008) = 5
    [0.008, 0.009) = 6
```

```
    [0.009, 0.010) = 1
    [0.010, 0.011) = 2
    [0.011, 0.013) = 1
    [0.013, 0.014) = 1
    [0.014, 0.015) = 0
    [0.015, 0.016) = 0
    [0.016, 0.018) = 0
    [0.018, 0.019) = 0

  Percentiles, ms/op:
      p(0.0000) =     ≈ 10⁻⁴ ms/op
     p(50.0000) =     ≈ 10⁻⁴ ms/op
     p(90.0000) =     ≈ 10⁻⁴ ms/op
     p(95.0000) =     ≈ 10⁻⁴ ms/op
     p(99.0000) =     ≈ 10⁻⁴ ms/op
     p(99.9000) =     ≈ 10⁻⁴ ms/op
     p(99.9900) =      0.005 ms/op
     p(99.9990) =      0.012 ms/op
     p(99.9999) =      0.014 ms/op
    p(100.0000) =      0.014 ms/op


# JMH version: 1.36
# 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=51433:/Applications/IntelliJ IDEA.app/Contents/bin -Dfile.encoding=UTF-8
# Blackhole mode: compiler (auto-detected, use -Djmh.blackhole.autoDetect=false to disable)
# Warmup: 9 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.big_data.java_project.MatrixMultiplicationBenchmark.multiplyMatrices
```

```
# Parameters: (size = 10)

# Run progress: 16.67% complete, ETA 00:01:38
# Fork: 1 of 1
# Warmup Iteration   1: 0.001 ±(99.9%) 0.001 ms/op
# Warmup Iteration   2: 0.001 ±(99.9%) 0.001 ms/op
# Warmup Iteration   3: 0.001 ±(99.9%) 0.001 ms/op
# Warmup Iteration   4: 0.001 ±(99.9%) 0.001 ms/op
# Warmup Iteration   5: 0.001 ±(99.9%) 0.001 ms/op
# Warmup Iteration   6: 0.001 ±(99.9%) 0.001 ms/op
# Warmup Iteration   7: 0.001 ±(99.9%) 0.001 ms/op
# Warmup Iteration   8: 0.001 ±(99.9%) 0.001 ms/op
# Warmup Iteration   9: 0.001 ±(99.9%) 0.001 ms/op
Iteration   1: 0.001 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.001 ms/op
                 multiplyMatrices·p0.50:   0.001 ms/op
                 multiplyMatrices·p0.90:   0.001 ms/op
                 multiplyMatrices·p0.95:   0.001 ms/op
                 multiplyMatrices·p0.99:   0.001 ms/op
                 multiplyMatrices·p0.999:  0.001 ms/op
                 multiplyMatrices·p0.9999: 0.009 ms/op
                 multiplyMatrices·p1.00:   0.015 ms/op

Iteration   2: 0.001 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   ≈ 10⁻³ ms/op
                 multiplyMatrices·p0.50:   0.001 ms/op
                 multiplyMatrices·p0.90:   0.001 ms/op
                 multiplyMatrices·p0.95:   0.001 ms/op
                 multiplyMatrices·p0.99:   0.001
```

```
ms/op
                 multiplyMatrices·p0.999:  0.001 ms/op
                 multiplyMatrices·p0.9999: 0.010 ms/op
                 multiplyMatrices·p1.00:   0.011 ms/op

Iteration   3: 0.001 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   ≈ 10⁻³ ms/op
                 multiplyMatrices·p0.50:   0.001 ms/op
                 multiplyMatrices·p0.90:   0.001 ms/op
                 multiplyMatrices·p0.95:   0.001 ms/op
                 multiplyMatrices·p0.99:   0.001 ms/op
                 multiplyMatrices·p0.999:  0.001 ms/op
                 multiplyMatrices·p0.9999: 0.006 ms/op
                 multiplyMatrices·p1.00:   0.010 ms/op

Iteration   4: 0.001 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.001 ms/op
                 multiplyMatrices·p0.50:   0.001 ms/op
                 multiplyMatrices·p0.90:   0.001 ms/op
                 multiplyMatrices·p0.95:   0.001 ms/op
                 multiplyMatrices·p0.99:   0.001 ms/op
                 multiplyMatrices·p0.999:  0.001 ms/op
                 multiplyMatrices·p0.9999: 0.008 ms/op
```

```
                 multiplyMatrices·p1.00:   0.012 ms/op

Iteration   5: 0.001 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   ≈ 10⁻³ ms/op
                 multiplyMatrices·p0.50:   0.001 ms/op
                 multiplyMatrices·p0.90:   0.001 ms/op
                 multiplyMatrices·p0.95:   0.001 ms/op
                 multiplyMatrices·p0.99:   0.001 ms/op
                 multiplyMatrices·p0.999:  0.001 ms/op
                 multiplyMatrices·p0.9999: 0.008 ms/op
                 multiplyMatrices·p1.00:   0.010 ms/op

Iteration   6: 0.001 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.001 ms/op
                 multiplyMatrices·p0.50:   0.001 ms/op
                 multiplyMatrices·p0.90:   0.001 ms/op
                 multiplyMatrices·p0.95:   0.001 ms/op
                 multiplyMatrices·p0.99:   0.001 ms/op
                 multiplyMatrices·p0.999:  0.001 ms/op
                 multiplyMatrices·p0.9999: 0.007 ms/op
                 multiplyMatrices·p1.00:   0.010 ms/op

Iteration   7: 0.001 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.001
```

```
ms/op
                 multiplyMatrices·p0.50:   0.001 ms/op
                 multiplyMatrices·p0.90:   0.001 ms/op
                 multiplyMatrices·p0.95:   0.001 ms/op
                 multiplyMatrices·p0.99:   0.001 ms/op
                 multiplyMatrices·p0.999:  0.001 ms/op
                 multiplyMatrices·p0.9999: 0.013 ms/op
                 multiplyMatrices·p1.00:   0.034 ms/op

