hw8

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Import Data and Preparation

```
hwdata4 = read_csv("data/hwdata4.csv")
```

```
## Rows: 632 Columns: 4
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (1): treat
## dbl (3): size, time, tree
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
# data prep
hwdata4$treat = as.factor(hwdata4$treat)
hwdata4$tree = as.factor(hwdata4$tree)
```

1. Fit a GEE model with size of the tree as outcome and time, environment, and their interaction as covariates. Write down the mean response of the GEE model.

```
# fit the model with CS correlation matrix
library(gee)

fit_1 =
  gee(size ~ time * treat,
      data = hwdata4,
      id = tree,
      family = gaussian,
      corstr = "exchangeable")
```

```
## Beginning Cgee S-function, @(#) geeformula.q 4.13 98/01/27
```

```
## running glm to get initial regression estimate
```

```
##     (Intercept)            time      treatozone time:treatozone
##    5.479453e+00    3.706259e-03   -3.378012e-01   -8.026838e-05
```

```
summary(fit_1)
```

```
##
##  GEE:  GENERALIZED LINEAR MODELS FOR DEPENDENT DATA
##  gee S-function, version 4.13 modified 98/01/27 (1998)
##
## Model:
##  Link:                      Identity
```

```
##  Variance to Mean Relation: Gaussian
##  Correlation Structure:     Exchangeable
##
## Call:
## gee(formula = size ~ time * treat, id = tree, data = hwdata4,
##     family = gaussian, corstr = "exchangeable")
##
## Summary of Residuals:
##         Min          1Q      Median          3Q         Max
## -2.03126650 -0.35710410  0.05785154  0.43662246  1.34601233
##
##
## Coefficients:
##                      Estimate   Naive S.E.    Naive z  Robust S.E.   Robust z
## (Intercept)      5.479453e+00 0.1293041927 42.3764510 0.1403852679 39.0315371
## time             3.706259e-03 0.0001485844 24.9437976 0.0002259020 16.4064939
## treatozone      -3.378012e-01 0.1563973078 -2.1598914 0.1688164000 -2.0009975
## time:treatozone -8.026838e-05 0.0001797173 -0.4466369 0.0002644467 -0.3035333
##
## Estimated Scale Parameter:  0.412159
## Number of Iterations:  1
##
## Working Correlation
##           [,1]      [,2]      [,3]      [,4]      [,5]      [,6]      [,7]
## [1,] 1.0000000 0.9529438 0.9529438 0.9529438 0.9529438 0.9529438 0.9529438
## [2,] 0.9529438 1.0000000 0.9529438 0.9529438 0.9529438 0.9529438 0.9529438
## [3,] 0.9529438 0.9529438 1.0000000 0.9529438 0.9529438 0.9529438 0.9529438
## [4,] 0.9529438 0.9529438 0.9529438 1.0000000 0.9529438 0.9529438 0.9529438
## [5,] 0.9529438 0.9529438 0.9529438 0.9529438 1.0000000 0.9529438 0.9529438
## [6,] 0.9529438 0.9529438 0.9529438 0.9529438 0.9529438 1.0000000 0.9529438
## [7,] 0.9529438 0.9529438 0.9529438 0.9529438 0.9529438 0.9529438 1.0000000
## [8,] 0.9529438 0.9529438 0.9529438 0.9529438 0.9529438 0.9529438 0.9529438
##           [,8]
## [1,] 0.9529438
## [2,] 0.9529438
## [3,] 0.9529438
## [4,] 0.9529438
## [5,] 0.9529438
## [6,] 0.9529438
## [7,] 0.9529438
## [8,] 1.0000000
```