

# MLRegress Components 1.0 for 32-Bit Delphi

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Decision Technologies Group

## Purpose of Linear Regression

Many Delphi programmers are involved in the development of (database) systems for the gathering of experimental data. The majority of experimental activities have goals of producing models or formulas by which a response  $y$  can be *predicted* given the values of one (or more) controllable variables  $x[1], \dots, x[n]$ . Regression is an approach which uses least-squares approximation to extract from experimental data, the nature of the cause and effect relationship between  $x$  and  $y$ . Thus it assumes (1) that such a relationship exists, and (2) that the control variable(s) can be observed without error.

A (small) sample of systems which programmers might be involved in the development where regression analysis proves a useful methodology are:

- [amount of precipitate] caused by a <solution's chemical reagent> and <temperature>
- [job performance rating] based on scores of <test 1>, <test 2>, <test 3> and <test 4>
- [sales] for a \$ amount of <advertising>, <available staffing>, and [hours open]
- [percentage of insect spoiled fruit] per <crop size> and <acreage>
- [infant mortality rate] vs. <income>, <ethnic background>, <locality>

In the list above, the terms in the square brackets are the [response variables] to be predicted or classified, and those in the angular brackets are the <control variables> used to predict the value of [response].

Developers of data collection software provide significant added value to their clients or employers when their software makes serious attempts to provide explanations of the data relationships rather than simply storing and printing it. The Multiple Regression Components allow users to explore many linear and non-linear relationships between various datafields in a dataset.

## Role of the MLR Components

The Multiple Linear Regression components contain all of the mathematics required for modeling data from tables in which a relationship between the data in *multiple* datafields is suspected. In addition to the mathematical formulas contained in the MLRQuery and MLRTable components, each of these components possess all of the functionality, methods, events, and properties of the Query (TQuery) and Table (TTable) components respectively.

The MLR components are very flexible, allowing any of the control variables to represent a transformation of the data contained in database table fields. Possible transformations include products and quotients of two data fields, log of a datafield, inverse of a datafield, and values of any datafield raised to an integer power. Response variables can also be transformed to achieve a curvi-linear regression model. Modeling the data transformations is explained in the MLR Help file. In addition, Applied Analytic Systems is developing a publication "Statistical Modeling with Delphi and C++ Builder", available in October 1997.

The MLRTable component requires all control variables and response variables to reside in the same database table. Use the MLRQuery component with the appropriate SQL joins whenever

the control and response variables are stored in multiple database tables. Sample uses of both components are shown in the demo program.

**Benefits:**

- ⇒ Delivering a self contained program which can instantaneously perform regression on any table(s) accessible by the TTable and/or TQuery through the Borland Database Engine.
- ⇒ No need to export data from Paradox, dBase, InterBase or other table formats into SPSS, SAS, Excel, Quattro Pro, or 1-2-3.
- ⇒ Scatter plots quickly show whether a linear data trend appears to be present among any of the control variables and the response variable.
- ⇒ A variety of residual plots are available to access whether the general assumptions of a linear regression model are satisfied.
- ⇒ Plots of residuals, y vs x, and cumulative distribution function can be viewed using the component methods, or via another third-party graphing utility using the component properties.
- ⇒ The Predict function can be used to indicate when a new data record appears to have problematic (outlying) data points (as soon as it is input by data entry personnel).
- ⇒ Delphi direct linkable DCU file along with a two VCL Components, allows developers to set all the parameters visually if desired.
- ⇒ Sample project with multiple data tables and demo source code in Delphi 2.0 and 3.0.

**Possible Concerns:**

- ⇒ Both the developer and client may have insufficient understanding of the meaning of the regression outputs, consequently using it where it does not apply. Users should always locate an Intermediate Statistical Methods text if in doubt. The Applied Analytic Systems Statistical Consulting Group is available (at our normal rate) if specialized help is needed.

**Evaluation Version Limitations:**

The shareware evaluation version is fully functional within the Delphi IDE. Applications which use the evaluation components cannot be distributed or run without Delphi.

**There are two 32-Bit version of the MLR Components:**

1. DCU Versions for Delphi 2.0 (Includes TMLRQuery and TMLRTable)  
includes demo project and source code for the demo showing how to use the components.
2. DPK/DCU Package version for Delphi 3.0 (Includes TMLRQuery and TMLRTable)  
includes demo project and source code for the demo showing how to use the components.
3. Full versions of each of the above are included when registered. Source code is now available at a price of US \$79.

NOTE: In addition to (or in lieu of) the source code for the component set, we can provide each user with detailed references on each of the mathematical routines used in the component.

**Files to install (32-Bit)**

The user can copy or unzip the files to any directory on the system. The files named below are common to both 32-bit installations. Note that there are separate file sets included for Delphi 2.0 and 3.0. Only the names are the same. In addition to the common installation files, the Delphi 3.0 version includes package files.