Iteration   8: 0.001 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   ≈ 10⁻³ ms/op
                 multiplyMatrices·p0.50:   0.001 ms/op
                 multiplyMatrices·p0.90:   0.001 ms/op
                 multiplyMatrices·p0.95:   0.001 ms/op
                 multiplyMatrices·p0.99:   0.001 ms/op
                 multiplyMatrices·p0.999:  0.009 ms/op
                 multiplyMatrices·p0.9999: 0.064 ms/op
                 multiplyMatrices·p1.00:   0.126 ms/op

Iteration   9: 0.001 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   ≈ 10⁻³ ms/op
                 multiplyMatrices·p0.50:   0.001 ms/op
                 multiplyMatrices·p0.90:   0.001 ms/op
```

```
                 multiplyMatrices·p0.95:   0.001 ms/op
                 multiplyMatrices·p0.99:   0.001 ms/op
                 multiplyMatrices·p0.999:  0.005 ms/op
                 multiplyMatrices·p0.9999: 0.022 ms/op
                 multiplyMatrices·p1.00:   0.053 ms/op

Iteration  10: 0.001 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.001 ms/op
                 multiplyMatrices·p0.50:   0.001 ms/op
                 multiplyMatrices·p0.90:   0.001 ms/op
                 multiplyMatrices·p0.95:   0.001 ms/op
                 multiplyMatrices·p0.99:   0.001 ms/op
                 multiplyMatrices·p0.999:  0.008 ms/op
                 multiplyMatrices·p0.9999: 0.028 ms/op
                 multiplyMatrices·p1.00:   0.099 ms/op



Result "com.big_data.java_project.MatrixMultiplicationBenchmark.multiplyMatrices":
  N = 284019
  mean =      0.001 ±(99.9%) 0.001 ms/op

  Histogram, ms/op:
    [0.000, 0.013) = 283991
    [0.013, 0.025) = 15
    [0.025, 0.038) = 3
    [0.038, 0.050) = 4
```

```
    [0.050, 0.063) = 3
    [0.063, 0.075) = 0
    [0.075, 0.088) = 1
    [0.088, 0.100) = 1
    [0.100, 0.113) = 0
    [0.113, 0.125) = 0
    [0.125, 0.138) = 1
    [0.138, 0.150) = 0
    [0.150, 0.163) = 0
    [0.163, 0.175) = 0
    [0.175, 0.188) = 0

  Percentiles, ms/op:
      p(0.0000) =     ≈ 10⁻³ ms/op
     p(50.0000) =      0.001 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) =      0.002 ms/op
     p(99.9900) =      0.013 ms/op
     p(99.9990) =      0.082 ms/op
     p(99.9999) =      0.126 ms/op
    p(100.0000) =      0.126 ms/op


# JMH version: 1.36
# 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=51433:/Applications/IntelliJ IDEA.app/Contents/bin -Dfile.encoding=UTF-8
# Blackhole mode: compiler (auto-detected, use -Djmh.blackhole.autoDetect=false to disable)
# Warmup: 9 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.big_data.java_project.MatrixMultiplicationBenchmark.multiplyMatrices
# Parameters: (size = 50)

# Run progress: 33.33% complete, ETA 00:01:18
# Fork: 1 of 1
# Warmup Iteration   1: 0.064 ±(99.9%) 0.001 ms/op
# Warmup Iteration   2: 0.061 ±(99.9%) 0.001 ms/op
# Warmup Iteration   3: 0.061 ±(99.9%) 0.001 ms/op
# Warmup Iteration   4: 0.061 ±(99.9%) 0.001 ms/op
# Warmup Iteration   5: 0.064 ±(99.9%) 0.001 ms/op
# Warmup Iteration   6: 0.063 ±(99.9%) 0.001 ms/op
# Warmup Iteration   7: 0.063 ±(99.9%) 0.001 ms/op
# Warmup Iteration   8: 0.064 ±(99.9%) 0.001 ms/op
# Warmup Iteration   9: 0.063 ±(99.9%) 0.001 ms/op
Iteration   1: 0.064 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.062 ms/op
                 multiplyMatrices·p0.50:   0.063 ms/op
                 multiplyMatrices·p0.90:   0.067 ms/op
                 multiplyMatrices·p0.95:   0.071 ms/op
                 multiplyMatrices·p0.99:   0.085 ms/op
                 multiplyMatrices·p0.999:  0.134 ms/op
                 multiplyMatrices·p0.9999: 0.190 ms/op
                 multiplyMatrices·p1.00:   0.193 ms/op

Iteration   2: 0.067 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.062 ms/op
                 multiplyMatrices·p0.50:   0.063 ms/op
                 multiplyMatrices·p0.90:   0.069 ms/op
```

```
                  multiplyMatrices·p0.95:   0.074 ms/op
                  multiplyMatrices·p0.99:   0.161 ms/op
                  multiplyMatrices·p0.999:  0.323 ms/op
                  multiplyMatrices·p0.9999: 0.430 ms/op
                  multiplyMatrices·p1.00:   0.436 ms/op

Iteration   3: 0.065 ±(99.9%) 0.001 ms/op
                  multiplyMatrices·p0.00:   0.062 ms/op
                  multiplyMatrices·p0.50:   0.063 ms/op
                  multiplyMatrices·p0.90:   0.067 ms/op
                  multiplyMatrices·p0.95:   0.071 ms/op
                  multiplyMatrices·p0.99:   0.082 ms/op
                  multiplyMatrices·p0.999:  0.381 ms/op
                  multiplyMatrices·p0.9999: 0.568 ms/op
                  multiplyMatrices·p1.00:   0.570 ms/op

Iteration   4: 0.064 ±(99.9%) 0.001 ms/op
                  multiplyMatrices·p0.00:   0.062 ms/op
                  multiplyMatrices·p0.50:   0.063 ms/op
                  multiplyMatrices·p0.90:   0.066 ms/op
                  multiplyMatrices·p0.95:   0.068 ms/op
                  multiplyMatrices·p0.99:   0.076 ms/op
                  multiplyMatrices·p0.999:  0.342
```

