3 A LogXact Tutorial

We believe you will enjoy analyzing data using LogXact. One reason is of course that it performs exact inference. A second reason is its user interface. You can enter, view, or alter data, build models, and browse through the output in a friendly interactive environment. You will find this very convenient even if you use LogXact only for asymptotic inference.

The easiest way to learn LogXact is to sit at the computer and analyze a data set. This tutorial will take you through such a hands-on analysis quickly. In the process, you will become familiar with several of LogXact's important commands, and will gain an overall understanding of how they all work together. The subsequent chapters will build on your experience by providing more details about the individual commands, a broader variety of examples, technical details about the output, and some discussion of the theory behind exact logistic regression.

This tutorial also explains with an Example, a very useful feature available in LogXact, namely, batch lanuage commands. Using this feature, you can create a single batch command file containing commands for several different analyses on one or more data sets. This command file can be submitted in LogXact for execution without you having to wait at the computer.

3.1 Activating LogXact

Before you begin this tutorial:

1. Verify that LogXact is properly installed in a separate directory on your hard disk.
2. Verify the name of the directory in which all the sample data sets, supplied as part of the LogXact software, are stored.

This tutorial will assume that you have installed LogXact in `C:\LOGXACT` and have stored the LogXact data sets in `C:\LOGXACT\DATA`. Make appropriate modifications to the tutorial instructions if either LogXact or the data sets are stored in other directories.

3.2 Bringing Data into LogXact

3.2.0 Data Description
3.2.0 Opening a LogXact File
3.2.0 Examining Ungrouped Data
Converting to Group Data

Data may be entered into LogXact as case data or as group data, read in as a previously saved LogXact file through the `Open` command in the `File` menu, or read in from another software package through the `Import` command. In this tutorial, you will read in a previously saved data file using the `Open` command.

Description of the Data Set

We are grateful to Dr. S. Lai, University of Miami, for providing this example. A hospital based prospective study of perinatal infection and human immunodeficiency virus (HIV- 1) by Hutto, Parks, Lai, et al. (1991) investigated the possibility that the CD4 and CD8 blood serum levels measured in infants at 6 months of age might be good predictors of eventual HIV infection. The data on HIV infection rates and blood serum levels are tabulated below:

Proportion Developing HIV	Serum Levels at 6 Months CD4	CD8
4/7 (57%)	0	0
1/1 (100%)	0	2
2/7 (29%)	1	0
4/12 (33%)	1	1
2/2 (100%)	1	2
0/2 (0%)	2	0
0/13 (0%)	2	1
1/3 (33%)	2	2

The above data set is one of several that are supplied along with your LogXact software. It is stored in a file named HIV.CYD. If you followed the installation procedure exactly as described in the Chapter titled “Installation" in Cytel Studio manual, you should have this and all other data sets saved in a separate `DATA` subdirectory of your LogXact directory on your hard disk.

Opening a LogXact Data File

One of the data sets in the `DATA` subdirectory is a file named `HIV.CYD`. To open this file in LogXact, choose from the main menu:

```
File
Open ...
```

In the ensuing dialog box, select the file `HIV.CYD` in the `DATA` subdirectory, and click OK. Notice that a new workbook is created and data are brought into the “HIV.CYD"

The `HIV.CYD` file is brought into LogXact and the data window appears as follows:

Hiv.cyd

	HIV	CD4	CD8	FREQ	var
1	1	0	2	1	
2	1	1	2	2	
3	1	0	0	4	
4	0	0	0	3	
5	1	1	1	4	
6	0	1	1	8	
7	1	2	2	1	
8	0	2	2	2	
9	1	1	0	2	
10	0	1	0	5	
11	0	2	0	2	
12	0	2	1	13	

The name of the file just opened (HIV.CYD) appears at the top of the data window.

Examining Ungrouped Case Data in the Data Editor

The case data are now in the `Data Editor` where you can examine and possibly edit the HIV.CYD data.

Use the mouse or the ↑ ↓ → ← arrow keys to move the cursor around in the worksheet and examine more of the data records. You can easily alter the data by typing in a new entry at the current position of the cursor. However, please do not alter the data permanently as they are needed in their original form for this example.