**Installed Units (required in Delphi 2.0, 3.0 and 4.0)**

**Usage**

|              |                                       |
|--------------|---------------------------------------|
| LoadGage.DCU | Data load progress unit               |
| Matrix.DCU   | Performs matrix calculations          |
| Matrxdlg.DCU | Viewing correlation/covariance matrix |
| Maxdata.DCU  | Sets maximum data records allowed     |

Mlqabout.DCU  
Mlr32reg.DCU  
Mlrcoef.DCU  
Mlrctrl.DCU  
Mlrforms.DCU  
Mlroutpt.DCU  
Mlrplot.DCU  
Mlrquery.DCU  
Mlrresp.DCU  
Mlrtable.DCU  
Mlrtypes.DCU  
Mltabout.DCU

Loadgag.DFM  
Matrxdlg.DFM  
Mlqabout.DFM  
Mlrctrl.DFM  
Mlroutpt.DFM  
Mlrresp.DFM  
Mltabout.DFM

Mlr32reg.DCR`

**Installed Units (Delphi 3.0 Only)**

MlrDel30.DCP  
MlrDel30.DPL  
MlrDel30.DCU  
MlrDel30.DPK  
MlrDel30.RES

**Installed Units (Delphi 4.0 Only)**

MlrDel40.CFG  
MlrDel40.BPL  
MlrDel40.DCU  
MlrDel40.DPK  
MlrDel40.RES

**Installed Units (optional)**

Maxdata.PAS

Mlr32reg.PAS

**Demo Units (optional)**

Aptitude.DB  
Bank.DB  
Bank.DBF  
Chemical.DBF  
Coffee.DB  
Exmp12-2.DB  
Invest.DB  
Mlrdemo.DPR  
Mlrdemo1.DFM

About the MLRQuery component  
Register the component set into VCL  
Code for registered users  
Control Variable Property Editor  
Misc. types and parameters  
Output report for regression  
Plotting unit for scatter, residuals, ECDF  
MLRQuery component unit  
Response Variable Property Editor  
MLRTable component unit  
MLR supporting classes  
About the MLRTable component

Form file for data load progress  
Form file for corr/covar matrix viewing  
Form file for About MLRQuery  
Form file for Control Var property editor  
Form file for Output report  
Form file for Response Var property ed.  
Form file for About MLRTable

MLR 32-bit component resource file

**Usage**

Delphi 3.0 Component Package  
Delphi 3.0 Package Library  
Delphi 3.0 Package Compiled Unit  
Delphi 3.0 Package Source File  
Delphi 3.0 Package Resource File

**Usage**

Delphi 4.0 Configuration File  
Delphi 4.0 Package Library  
Delphi 4.0 Package Compiled Unit  
Delphi 4.0 Package Source File  
Delphi 4.0 Package Resource File

**Usage**

Allows user to edit Maxdata constant

Allows user to edit installation Page

**Usage**

Paradox Sample data table  
Paradox Sample data table  
dBase Sample data table  
dBase Sample data table  
Paradox Sample data table  
Paradox Sample data table  
Paradox Sample data table  
Demo Project File  
Demo Form File

Mlrdemo.PAS  
Mlroptim.DCU  
Optgauge.DCU  
Optgauge.DFM  
Ovdc.DB  
Ovdc.DBF  
Probdesc.DB  
Probdesc.MB  
Probdesc.PX  
Qpro14-7.DB

Demo Source Code  
Optigress<sup>(TM)</sup> trial version  
Optigress<sup>(TM)</sup> progress gauge  
Optigress<sup>(TM)</sup> progress gauge form file  
Paradox Sample data table  
dBase Sample data table  
Descriptions of Sample Data  
Descriptions of Sample Data (memo)  
Descriptions of Sample Data (index)  
Paradox Sample data table

## Installation

Copy or unzip the files to the directory of choice for adding new VCL component. It may make sense to keep the installation files together in their own directory; however, this is not necessary.

### In Delphi 2.0

- 1) Select "Component" and select "Install...".
- 2) Add MLR32REG.DCU to the list of Installed Units.
- 3) Click OK.

The library will recompile and the Linear Regression component will be added to the "AAS Statistics" page on the Component Palette.

It is also possible to install to a different page of choice by editing the Register procedure in MLR32REG.PAS, and adding it instead of MLR32REG.DCU.

### In Delphi 3.0

- 1) Select "Component" and select "Install Packages...".
- 2) Click "Add...".
- 3) "Look in" the directory containing the MLR installation files.
- 4) Select MlrDel30.DPL and click Open.  
*Multiple Regression Components for Delphi 3.0* will be added to the list of Design Packages.
- 5) Click OK.