```
ms/op
                 multiplyMatrices·p0.9999: 0.540 ms/op
                 multiplyMatrices·p1.00:   0.553 ms/op

Iteration   5: 0.063 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.062 ms/op
                 multiplyMatrices·p0.50:   0.063 ms/op
                 multiplyMatrices·p0.90:   0.065 ms/op
                 multiplyMatrices·p0.95:   0.067 ms/op
                 multiplyMatrices·p0.99:   0.074 ms/op
                 multiplyMatrices·p0.999:  0.082 ms/op
                 multiplyMatrices·p0.9999: 0.113 ms/op
                 multiplyMatrices·p1.00:   0.134 ms/op

Iteration   6: 0.063 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.062 ms/op
                 multiplyMatrices·p0.50:   0.063 ms/op
                 multiplyMatrices·p0.90:   0.065 ms/op
                 multiplyMatrices·p0.95:   0.067 ms/op
                 multiplyMatrices·p0.99:   0.075 ms/op
                 multiplyMatrices·p0.999:  0.081 ms/op
                 multiplyMatrices·p0.9999: 0.091 ms/op
                 multiplyMatrices·p1.00:   0.101 ms/op
```

```

Iteration   7: 0.064 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.062 ms/op
                 multiplyMatrices·p0.50:   0.063 ms/op
                 multiplyMatrices·p0.90:   0.067 ms/op
                 multiplyMatrices·p0.95:   0.072 ms/op
                 multiplyMatrices·p0.99:   0.084 ms/op
                 multiplyMatrices·p0.999:  0.133 ms/op
                 multiplyMatrices·p0.9999: 0.192 ms/op
                 multiplyMatrices·p1.00:   0.195 ms/op

Iteration   8: 0.063 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.062 ms/op
                 multiplyMatrices·p0.50:   0.063 ms/op
                 multiplyMatrices·p0.90:   0.065 ms/op
                 multiplyMatrices·p0.95:   0.067 ms/op
                 multiplyMatrices·p0.99:   0.074 ms/op
                 multiplyMatrices·p0.999:  0.081 ms/op
                 multiplyMatrices·p0.9999: 0.088 ms/op
                 multiplyMatrices·p1.00:   0.089 ms/op

Iteration   9: 0.065 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.062 ms/op
                 multiplyMatrices·p0.50:   0.063
```

```
ms/op
                 multiplyMatrices·p0.90:   0.069 ms/op
                 multiplyMatrices·p0.95:   0.074 ms/op
                 multiplyMatrices·p0.99:   0.107 ms/op
                 multiplyMatrices·p0.999:  0.218 ms/op
                 multiplyMatrices·p0.9999: 0.349 ms/op
                 multiplyMatrices·p1.00:   0.373 ms/op

Iteration  10: 0.065 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.062 ms/op
                 multiplyMatrices·p0.50:   0.063 ms/op
                 multiplyMatrices·p0.90:   0.070 ms/op
                 multiplyMatrices·p0.95:   0.075 ms/op
                 multiplyMatrices·p0.99:   0.101 ms/op
                 multiplyMatrices·p0.999:  0.162 ms/op
                 multiplyMatrices·p0.9999: 0.229 ms/op
                 multiplyMatrices·p1.00:   0.232 ms/op



Result "com.big_data.java_project.MatrixMultiplicationBenchmark.multiplyMatrices":
  N = 155555
  mean =      0.065 ±(99.9%) 0.001 ms/op

  Histogram, ms/op:
    [0.000, 0.050) = 0
```

```
    [0.050, 0.100) = 154650
    [0.100, 0.150) = 527
    [0.150, 0.200) = 170
    [0.200, 0.250) = 82
    [0.250, 0.300) = 43
    [0.300, 0.350) = 34
    [0.350, 0.400) = 24
    [0.400, 0.450) = 15
    [0.450, 0.500) = 4
    [0.500, 0.550) = 3
    [0.550, 0.600) = 3

  Percentiles, ms/op:
      p(0.0000) =      0.062 ms/op
     p(50.0000) =      0.063 ms/op
     p(90.0000) =      0.067 ms/op
     p(95.0000) =      0.071 ms/op
     p(99.0000) =      0.083 ms/op
     p(99.9000) =      0.225 ms/op
     p(99.9900) =      0.433 ms/op
     p(99.9990) =      0.568 ms/op
     p(99.9999) =      0.570 ms/op
    p(100.0000) =      0.570 ms/op


# JMH version: 1.36
# 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=51433:/Applications/IntelliJ IDEA.app/Contents/bin -Dfile.encoding=UTF-8
# Blackhole mode: compiler (auto-detected, use -Djmh.blackhole.autoDetect=false to disable)
# Warmup: 9 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.big_data.java_project.MatrixMultiplicationBenchmark.multiplyMatrices
# Parameters: (size = 100)

# Run progress: 50.00% complete, ETA 00:00:58
# Fork: 1 of 1
# Warmup Iteration   1: 0.550 ±(99.9%) 0.006 ms/op
# Warmup Iteration   2: 0.538 ±(99.9%) 0.001 ms/op
# Warmup Iteration   3: 0.532 ±(99.9%) 0.001 ms/op
# Warmup Iteration   4: 0.548 ±(99.9%) 0.003 ms/op
# Warmup Iteration   5: 0.561 ±(99.9%) 0.004 ms/op
# Warmup Iteration   6: 0.543 ±(99.9%) 0.003 ms/op
# Warmup Iteration   7: 0.535 ±(99.9%) 0.001 ms/op
# Warmup Iteration   8: 0.532 ±(99.9%) 0.001 ms/op
# Warmup Iteration   9: 0.555 ±(99.9%) 0.005 ms/op
Iteration   1: 0.554 ±(99.9%) 0.003 ms/op
                 multiplyMatrices·p0.00:   0.527 ms/op
                 multiplyMatrices·p0.50:   0.538 ms/op
                 multiplyMatrices·p0.90:   0.598 ms/op
                 multiplyMatrices·p0.95:   0.629 ms/op
                 multiplyMatrices·p0.99:   0.732 ms/op
                 multiplyMatrices·p0.999:  0.827 ms/op
                 multiplyMatrices·p0.9999: 0.858 ms/op
                 multiplyMatrices·p1.00:   0.858 ms/op

