

# The qlspack Package

June 23, 2008

**Version** 1.0-1

**Date** 2007-07-13

**Title** Quasi Least Square Package

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**Depends** R (>= 2.4.1), geepack (>= 1.0-12)

**Description** QLS is a two-stage computational approach for estimation of the correlation parameters within the framework of GEE. It helps solving parameters in mean, scale, and correlation structures for longitudinal data.

**License** GPL (>= 2)

**URL** <http://www.cceb.upenn.edu/~sratclif/QLSproject.html>

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qls-internal	<i>Internal qls functions</i>
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## Description

Internal functions called by other functions in qlspack.

**Usage**

```

cluster.size(id)
proc(data = "NA", time = "NA", id)
data.process(data = "NA", time = "NA", id)
data.proc.exfam(data = "NA", time = "NA", id)
residual(x, y, beta, family = "gaussian")
cormax.ar1(alpha, id, time = "NA")
cormax.exch(alpha, id, time = "NA")
cormax.markov(alpha, time)
cormax.tri(alpha, id, time = "NA")
cormax.exfam(alpha, id, time = "NA")
gen.zcor(cor.max, id, time = "NA", markov = FALSE)
gee.ar1.fixed(formula, data, id, alpha, family = "gaussian",
              time = "NA", std.err = std.err)
gee.exch.fixed(formula, data, id, alpha, family = "gaussian",
               time = "NA", std.err = std.err)
gee.markov.fixed(formula, data, id, alpha, family = "gaussian",
                 time = "NA", std.err = std.err)
gee.tri.fixed(formula, data, id, alpha, family = "gaussian",
              time = "NA", std.err = std.err)
gee.exfam.fixed(formula, data, id, alpha, family = "gaussian",
                time = "NA", std.err = std.err)
gee.fixed(formula, data, id, alpha, family = "gaussian", time = "NA",
           correlation, std.err = std.err)
ar1.one(resid, time = "NA", id)
ar1.two(alpha, resid = "NA", time = "NA", id = "NA")
exch.one(resid, time = "NA", id)
exch.two(alpha, resid = "NA", time = "NA", id)
markov.one(resid, time = "NA", id)
markov.two(alpha, resid = "NA", time = "NA", id)
tri.one(resid, time = "NA", id)
tri.two(alpha, resid = "NA", time = "NA", id)
exfam.one(resid, time = "NA", id)
exfam.two(alpha, id, time = "NA")
palp1(t)
palp2(t)
palp3(t)
palp4(t)
palp(t, j)

```

**Details**

These are not to be called directly by the user.

**Description**

The qls function fits quasi least square estimating equations based on the geeglm function in the geepack and cor.estimate function in the qlspack. qls has a syntax similar to glm and returns an object similar to a glm object. An important feature of qls, is that an anova method exists for these models.

**Usage**

```
qls(formula, data, id, family = "gaussian",
    time = "NA", correlation = "ar1", std.err = "san.se")
```

**Arguments**

formula	The model to be fitted. The form is similar to the item documented in geeglm. However, please note that you should list all the design variable name in the formula. Functions like <code>as.factor</code> might not work here.
data	A data frame containing the variables in the model.
id	a vector which identifies the clusters. The length of 'id' should be the same as the number of observations. Data are assumed to be sorted so that observations on a cluster are contiguous rows for all entities in the formula. The 'id's for different clusters should be different, but need not to be consecutive.
family	A character string describing the error distribution and link function to be used in the model. There are three options: "guassian", "binomial" and "poisson". The default option is "guassian".
time	a vector which identifies the time in the clusters. The length of 'time' should be the same as the number of observations. This argument is used if and only if 'correlation == "markov"'.
correlation	a character string specifying the correlation structure. The following are permitted: "ar1", "exchangeable", "markov", "tridiagonal" and "ex.fam".
std.err	See corresponding documentation to geeglm.

**Value**

An object of type 'qlsglm'.

**Warning**

qls has not been thoroughly tested. Please report bugs.

**Note**

qls only works for complete data. Thus if there are NA's in data you can specify `data=na.omit(mydata)`.

**Author(s)**

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## References

Chaganty, N. R. 1997. An alternative approach to the analysis of longitudinal data via generalized estimating equations. *Journal of Statistical Planning and Inference* **63**: 39–54.

Shults, J. 1996. The analysis of unbalanced and unequally spaced longitudinal data using quasi-least squares. Ph.D. Thesis, Department of Mathematics and Statistics, Old Dominion University: Norfolk, Virginia.

Shults, J. and Chaganty, N.R. 1998. Analysis of serially correlated data using quasi-least squares. *Biometrics* **54**: 1622–1630.

Chaganty, N.R. and Shults, J. 1999. On eliminating the asymptotic bias in the quasi-least squares estimate of the correlation parameter. *Journal of Statistical Planning and Inference* **76**: 127–144.

## See Also

[glm](#)

## Examples

```
data(rat)
qls.fit <- qls(bp ~ time + group2 + group3 + group4, data = rat, id = rat$id,
              time = rat$time, correlation = "markov")
summary(qls.fit)
```

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rat

*Blood pressure measures of the rats*

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## Description

The description of each column of the data set is as follows:

id2 = the id variable for each rat that is provided in Davis (2002).

id = a new id variable that takes value 1,2,..43 after sorting on id and group.

time = the timing of each measurement.

group = the group variable that takes value 1, 2, 3, or 4

bp = the blood pressure value.

group1 = indicator variables for group 1 that takes value one for rats in group 1 and that takes value 0 otherwise.

group2 = indicator variables for group 2 that takes value one for rats in group 2 and that takes value 0 otherwise.

group3 = indicator variables for group 3 that takes value one for rats in group 3 and that takes value 0 otherwise.

group4 = indicator variables for group 4 that takes value one for rats in group 4 and that takes value 0 otherwise.

highbp = a variable that takes value 1 if the rat's blood pressure is at least 100.

**Usage**

*rat*

**Format**

A data frame contains 291 observations and 10 variables.

**Source**

Table 6.11 of Davis (2002)

**References**

Davis, C.(2002). *Statistical Methods for the Analysis of Repeated Measurements*.

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