

# PH1930 Final Project: Method Comparison

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2023-12-03

**This report and scripts are being submitted early for review and feedback.** It contains results for the CD and ADMM algorithms using both R and C++ then compares the results using identical random sample inputs.

```
#set parameters for simulation
rho <- 0.9
n <- 200
p <- 4

#create covariance matrix
cov_matrix <- matrix(0, nrow = p, ncol = p)
for (i in 1:p) {
  for (j in 1:p) {
    cov_matrix[i, j] <- rho^abs(i - j)
  }
}

#simulate data
set.seed(100) # for reproducibility
X <- MASS::mvrnorm(n = n, mu = rep(0, p), Sigma = cov_matrix)

#set b
b <- c(1, rep(0, p - 1))

#lambda value
lambda_value <- 0.01

#ADMM and CD algorithms and compare their results
cd_r <- cg_cd(X, b, lambda_value)
cd_cpp <- cg_cd_cpp(X, b, lambda_value)
admm_r <- cg_admm(X, b, lambda_value)
admm_cpp <- cg_admm_cpp(X, b, lambda_value, 1e-4, 1000)
```

---

## Coordinate Descent

```
print(cd_r)
```

```
## $u
##      [,1]
```

```
## [1,] 5.705206
## [2,] 0.000000
## [3,] 0.000000
## [4,] 0.000000
```

```
print(cd_cpp)
```

```
##           [,1]
## [1,] 1.138682
## [2,] 0.000000
## [3,] 0.000000
## [4,] 0.000000
```

---

## ADMM

```
print(admm_r)
```

```
##           [,1]
## [1,] 3.8217697
## [2,] -0.9483531
## [3,] -3.9735019
## [4,] 12.7479771
```

```
print(admm_cpp)
```

```
##           [,1]
## [1,] 15.31794
## [2,] 12.58969
## [3,] 11.62931
## [4,] 25.89176
```