Iteration   2: 0.534 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.527 ms/op
                 multiplyMatrices·p0.50:   0.530 ms/op
                 multiplyMatrices·p0.90:   0.548 ms/op
```

```
                  multiplyMatrices·p0.95:   0.561 ms/op
                  multiplyMatrices·p0.99:   0.585 ms/op
                  multiplyMatrices·p0.999:  0.643 ms/op
                  multiplyMatrices·p0.9999: 0.651 ms/op
                  multiplyMatrices·p1.00:   0.651 ms/op

Iteration   3: 0.539 ±(99.9%) 0.002 ms/op
                  multiplyMatrices·p0.00:   0.493 ms/op
                  multiplyMatrices·p0.50:   0.530 ms/op
                  multiplyMatrices·p0.90:   0.562 ms/op
                  multiplyMatrices·p0.95:   0.579 ms/op
                  multiplyMatrices·p0.99:   0.638 ms/op
                  multiplyMatrices·p0.999:  0.728 ms/op
                  multiplyMatrices·p0.9999: 0.849 ms/op
                  multiplyMatrices·p1.00:   0.849 ms/op

Iteration   4: 0.538 ±(99.9%) 0.001 ms/op
                  multiplyMatrices·p0.00:   0.527 ms/op
                  multiplyMatrices·p0.50:   0.530 ms/op
                  multiplyMatrices·p0.90:   0.560 ms/op
                  multiplyMatrices·p0.95:   0.578 ms/op
                  multiplyMatrices·p0.99:   0.606 ms/op
                  multiplyMatrices·p0.999:  0.665
```

```
ms/op
                 multiplyMatrices·p0.9999: 0.665 ms/op
                 multiplyMatrices·p1.00:   0.665 ms/op

Iteration   5: 0.532 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.527 ms/op
                 multiplyMatrices·p0.50:   0.527 ms/op
                 multiplyMatrices·p0.90:   0.542 ms/op
                 multiplyMatrices·p0.95:   0.552 ms/op
                 multiplyMatrices·p0.99:   0.580 ms/op
                 multiplyMatrices·p0.999:  0.643 ms/op
                 multiplyMatrices·p0.9999: 0.649 ms/op
                 multiplyMatrices·p1.00:   0.649 ms/op

Iteration   6: 0.532 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.527 ms/op
                 multiplyMatrices·p0.50:   0.527 ms/op
                 multiplyMatrices·p0.90:   0.540 ms/op
                 multiplyMatrices·p0.95:   0.549 ms/op
                 multiplyMatrices·p0.99:   0.577 ms/op
                 multiplyMatrices·p0.999:  0.643 ms/op
                 multiplyMatrices·p0.9999: 0.668 ms/op
                 multiplyMatrices·p1.00:   0.668 ms/op
```

```

Iteration   7: 0.533 ±(99.9%) 0.001 ms/op
                 multiplyMatrices·p0.00:   0.527 ms/op
                 multiplyMatrices·p0.50:   0.530 ms/op
                 multiplyMatrices·p0.90:   0.542 ms/op
                 multiplyMatrices·p0.95:   0.550 ms/op
                 multiplyMatrices·p0.99:   0.582 ms/op
                 multiplyMatrices·p0.999:  0.659 ms/op
                 multiplyMatrices·p0.9999: 0.660 ms/op
                 multiplyMatrices·p1.00:   0.660 ms/op

Iteration   8: 0.539 ±(99.9%) 0.005 ms/op
                 multiplyMatrices·p0.00:   0.526 ms/op
                 multiplyMatrices·p0.50:   0.530 ms/op
                 multiplyMatrices·p0.90:   0.548 ms/op
                 multiplyMatrices·p0.95:   0.560 ms/op
                 multiplyMatrices·p0.99:   0.607 ms/op
                 multiplyMatrices·p0.999:  1.640 ms/op
                 multiplyMatrices·p0.9999: 1.640 ms/op
                 multiplyMatrices·p1.00:   1.640 ms/op

Iteration   9: 0.539 ±(99.9%) 0.006 ms/op
                 multiplyMatrices·p0.00:   0.498 ms/op
                 multiplyMatrices·p0.50:   0.530
```

```
ms/op
                 multiplyMatrices·p0.90:   0.555 ms/op
                 multiplyMatrices·p0.95:   0.572 ms/op
                 multiplyMatrices·p0.99:   0.617 ms/op
                 multiplyMatrices·p0.999:  1.556 ms/op
                 multiplyMatrices·p0.9999: 3.420 ms/op
                 multiplyMatrices·p1.00:   3.420 ms/op

Iteration  10: 0.544 ±(99.9%) 0.003 ms/op
                 multiplyMatrices·p0.00:   0.526 ms/op
                 multiplyMatrices·p0.50:   0.531 ms/op
                 multiplyMatrices·p0.90:   0.575 ms/op
                 multiplyMatrices·p0.95:   0.592 ms/op
                 multiplyMatrices·p0.99:   0.627 ms/op
                 multiplyMatrices·p0.999:  1.313 ms/op
                 multiplyMatrices·p0.9999: 1.636 ms/op
                 multiplyMatrices·p1.00:   1.636 ms/op



Result "com.big_data.java_project.MatrixMultiplicationBenchmark.multiplyMatrices":
  N = 18644
  mean =      0.538 ±(99.9%) 0.001 ms/op