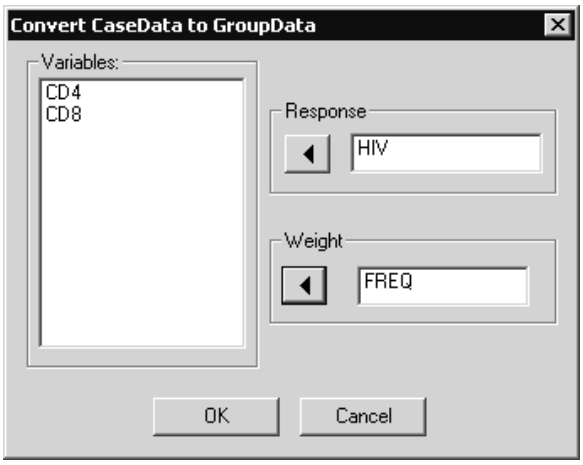
Converting to Group Data

In this data set, the binary HIV variable (1=yes, 0=no) is the response variable. The variable named FREQ gives the weight or frequency count, of the number of records with the same values of HIV, CD4 and CD8. For example, the second record displayed by the `Data Editor` had a weight of 2 (FREQ=2 for that record), implying that it will be treated as equivalent to two records, each having HIV=1, CD4=1, and CD8=2. The data are **ungrouped**. This means that we did not gather together records with the same covariate values. However, we might get a better feel for the data if they were first converted to **grouped** format. Choose from the menu:

```
DataEditor
```

```
Convert to Group Data ...
```

In the ensuing dialog box, select `HIV` as the `Response` variable and `FREQ` as the `Weight` variable. The dialog box now looks as shown below.



Click on OK.

On conversion, LogXact takes you to a new `Data Editor` window.

GroupData

	HIV	FREQ	Resp(%)	CD4	CD8	var
1	4	7	*57.14%*	0	0	
2	1	1	*100.00%*	0	2	
3	2	7	*28.57%*	1	0	
4	4	12	*33.33%*	1	1	
5	2	2	*100.00%*	1	2	
6	0	2	*0.00%*	2	0	
7	0	13	*0.00%*	2	1	
8	1	3	*33.33%*	2	2	
9						

To explain the above grouped form of the data, let us look at the first record: HIV=4, FREQ=7, Resp(%)=57.14%, CD4=0 and CD8=0. What this means is that there were 7 cases having covariate values as CD4=0 and CD8=0 and out of which in 4 cases, the response variable HIV had the value of 1 and in the remaining 3 cases, HIV took the value of 0. So the

response % for these 7 cases is 57.14% $(= (4/7)X100)$. The grouped form makes it a little easier to see how the covariates affect the response rate. It is also easier to enter small data sets into LogXact in grouped form, since that is how they usually appear in journal articles. Indeed that is the way the data were presented at the start of this section.

3.3 Saving Your Data

As a LogXact file

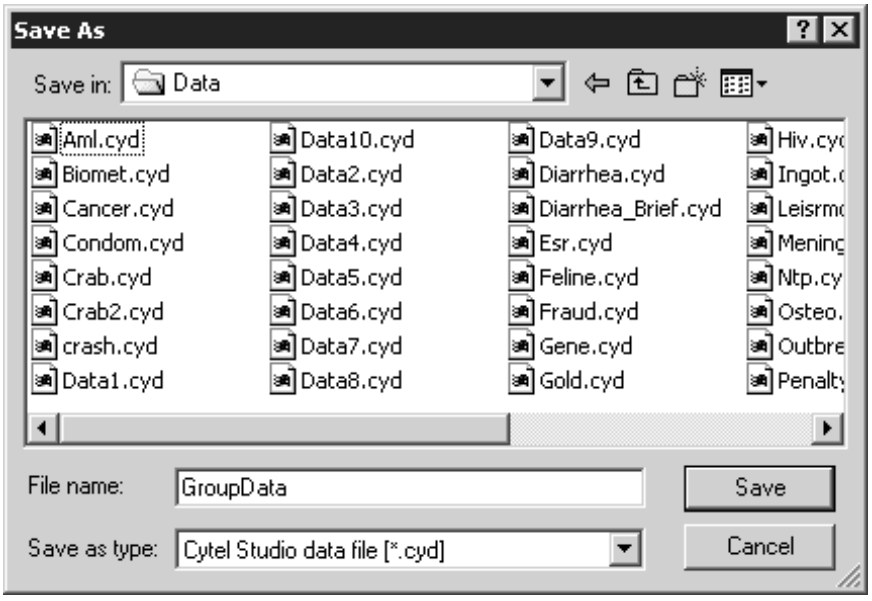
It is usually a good idea to save your data set after you have worked on it. LogXact allows you to save the current data set (if it is case data) in LogXact or Text data file format. If the current data set is in grouped data format, then you can save it only in LogXact grouped data file format.

