

# Acceleration

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```
library(Matrix)
```

## Warning: 程辑包'Matrix'是用R版本4.3.1 来建造的

```
rm(list = ls())
iter <- 10
time <- 0

for (i in 1:iter) {
  c <- system.time({n <- 9000
  A <- matrix(runif(n * n), nrow = n, ncol = n)
  trans_A <- t(A)
  A_Square <- A * A})[3]
  time <- time + c
}

time_1 <- time / iter
cat(" 任务一平均用时:", time_1, " 秒.\n")
```

## 任务一平均用时: 1.118 秒.

```
rm(list = ls())
iter <- 10
time <- 0
n <- 3600
N <- 1200
for (i in 1:iter) {
  c <- system.time({A <- matrix(rnorm(n * n), nrow = n, ncol = n)
  A_N <- A ^ N})[3]
  time <- time + c
}
```

```
time_2 <- time / iter
cat(" 任务二平均用时:", time_2, " 秒.\n")
```

## 任务二平均用时: 1.021 秒.

```
iter <- 10
time <- 0
n <- 1.4e7

for (i in 1:iter) {
  c <- system.time({randoms <- rnorm(n)
    sorted <- sort(randoms)})[3]
  time <- time + c
}

time_3 <- time / iter
cat(" 任务三平均用时:", time_3, " 秒.\n")
```

## 任务三平均用时: 1.08 秒.

```
rm(list = ls())
iter <- 10
time <- 0
n <- 30000

for (i in 1:iter) {
  c <- system.time({a <- rnorm(n)
    b <- a%*%t(a)})[3]
  time <- time + c
}

time_4 <- time / iter
cat(" 任务四平均用时:", time_4, " 秒.\n")
```

## 任务四平均用时: 0.915 秒.

```
iter <- 10
time <- 0
n <- 25000
p <- 250
```

```
for (i in 1:iter) {  
  c <- system.time({X <- matrix(rnorm(n * p), nrow = n, ncol = p)  
  Y <- rnorm(n)  
  beta <- solve(crossprod(X)) %*% t(X) %*% Y})[3]  
  time <- time + c  
}  
  
time_5 <- time / iter  
cat(" 任务五平均用时:", time_5, " 秒.\n")
```

## 任务五平均用时: 0.262 秒.

```
iter <- 10  
time <- 0  
n <- 1.3e7  
  
for (i in 1:iter) {  
  c <- system.time({randoms <- rnorm(n)  
  result <- fft(randoms)})[3]  
  time <- time + c  
}  
  
time_6 <- time / iter  
cat(" 任务六平均用时:", time_6, " 秒.\n")
```

## 任务六平均用时: 1.072 秒.

```
iter <- 10  
time <- 0  
n <- 750  
  
for (i in 1:iter) {  
  c <- system.time({matrix <- matrix(rnorm(n * n), nrow = n, ncol = n)  
  eigenvalues <- eigen(matrix)$values})[3]  
  time <- time + c  
}  
  
time_7 <- time / iter  
cat(" 任务七平均用时:", time_7, " 秒.\n")
```

## 任务七平均用时: 0.347 秒.

```
rm(list = ls())
iter <- 10
time <- 0
n <- 2200

for (i in 1:iter) {
  c <- system.time({matrix <- matrix(rnorm(n * n), nrow = n, ncol = n)
  det_value <- det(matrix)})[3]
  time <- time + c
}

time_8 <- time / iter
cat(" 任务八平均用时:", time_8, " 秒.\n")
```

## 任务八平均用时: 0.18 秒.

```
rm(list = ls())
iter <- 10
time <- 0
n <- 1500

for (i in 1:iter) {
  c <- system.time({matrix <- matrix(rnorm(n * n), nrow = n, ncol = n)
  sym_matrix <- t(matrix) %*% matrix
  cholesky_matrix <- chol(sym_matrix, lower = TRUE)})[3]
  time <- time + c
}

time_9 <- time / iter
cat(" 任务九平均用时:", time_9, " 秒.\n")
```

## 任务九平均用时: 0.102 秒.

```
rm(list = ls())
iter <- 10
time <- 0
n <- 1400

for (i in 1:iter) {
  c <- system.time({matrix <- matrix(rnorm(n * n), nrow = n, ncol = n)
  solve(matrix)})[3]
}
```

```
    time <- time + c
  }

time_10 <- time / iter
cat(" 任务十平均用时:", time_10, " 秒.\n")
```

## 任务十平均用时: 0.092 秒.

```
iter <- 10
time <- 0
n <- 1.8e7

for (i in 1:iter) {
  c <- system.time({fibonacci_numbers <- numeric(n)
    fibonacci_numbers[1:2] <- c(0, 1)
    for (j in 3:n) {
      fibonacci_numbers[j] <- fibonacci_numbers[j - 1] + fibonacci_numbers[j - 2]
    })[3]
  time <- time + c
}

time_11 <- time / iter
cat(" 任务十一平均用时:", time_11, " 秒.\n")
```

## 任务十一平均用时: 1.08 秒.

```
rm(list = ls())
iter <- 10
time <- 0
n <- 11000

for (i in 1:iter) {
  c <- system.time({hilbert_matrix <- Hilbert(n)})[3]
  time <- time + c
}

time_12 <- time / iter
cat(" 任务十二平均用时:", time_12, " 秒.\n")
```

## 任务十二平均用时: 1.081 秒.

```
rm(list = ls())
gcd_recursive <- function(a, b){
  if (b == 0) return(a)
  else{
    return(gcd_recursive(b, a%%b))
  }
}

iter <- 10
time <- 0
n <- 350000
p <- 1400

for (i in 1:iter) {
  c <- system.time({pairs_num <- n
  pairs <- matrix(sample(1:p, pairs_num * 2, replace = TRUE), ncol = 2)
  gcd_values <- numeric(pairs_num)
  for (j in 1:pairs_num) {
    gcd_values[j] <- gcd_recursive(pairs[j, 1], pairs[j, 2])
  })[3]
  time <- time + c
}
time_13 <- time / iter
cat(" 任务十三平均用时:", time_13, " 秒.\n")
```

## 任务十三平均用时: 1.048 秒.

```
rm(list = ls())
iter <- 10
time <- 0
n <- 3500

for (k in 1:iter) {
  c <- system.time({first_row <- 1:n
  toeplitz_matrix <- matrix(0, nrow = n, ncol = n)
  for (i in 1:n) {
    for (j in 1:n) {
      toeplitz_matrix[i, j] <- first_row[abs(i - j) + 1]
    }
  })[3]
  time <- time + c
}
```

```
}

time_14 <- time / iter
cat(" 任务十四平均用时:", time_14, " 秒.\n")
```

## 任务十四平均用时: 1.151 秒.

```
rm(list = ls())
iter <- 10
time <- 0
n <- 17000
p <- 200

for (k in 1:iter) {
  c <- system.time({data_matrix <- matrix(rnorm(n * p), nrow = n, ncol = p)
  pca_result <- prcomp(data_matrix)})[3]
  time <- time + c
}

time_15 <- time / iter
cat(" 任务十五平均用时:", time_15, " 秒.\n")
```

## 任务十五平均用时: 0.243 秒.