  Histogram, ms/op:
    [0.000, 0.250) = 0
```

```
    [0.250, 0.500) = 2
    [0.500, 0.750) = 18616
    [0.750, 1.000) = 15
    [1.000, 1.250) = 2
    [1.250, 1.500) = 3
    [1.500, 1.750) = 5
    [1.750, 2.000) = 0
    [2.000, 2.250) = 0
    [2.250, 2.500) = 0
    [2.500, 2.750) = 0
    [2.750, 3.000) = 0
    [3.000, 3.250) = 0
    [3.250, 3.500) = 1
    [3.500, 3.750) = 0

  Percentiles, ms/op:
      p(0.0000) =      0.493 ms/op
     p(50.0000) =      0.530 ms/op
     p(90.0000) =      0.557 ms/op
     p(95.0000) =      0.577 ms/op
     p(99.0000) =      0.627 ms/op
     p(99.9000) =      0.779 ms/op
     p(99.9900) =      1.882 ms/op
     p(99.9990) =      3.420 ms/op
     p(99.9999) =      3.420 ms/op
    p(100.0000) =      3.420 ms/op


# JMH version: 1.36
# 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=51433:/Applications/IntelliJ IDEA.app/Contents/bin -Dfile.encoding=UTF-8
# Blackhole mode: compiler (auto-detected, use -Djmh.blackhole.autoDetect=false to disable)
# Warmup: 9 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.big_data.java_project.MatrixMultiplicationBenchmark.multiplyMatrices
# Parameters: (size = 150)

# Run progress: 66.67% complete, ETA 00:00:39
# Fork: 1 of 1
# Warmup Iteration   1: 1.978 ±(99.9%) 0.036 ms/op
# Warmup Iteration   2: 1.999 ±(99.9%) 0.011 ms/op
# Warmup Iteration   3: 1.949 ±(99.9%) 0.005 ms/op
# Warmup Iteration   4: 1.956 ±(99.9%) 0.008 ms/op
# Warmup Iteration   5: 1.959 ±(99.9%) 0.006 ms/op
# Warmup Iteration   6: 1.955 ±(99.9%) 0.007 ms/op
# Warmup Iteration   7: 1.956 ±(99.9%) 0.014 ms/op
# Warmup Iteration   8: 1.937 ±(99.9%) 0.003 ms/op
# Warmup Iteration   9: 1.938 ±(99.9%) 0.003 ms/op
Iteration   1: 1.943 ±(99.9%) 0.005 ms/op
                 multiplyMatrices·p0.00:   1.923 ms/op
                 multiplyMatrices·p0.50:   1.933 ms/op
                 multiplyMatrices·p0.90:   1.964 ms/op
                 multiplyMatrices·p0.95:   1.997 ms/op
                 multiplyMatrices·p0.99:   2.087 ms/op
                 multiplyMatrices·p0.999:  2.236 ms/op
                 multiplyMatrices·p0.9999: 2.236 ms/op
                 multiplyMatrices·p1.00:   2.236 ms/op

Iteration   2: 1.966 ±(99.9%) 0.023 ms/op
                 multiplyMatrices·p0.00:   1.862 ms/op
                 multiplyMatrices·p0.50:   1.944
```

```
ms/op
                 multiplyMatrices·p0.90:   2.023 ms/op
                 multiplyMatrices·p0.95:   2.046 ms/op
                 multiplyMatrices·p0.99:   2.177 ms/op
                 multiplyMatrices·p0.999:  5.407 ms/op
                 multiplyMatrices·p0.9999: 5.407 ms/op
                 multiplyMatrices·p1.00:   5.407 ms/op

Iteration   3: 1.958 ±(99.9%) 0.005 ms/op
                 multiplyMatrices·p0.00:   1.925 ms/op
                 multiplyMatrices·p0.50:   1.946 ms/op
                 multiplyMatrices·p0.90:   2.006 ms/op
                 multiplyMatrices·p0.95:   2.030 ms/op
                 multiplyMatrices·p0.99:   2.104 ms/op
                 multiplyMatrices·p0.999:  2.220 ms/op
                 multiplyMatrices·p0.9999: 2.220 ms/op
                 multiplyMatrices·p1.00:   2.220 ms/op

Iteration   4: 1.946 ±(99.9%) 0.004 ms/op
                 multiplyMatrices·p0.00:   1.925 ms/op
                 multiplyMatrices·p0.50:   1.935 ms/op
                 multiplyMatrices·p0.90:   1.976 ms/op
                 multiplyMatrices·p0.95:   2.006 ms/op
```

```
                 multiplyMatrices·p0.99:   2.066 ms/op
                 multiplyMatrices·p0.999:  2.220 ms/op
                 multiplyMatrices·p0.9999: 2.220 ms/op
                 multiplyMatrices·p1.00:   2.220 ms/op

Iteration   5: 1.947 ±(99.9%) 0.004 ms/op
                 multiplyMatrices·p0.00:   1.925 ms/op
                 multiplyMatrices·p0.50:   1.937 ms/op
                 multiplyMatrices·p0.90:   1.972 ms/op
                 multiplyMatrices·p0.95:   2.005 ms/op
                 multiplyMatrices·p0.99:   2.083 ms/op
                 multiplyMatrices·p0.999:  2.228 ms/op
                 multiplyMatrices·p0.9999: 2.228 ms/op
                 multiplyMatrices·p1.00:   2.228 ms/op

Iteration   6: 1.980 ±(99.9%) 0.007 ms/op
                 multiplyMatrices·p0.00:   1.925 ms/op
                 multiplyMatrices·p0.50:   1.965 ms/op
                 multiplyMatrices·p0.90:   2.048 ms/op
                 multiplyMatrices·p0.95:   2.066 ms/op
                 multiplyMatrices·p0.99:   2.105 ms/op
                 multiplyMatrices·p0.999:  2.245 ms/op
                 multiplyMatrices·p0.9999: 2.245
```