As a LogXact file

Suppose you wish to save the current grouped data set in LogXact file format. Choose from the menu:

```
File
Save As
```

This brings up the following dialog box:



Enter the file name as `HIV_Group` and click on `Save`. Now the file `HIV_Group` will be saved in the `DATA` subdirectory. Notice that the `.CYD` extension is the default extension

assigned to the file name. You can override the default by specifying another extension explicitly.

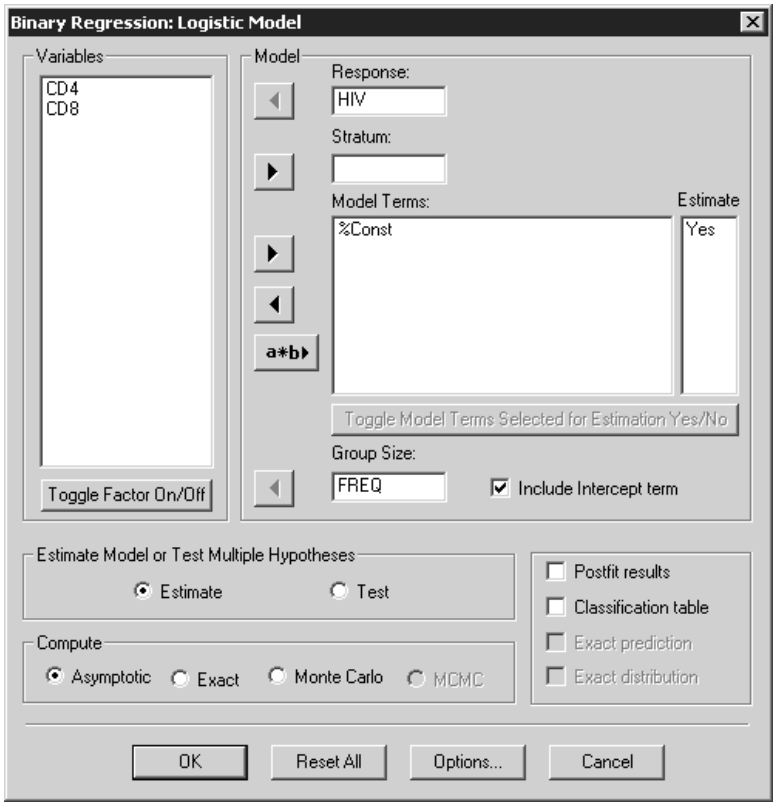
3.4 Model Specification, Estimation and Testing

The directions in this section will take you through the steps of building a binary logistic regression model, estimating its parameters, and performing hypothesis tests. The technical details of the maximum likelihood and conditional inference procedures underlying these steps, are provided in Appendix A. You may skip Appendix A for the present, since the goal of this tutorial is to gain a quick understanding of how LogXact works without being overwhelmed by technical details.

To fit a logistic regression model, choose from the menu:

```
Regression
Binary Response
Logistic Model ...
```

This brings up the following `Binary Regression: Logistic Model` dialog box:



In the dialog box, notice that `HIV` is the `Response` variable, and `FREQ` is the `Groupsize` variable, reflecting the choices you made in converting to grouped data. Also notice that `%Const` is shown as a model term. This is because LogXact, by default always fits a model which includes the constant term unless you uncheck the box shown against "Include intercept term" or you are fitting a conditional logistic regression model (See Chapter 8 for details on conditional logistic regression.).

Model Specification

Select `Model Terms` to specify an appropriate model. To begin with, model the HIV response rate as a function of CD4 and CD8, both covariates being regarded as ordinal. In the `Binary Logistic Regression` dialog box, select `CD4` and `CD8` as the `Model Terms`. The variables `CD4` and `CD8` should now appear in the `Model Terms` section of the `Binary Logistic Regression` dialog box.