### In Delphi 4.0

- 1) Select "Component" and select "Install Packages...".
- 2) Click "Add...".
- 3) "Look in" the directory containing the MLR installation files.
- 4) Select MlrDel40.BPL and click Open.  
*Multiple Regression Components for Delphi 4.0* will be added to the list of Design Packages.
- 5) Click OK.

The Multiple Linear Regression components will be added to the "AAS Statistics" page on the Component Palette.

It is also possible to install to a different page of choice by editing the Register procedure in MLR32REG.PAS, and compiling a new component package set. This should be done INSTEAD of 1) - 5) above. If the user is unfamiliar with this procedure, 1) - 5) should be used. The user can change MLR component locations or palette page name by setting the Delphi 3.0 Environments Options.

The Demo Directory can be moved to any directory of choice. Note that the Demo program looks for the database tables to be in the same directory as the Demo exe file. Keep all demo files together in the same directory.

## Run the Demo Program

The demo program helps to understand the usage of the components in a programmer's application. Examine the Mlrdemo1.PAS source code.

Compile and run the Demo program. Open the Regression Output Report by clicking the "Output" button. Click "Plots" to view scatter and residual plots. An "Optimal" regression for the given control variables can be found by clicking "Optimize". This demo also uses a TRIAL VERSION of Optigress(TM), available separately from Applied Analytic Systems, currently priced at US \$99.

**IMPORTANT:** Please contact AAS if you experience any difficulty installing the component set and compiling/running the demo. We will provide immediate support.

## Function Reference

*Both the MLRQuery and MLRTable components provide the same functions.*

### Data Input functions:

LoadValues  
ReLoad

### Regression functions:

Execute  
Predict

### Reporting and Graphing/Plotting functions:

Output  
ShowPlots

For the exact descriptions and usage of each of these functions, please see the MLR help file.

## Registration

### License fees:

Both 16-bit and 32-bit Delphi DCUs (each containing MLRQuery and MLRTable VCL components):

- 3 Independent Variables: US \$79 for single-user, single-workstation.
- 5 Independent Variables: US \$99 for single-user, single-workstation.
  - 10 Independent Variables: US \$149 for single-user, single-workstation.

MLRegress license includes **royalty-free** runtime distribution.

No shipping charges within US or Canada. US \$5 for shipping outside of North America.

Pennsylvania-based developers must include an additional 7% sales tax on the total order.

Contact Applied Analytic Systems for site license discounts for multiple users at a single location.

**The following payment methods are currently available:**

*Checks:* Only checks drawn on a US bank valued in US\$ can be accepted. Product will be shipped as soon as payment is received. Mail Checks to:

Applied Analytic Systems, Inc.  
Carnegie Office Park  
Bldg 1, Suite 116  
Carnegie, PA 15106  
USA

If the order is to be shipped to a Pennsylvania address, don't forget to include an additional 7% sales tax on the total order.

***Credit Card Orders:***

Applied Analytic Systems has contracted NorthStar Solutions to process orders placed using Visa, MasterCard, or Discover card. Please be sure to note the TMLRegress Product # when placing the order:

- 3 Independent Variables: US \$79 for single-user, single-workstation - Product # [1891]
- 5 Independent Variables: US \$99 for single-user, single-workstation - Product # [1892]
  - 10 Independent Variables: US \$149 for single-user, single-workstation - Product # [1893]

**INTERNET ORDERS**

Order MLRegress Components through <http://www.aasdt.com/statistics/mlr.html> which links to the appropriate NorthStar online order form--fast, easy and **secure!** Select the appropriate ***TMLRegress*** set from the product list.

**PHONED ORDERS**

Calls are taken 10 am - 8 pm, EST, Monday thru Saturday.

1-800-699-6395 (From the U.S. only.)  
1-803-699-6395

**FAXED ORDERS**

Available 24 hours.  
1-803-699-5465

Any questions about the status of the shipment of an order, registration options, product details, technical support, volume discounts, dealer pricing, site licenses, non-credit card orders, ... should be directed to the Decision Technologies Group:

|           |   |
|-----------|---|
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| AOL:      | aascorp   |
| Internet: | support@aasdt.com   |
| Web:      | <a href="http://www.aasdt.com/">http://www.aasdt.com/</a> |
| Phone     | 412.278.2360  |
| FAX:      | 412.788.4205  |

**Shipping:**

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**Distribution:**

This package can be redistributed ***if and only if*** it is a trial version and the original zip file is distributed intact. Registered user's packages are not trial versions, and the licensees agree **NOT** to redistribute their component set in any way.

If you would like to provide a trialware copy to a colleague, please contact Applied Analytic Systems for a distributable version, or link to <http://www.aasdt.com/statistics/>.