```
ms/op
                 multiplyMatrices·p1.00:   2.245 ms/op

Iteration   7: 1.984 ±(99.9%) 0.007 ms/op
                 multiplyMatrices·p0.00:   1.901 ms/op
                 multiplyMatrices·p0.50:   1.966 ms/op
                 multiplyMatrices·p0.90:   2.054 ms/op
                 multiplyMatrices·p0.95:   2.066 ms/op
                 multiplyMatrices·p0.99:   2.104 ms/op
                 multiplyMatrices·p0.999:  2.363 ms/op
                 multiplyMatrices·p0.9999: 2.363 ms/op
                 multiplyMatrices·p1.00:   2.363 ms/op

Iteration   8: 1.971 ±(99.9%) 0.006 ms/op
                 multiplyMatrices·p0.00:   1.925 ms/op
                 multiplyMatrices·p0.50:   1.958 ms/op
                 multiplyMatrices·p0.90:   2.040 ms/op
                 multiplyMatrices·p0.95:   2.059 ms/op
                 multiplyMatrices·p0.99:   2.101 ms/op
                 multiplyMatrices·p0.999:  2.249 ms/op
                 multiplyMatrices·p0.9999: 2.249 ms/op
                 multiplyMatrices·p1.00:   2.249 ms/op

Iteration   9: 1.953 ±(99.9%) 0.005 ms/op
```

```
                 multiplyMatrices·p0.00:   1.925 ms/op
                 multiplyMatrices·p0.50:   1.939 ms/op
                 multiplyMatrices·p0.90:   1.989 ms/op
                 multiplyMatrices·p0.95:   2.016 ms/op
                 multiplyMatrices·p0.99:   2.100 ms/op
                 multiplyMatrices·p0.999:  2.150 ms/op
                 multiplyMatrices·p0.9999: 2.150 ms/op
                 multiplyMatrices·p1.00:   2.150 ms/op

Iteration  10: 1.946 ±(99.9%) 0.004 ms/op
                 multiplyMatrices·p0.00:   1.925 ms/op
                 multiplyMatrices·p0.50:   1.935 ms/op
                 multiplyMatrices·p0.90:   1.972 ms/op
                 multiplyMatrices·p0.95:   2.008 ms/op
                 multiplyMatrices·p0.99:   2.064 ms/op
                 multiplyMatrices·p0.999:  2.220 ms/op
                 multiplyMatrices·p0.9999: 2.220 ms/op
                 multiplyMatrices·p1.00:   2.220 ms/op



Result "com.big_data.java_project.MatrixMultiplicationBenchmark.multiplyMatrices":
  N = 5130
  mean =      1.959 ±(99.9%) 0.003 ms/op
```

```

  Histogram, ms/op:
    [1.000, 1.500) = 0
    [1.500, 2.000) = 4452
    [2.000, 2.500) = 677
    [2.500, 3.000) = 0
    [3.000, 3.500) = 0
    [3.500, 4.000) = 0
    [4.000, 4.500) = 0
    [4.500, 5.000) = 0
    [5.000, 5.500) = 1

  Percentiles, ms/op:
      p(0.0000) =      1.862 ms/op
     p(50.0000) =      1.944 ms/op
     p(90.0000) =      2.019 ms/op
     p(95.0000) =      2.046 ms/op
     p(99.0000) =      2.101 ms/op
     p(99.9000) =      2.274 ms/op
     p(99.9900) =      5.407 ms/op
     p(99.9990) =      5.407 ms/op
     p(99.9999) =      5.407 ms/op
    p(100.0000) =      5.407 ms/op


# JMH version: 1.36
# 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=51433:/Applications/IntelliJ IDEA.app/Contents/bin -Dfile.encoding=UTF-8
# Blackhole mode: compiler (auto-detected, use -Djmh.blackhole.autoDetect=false to disable)
# Warmup: 9 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.big_data.java_project.MatrixMultiplicationBenchmark.multiplyMatrices
# Parameters: (size = 200)

# Run progress: 83.33% complete, ETA 00:00:19
# Fork: 1 of 1
# Warmup Iteration   1: 4.965 ±(99.9%) 0.090 ms/op
# Warmup Iteration   2: 4.947 ±(99.9%) 0.026 ms/op
# Warmup Iteration   3: 4.995 ±(99.9%) 0.035 ms/op
# Warmup Iteration   4: 4.989 ±(99.9%) 0.042 ms/op
# Warmup Iteration   5: 4.882 ±(99.9%) 0.010 ms/op
# Warmup Iteration   6: 4.880 ±(99.9%) 0.011 ms/op
# Warmup Iteration   7: 4.901 ±(99.9%) 0.019 ms/op
# Warmup Iteration   8: 4.930 ±(99.9%) 0.029 ms/op
# Warmup Iteration   9: 4.941 ±(99.9%) 0.054 ms/op
Iteration   1: 4.948 ±(99.9%) 0.019 ms/op
                 multiplyMatrices·p0.00:   4.850 ms/op
                 multiplyMatrices·p0.50:   4.932 ms/op
                 multiplyMatrices·p0.90:   5.046 ms/op
                 multiplyMatrices·p0.95:   5.076 ms/op
                 multiplyMatrices·p0.99:   5.144 ms/op
                 multiplyMatrices·p0.999:  5.538 ms/op
                 multiplyMatrices·p0.9999: 5.538 ms/op
                 multiplyMatrices·p1.00:   5.538 ms/op

Iteration   2: 4.924 ±(99.9%) 0.031 ms/op
                 multiplyMatrices·p0.00:   4.841 ms/op
                 multiplyMatrices·p0.50:   4.882 ms/op
                 multiplyMatrices·p0.90:   5.095 ms/op
```

```
                 multiplyMatrices·p0.95:   5.237 ms/op
                 multiplyMatrices·p0.99:   5.507 ms/op
                 multiplyMatrices·p0.999:  5.915 ms/op
                 multiplyMatrices·p0.9999: 5.915 ms/op
                 multiplyMatrices·p1.00:   5.915 ms/op