Parameter Estimation

Estimate the regression coefficients by clicking on the `OK` button, accepting the `Estimate` and `Asymptotic` defaults in the dialog box. The maximum likelihood estimates, asymptotic p-values and asymptotic confidence intervals for the regression parameters are computed and displayed in the `Binary Regression (As) - Estimate` worksheet of the workbook, as shown below:

Binary Regression

Basic Information

Data file	Hiv_Group.cyd
Model	HIV=%Const+CD4+CD8
Link type	Logit
Group Size variable	FREQ
Stratum variable	<Unstratified>
Analysis type	Estimate :: Asymptotic
Number of terms in model	3
Number of term(s) dropped	0
Number of observations in analysis	47
Number of records rejected	0
Number of groups	8

Summary Statistics

Statistics	Value	DF	P-Value
Deviance	4.471	5	0.4837
Likelihood Ratio	23.65	3	2.952e-005

Parameter Estimates

	Point Estimate			Confidence Interval and P-Value for Beta			
					95 %CI		2*1-sided
Model Term	Type	Beta	SE(Beta)	Type	Lower	Upper	P-Value
%Const	MLE	0.5132	0.6809	Asymptotic	-0.8213	1.848	0.451
CD4	MLE	-2.542	0.8392	Asymptotic	-4.187	-0.8968	0.002457
CD8	MLE	1.659	0.8211	Asymptotic	0.04923	3.268	0.04339

The `Binary Regression` worksheet in the workbook enables you to view all the regression estimates during the current model-fit. If you leave this worksheet, you can always return to it. The results of fitting the model are displayed in three sections. (See Section 5.2 for details on the contents of this worksheet.)

The first section, titled “Basic Information”, gives the filename of the data used to fit the model; specifies the model; shows the group size variable used, if any; specifies the stratum, if any; and describes the type of analysis performed, gives the number of model terms, the number of terms dropped, the number of observations, and the number of distinct groups (or covariate combinations that can be formed by the covariates in the current model).

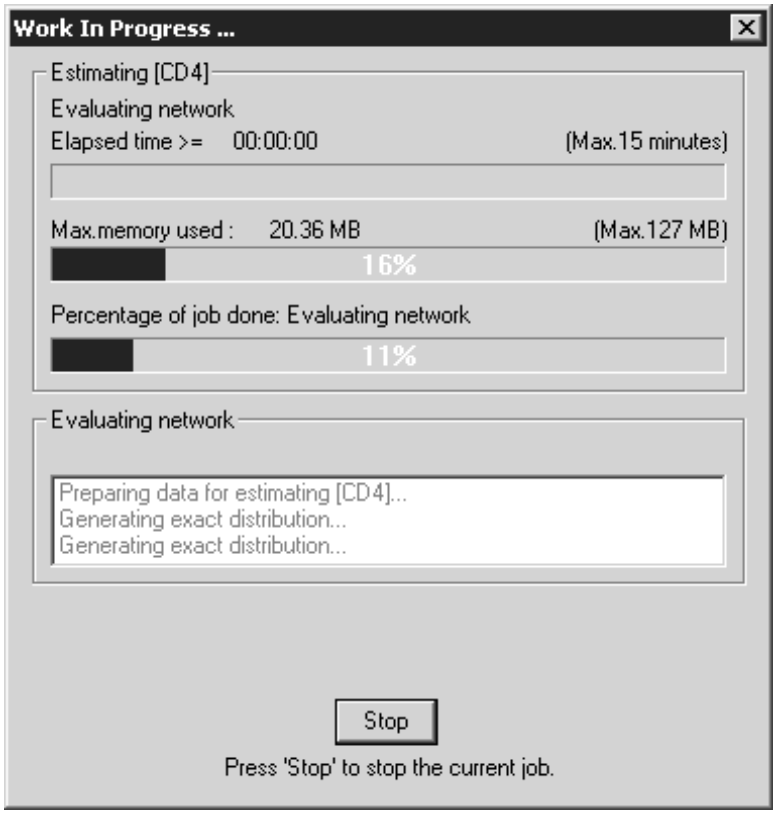
The second section, titled “Summary Statistics”, gives the value of the deviance and the value

of the likelihood ratio statistic, the corresponding degrees of freedom, and the p- value for testing the overall significance of the model, i.e., for testing the null hypothesis that all the model parameters (including the constant term) are zero.

The third section, titled "Parameter Estimates" contains output relating to the terms in your model. Here, you can examine point estimates and their standard errors, asymptotic confidence intervals, and p-values for the regression coefficients corresponding to CD4, CD8, and the constant term.

Suppose you wish to estimate the regression coefficients using the exact method. Simply choose the `Exact` option in the `Binary Regression: Logistic Model` dialog box and click on `OK`.

The `Work In Progress` display box will appear as shown below.



There is a section containing three progress meters at the top of the `Work In Progress` box. Immediately above the first progress meter, there is a line that tells you what job is being performed. In this example, it is "Estimating [CD4]", the current model term.

The *Elapsed time* progress meter indicates how much of the maximum computation time has elapsed while estimating the current model term. The time displayed is incremented at regular intervals of at least 5 seconds.

The *Max. memory used* progress meter indicates how much of the maximum available memory has been consumed while estimating the current model term.

The *Percentage of job done* progress meter indicates how much of the current job has been completed.

Since this is a small data set, the execution of the job will be very fast and the `Work In Progress` message box may not remain on the screen for long for you to see it properly. But while analysising larger data sets, you will be able to see properly the message box and the information it diplays on the the continuous monitoring of the job.

(See Section 9.2.3 for more details on the `Work In Progress` message box.)

After some time, the results appear in Binary Regression (EX) worksheet as shown below.

Summary Statistics

Statistics	Value	DF	P-Value
Deviance	4.471	5	0.4837
Likelihood Ratio	23.65	3	2.952e-005

Parameter Estimates

Model Term	Point Estimate			Confidence Interval and P-Value for Beta			
					95 %CI		2*1-sided
	Type	Beta	SE(Beta)	Type	Lower	Upper	P-Value
%Const	MLE	0.5132	0.6809	Asymptotic	-0.8213	1.848	0.451
CD4	MLE	-2.542	0.8392	Asymptotic	-4.187	-0.8968	0.002457
	CMLE	-2.388	0.8006	Exact	-4.7	-0.8222	0.0004138
CD8	MLE	1.659	0.8211	Asymptotic	0.04923	3.268	0.04339
	CMLE	1.592	0.8047	Exact	-0.01378	3.908	0.05278

Notice that the asymptotic and exact estimation methods can lead to different conclusions. For example the exact p-value for CD4 is about six times smaller than the asymptotic p-value. Again, CD8 is statistically significant at the 5% level asymptotically, but not by the exact method.

Sometimes, exact estimation may take too much computation time. In such situations, it is advisable to use Monte Carlo estimation instead. To do this, simply choose the `Monte Carlo` option in the `Binary Regression: Logistic Model` dialog box and click on `OK`.

The `Work In Progress` display box will appear at first. After some time, the Monte Carlo estimates will appear in the worksheet `Binary Regression (MO)` as shown below.

Summary Statistics

Statistics	Value	DF	P-Value
Deviance	4.471	5	0.4837
Likelihood Ratio	23.65	3	2.952e-005

Parameter Estimates

	Point Estimate			Confidence Interval and P-Value for Beta				
					99 %CI		P-Value	
Model Term	Type	Beta	SE(Beta)	Type	Lower	Upper	2*1-sided	SE
%Const	MLE	0.5132	0.6809	Asymptotic	-0.8213	1.848	0.451	
CD4	MLE	-2.542	0.8392	Asymptotic	-4.187	-0.8968	0.002457	
	CMLE	-2.381	0.8082	Monte Carlo	-4.697	-0.8263	0.0002	0.0002
				(Seed = 1096148000, Samples = 10000)				
CD8	MLE	1.659	0.8211	Asymptotic	0.04923	3.268	0.04339	
	CMLE	1.587	0.8183	Monte Carlo	-0.007748	3.869	0.05	0.003122
				(Seed = 1096148000, Samples = 10000)				

3.4.1 Factor Variables

In this data set, CD4 and CD8 assume the values 0,1,2. But these are not the actual blood serum levels. Rather they are coded surrogates for them. Thus suppose you are unwilling to treat CD4 and CD8 as ordinal variables, but would like to treat them as factors. This requires that CD4 and CD8 each be split up into two dummy variables. The `Toggle Factor` option in the `Binary Logistic Regression` dialog box accomplishes this splitting. You may choose as the baseline for the splitting either the highest value or the lowest value of the variable being split, by editing the variable properties in the data editor window. The default takes the highest value as the baseline. Choose from the menu:

```
Regression
Binary Response
Logistic Model ...
```

Select CD4 and CD8. Then, click on the `Toggle Factor On/Off` button under the list of variables. Notice that the `Model Terms` section of the window shows <fa> next to both CD4 and CD8. This means that CD4 has been split into two dummy variables, CD4_0 and CD4_1. The CD4_0 variable assumes the value 1 when CD4 is 0, and assumes the value 0 otherwise. The CD4_1 variable assumes the value 1 when CD4 is 1 and 0 otherwise. CD8 has been similarly split.