Iteration   3: 4.896 ±(99.9%) 0.018 ms/op
                 multiplyMatrices·p0.00:   4.841 ms/op
                 multiplyMatrices·p0.50:   4.882 ms/op
                 multiplyMatrices·p0.90:   4.932 ms/op
                 multiplyMatrices·p0.95:   5.024 ms/op
                 multiplyMatrices·p0.99:   5.314 ms/op
                 multiplyMatrices·p0.999:  5.603 ms/op
                 multiplyMatrices·p0.9999: 5.603 ms/op
                 multiplyMatrices·p1.00:   5.603 ms/op

Iteration   4: 5.261 ±(99.9%) 0.301 ms/op
                 multiplyMatrices·p0.00:   4.841 ms/op
                 multiplyMatrices·p0.50:   4.981 ms/op
                 multiplyMatrices·p0.90:   5.400 ms/op
                 multiplyMatrices·p0.95:   6.411 ms/op
                 multiplyMatrices·p0.99:   12.785 ms/op
                 multiplyMatrices·p0.999:  14.926
```

```
ms/op
                 multiplyMatrices·p0.9999: 14.926 ms/op
                 multiplyMatrices·p1.00:   14.926 ms/op

Iteration   5: 5.000 ±(99.9%) 0.163 ms/op
                 multiplyMatrices·p0.00:   4.841 ms/op
                 multiplyMatrices·p0.50:   4.891 ms/op
                 multiplyMatrices·p0.90:   5.110 ms/op
                 multiplyMatrices·p0.95:   5.249 ms/op
                 multiplyMatrices·p0.99:   5.774 ms/op
                 multiplyMatrices·p0.999:  14.533 ms/op
                 multiplyMatrices·p0.9999: 14.533 ms/op
                 multiplyMatrices·p1.00:   14.533 ms/op

Iteration   6: 5.082 ±(99.9%) 0.181 ms/op
                 multiplyMatrices·p0.00:   4.833 ms/op
                 multiplyMatrices·p0.50:   4.956 ms/op
                 multiplyMatrices·p0.90:   5.195 ms/op
                 multiplyMatrices·p0.95:   5.300 ms/op
                 multiplyMatrices·p0.99:   8.224 ms/op
                 multiplyMatrices·p0.999:  14.205 ms/op
                 multiplyMatrices·p0.9999: 14.205 ms/op
                 multiplyMatrices·p1.00:   14.205 ms/op
```

```

Iteration   7: 5.295 ±(99.9%) 0.185 ms/op
                 multiplyMatrices·p0.00:   4.858 ms/op
                 multiplyMatrices·p0.50:   5.112 ms/op
                 multiplyMatrices·p0.90:   5.562 ms/op
                 multiplyMatrices·p0.95:   6.313 ms/op
                 multiplyMatrices·p0.99:   9.710 ms/op
                 multiplyMatrices·p0.999:  10.813 ms/op
                 multiplyMatrices·p0.9999: 10.813 ms/op
                 multiplyMatrices·p1.00:   10.813 ms/op

Iteration   8: 4.919 ±(99.9%) 0.031 ms/op
                 multiplyMatrices·p0.00:   4.841 ms/op
                 multiplyMatrices·p0.50:   4.874 ms/op
                 multiplyMatrices·p0.90:   5.009 ms/op
                 multiplyMatrices·p0.95:   5.151 ms/op
                 multiplyMatrices·p0.99:   5.625 ms/op
                 multiplyMatrices·p0.999:  5.890 ms/op
                 multiplyMatrices·p0.9999: 5.890 ms/op
                 multiplyMatrices·p1.00:   5.890 ms/op

Iteration   9: 4.878 ±(99.9%) 0.012 ms/op
                 multiplyMatrices·p0.00:   4.841 ms/op
                 multiplyMatrices·p0.50:   4.866
```

```
ms/op
                 multiplyMatrices·p0.90:   4.933 ms/op
                 multiplyMatrices·p0.95:   4.981 ms/op
                 multiplyMatrices·p0.99:   5.062 ms/op
                 multiplyMatrices·p0.999:  5.333 ms/op
                 multiplyMatrices·p0.9999: 5.333 ms/op
                 multiplyMatrices·p1.00:   5.333 ms/op

Iteration  10: 4.878 ±(99.9%) 0.011 ms/op
                 multiplyMatrices·p0.00:   4.841 ms/op
                 multiplyMatrices·p0.50:   4.866 ms/op
                 multiplyMatrices·p0.90:   4.932 ms/op
                 multiplyMatrices·p0.95:   4.973 ms/op
                 multiplyMatrices·p0.99:   5.054 ms/op
                 multiplyMatrices·p0.999:  5.235 ms/op
                 multiplyMatrices·p0.9999: 5.235 ms/op
                 multiplyMatrices·p1.00:   5.235 ms/op



Result "com.big_data.java_project.MatrixMultiplicationBenchmark.multiplyMatrices":
  N = 2008
  mean =      5.004 ±(99.9%) 0.042 ms/op

  Histogram, ms/op:
    [ 0.000,  1.250) = 0
```

```
    [ 1.250,  2.500) = 0
    [ 2.500,  3.750) = 0
    [ 3.750,  5.000) = 1514
    [ 5.000,  6.250) = 468
    [ 6.250,  7.500) = 8
    [ 7.500,  8.750) = 8
    [ 8.750, 10.000) = 2
    [10.000, 11.250) = 3
    [11.250, 12.500) = 1
    [12.500, 13.750) = 1
    [13.750, 15.000) = 3
    [15.000, 16.250) = 0
    [16.250, 17.500) = 0
    [17.500, 18.750) = 0

  Percentiles, ms/op:
      p(0.0000) =      4.833 ms/op
     p(50.0000) =      4.891 ms/op
     p(90.0000) =      5.145 ms/op
     p(95.0000) =      5.256 ms/op
     p(99.0000) =      6.918 ms/op
     p(99.9000) =     14.530 ms/op
     p(99.9900) =     14.926 ms/op
     p(99.9990) =     14.926 ms/op
     p(99.9999) =     14.926 ms/op
    p(100.0000) =     14.926 ms/op


# Run complete. Total time: 00:01:57

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.

```

```
NOTE: Current JVM experimentally supports Compiler Blackholes, and they are in use. Please exercise
extra caution when trusting the results, look into the generated code to check the benchmark still
works, and factor in a small probability of new VM bugs. Additionally, while comparisons between
different JVMs are already problematic, the performance difference caused by different Blackhole
modes can be very significant. Please make sure you use the consistent Blackhole mode for comparisons.

Benchmark                                                  (size)    Mode     Cnt   Score    Error  Units
MatrixMultiplicationBenchmark.multiplyMatrices                    5  sample  225776  ≈ 10⁻⁴           ms/op
MatrixMultiplicationBenchmark.multiplyMatrices:multiplyMatrices·p0.00         5  sample  ≈ 10⁻⁴           ms/op
MatrixMultiplicationBenchmark.multiplyMatrices:multiplyMatrices·p0.50         5  sample  ≈ 10⁻⁴           ms/op
MatrixMultiplicationBenchmark.multiplyMatrices:multiplyMatrices·p0.90         5  sample  ≈ 10⁻⁴           ms/op
MatrixMultiplicationBenchmark.multiplyMatrices:multiplyMatrices·p0.95         5  sample  ≈ 10⁻⁴           ms/op
MatrixMultiplicationBenchmark.multiplyMatrices:multiplyMatrices·p0.99         5  sample  ≈ 10⁻⁴           ms/op
MatrixMultiplicationBenchmark.multiplyMatrices:multiplyMatrices·p0.999        5  sample  ≈ 10⁻⁴           ms/op
MatrixMultiplicationBenchmark.multiplyMatrices:
```

```
975 multiplyMatrices·p0.9999       5  sample
                0.005           ms/op
976 MatrixMultiplicationBenchmark.multiplyMatrices:
    multiplyMatrices·p1.00         5  sample
                0.014           ms/op
977 MatrixMultiplicationBenchmark.multiplyMatrices
                                   10  sample  284019
       0.001 ±  0.001  ms/op
978 MatrixMultiplicationBenchmark.multiplyMatrices:
    multiplyMatrices·p0.00        10  sample
               ≈ 10⁻³           ms/op
979 MatrixMultiplicationBenchmark.multiplyMatrices:
    multiplyMatrices·p0.50        10  sample
                0.001           ms/op
980 MatrixMultiplicationBenchmark.multiplyMatrices:
    multiplyMatrices·p0.90        10  sample
                0.001           ms/op
981 MatrixMultiplicationBenchmark.multiplyMatrices:
    multiplyMatrices·p0.95        10  sample
                0.001           ms/op
982 MatrixMultiplicationBenchmark.multiplyMatrices:
    multiplyMatrices·p0.99        10  sample
                0.001           ms/op
983 MatrixMultiplicationBenchmark.multiplyMatrices:
    multiplyMatrices·p0.999       10  sample
                0.002           ms/op
984 MatrixMultiplicationBenchmark.multiplyMatrices:
    multiplyMatrices·p0.9999      10  sample
                0.013           ms/op
985 MatrixMultiplicationBenchmark.multiplyMatrices:
    multiplyMatrices·p1.00        10  sample
                0.126           ms/op
986 MatrixMultiplicationBenchmark.multiplyMatrices
                                   50  sample  155555
       0.065 ±  0.001  ms/op
987 MatrixMultiplicationBenchmark.multiplyMatrices:
    multiplyMatrices·p0.00        50  sample
                0.062           ms/op
988 MatrixMultiplicationBenchmark.multiplyMatrices:
    multiplyMatrices·p0.50        50  sample
                0.063           ms/op
```

```
 989 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.90        50  sample
                 0.067           ms/op
 990 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.95        50  sample
                 0.071           ms/op
 991 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.99        50  sample
                 0.083           ms/op
 992 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.999       50  sample
                 0.225           ms/op
 993 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.9999      50  sample
                 0.433           ms/op
 994 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p1.00        50  sample
                 0.570           ms/op
 995 MatrixMultiplicationBenchmark.multiplyMatrices
                                   100  sample   18644
        0.538 ±  0.001  ms/op
 996 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.00       100  sample
                 0.493           ms/op
 997 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.50       100  sample
                 0.530           ms/op
 998 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.90       100  sample
                 0.557           ms/op
 999 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.95       100  sample
                 0.577           ms/op
1000 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.99       100  sample
                 0.627           ms/op
1001 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.999      100  sample
                 0.779           ms/op
1002 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.9999     100  sample
```

```
1002            1.882           ms/op
1003 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p1.00       100  sample
                3.420           ms/op
1004 MatrixMultiplicationBenchmark.multiplyMatrices
                                  150  sample    5130
        1.959 ±  0.003  ms/op
1005 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.00       150  sample
                1.862           ms/op
1006 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.50       150  sample
                1.944           ms/op
1007 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.90       150  sample
                2.019           ms/op
1008 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.95       150  sample
                2.046           ms/op
1009 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.99       150  sample
                2.101           ms/op
1010 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.999      150  sample
                2.274           ms/op
1011 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.9999     150  sample
                5.407           ms/op
1012 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p1.00       150  sample
                5.407           ms/op
1013 MatrixMultiplicationBenchmark.multiplyMatrices
                                  200  sample    2008
        5.004 ±  0.042  ms/op
1014 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.00       200  sample
                4.833           ms/op
1015 MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.50       200  sample
                4.891           ms/op
1016 MatrixMultiplicationBenchmark.multiplyMatrices:
```

```
multiplyMatrices·p0.90       200  sample
                5.145           ms/op
MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.95       200  sample
                5.256           ms/op
MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.99       200  sample
                6.918           ms/op
MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.999      200  sample
               14.530           ms/op
MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p0.9999     200  sample
               14.926           ms/op
MatrixMultiplicationBenchmark.multiplyMatrices:
     multiplyMatrices·p1.00       200  sample
               14.926           ms/op

Process finished with exit code 0
```