The Toggle Factor on/off button toggles the factor variables on or off. If you want to restore the factor variables as ordinal variables, click on this button again. Sometimes, a variable could have been declared as factor variable in the editor. In that case, <fa> will appear next to the factor variable. You can click on Toggle Factor on/off to use the variable as ordinal variable in the current model.

Maximum Likelihood Can Fail

With CD4 and CD8 declared as factor variables, try to obtain the unconditional maximum likelihood estimates of the regression coefficients for the model HIV=CD4+CD8 by selecting Asymptotic and then clicking on the OK button.

Because the maximum likelihood estimates do not exist for this small data set, convergence is not possible in this case. The Results window contains only question marks for all the model terms.

Binary Regression

Basic Information

Data file	Hiv_Group.cyd
Model	HIV=%Const+CD4+CD8(Factor: CD4 CD8)
Link type	Logit
Group Size variable	FREQ
Stratum variable	<Unstratified>
Analysis type	Estimate :: Asymptotic
Number of terms in model	3
Number of term(s) dropped	0
Number of observations in analysis	47
Number of records rejected	0
Number of groups	8

Summary Statistics

Statistics	Value	DF	P-Value
Deviance	NA	NA	NA
Likelihood Ratio	NA	NA	NA

Parameter Estimates

	Point Estimate			Confidence Interval and P-Value for Beta			
					95 %CI		2*1-sided
Model Term	Type	Beta	SE(Beta)	Type	Lower	Upper	P-Value
%Const	MLE	?	?	Asymptotic	?	?	?
CD4_0	MLE	?	?	Asymptotic	?	?	?
CD4_1	MLE	?	?	Asymptotic	?	?	?
CD8_0	MLE	?	?	Asymptotic	?	?	?
CD8_1	MLE	?	?	Asymptotic	?	?	?

This is not a problem in LogXact alone. You will face the same difficulty with any other logistic regression software: SAS, BMDP, GLIM or Egret. Appendix F explains why the maximum likelihood method fails in some situations.

Exact Estimates Exist

We saw previously that CD4 and CD8 are statistically significant when treated as ordinal variables. Unfortunately, the unconditional maximum likelihood method failed when these two variables were treated as factors. Is there any other way to assess the significance of CD4 and CD8 when they are factor variables? There is! The exact conditional approach (discussed in Appendix A) comes to our rescue here. Choose from the menu:

```
Regression
Binary Response
Logistic Model ...
```

Then select the `Exact` option, and click `OK` in the ensuing dialog box.

At first, the `Work In Progress` box appears. After some time, the following `Results` window appears:

Summary Statistics

Statistics	Value	DF	P-Value
Deviance	NA	NA	NA
Likelihood Ratio	NA	NA	NA

Parameter Estimates

	Point Estimate			Confidence Interval and P-Value for Beta			
					95 %CI		2*1-sided
Model Term	Type	Beta	SE(Beta)	Type	Lower	Upper	P-Value
%Const	MLE	?	?	Asymptotic	?	?	?
CD4_0	MLE	?	?	Asymptotic	?	?	?
	MUE	2.935	NA	Exact	0.5389	+INF	0.01448
CD4_1	MLE	?	?	Asymptotic	?	?	?
	MUE	2.446	NA	Exact	0.4544	+INF	0.01274
CD8_0	MLE	?	?	Asymptotic	?	?	?
	MUE	-2.247	NA	Exact	-INF	0.07002	0.05799
CD8_1	MLE	?	?	Asymptotic	?	?	?
	MUE	-2.319	NA	Exact	-INF	-0.0164	0.0483

Now notice that exact point estimates, confidence intervals, and p-values do exist even though the asymptotic ones do not. In the `Results` window, you can also see the estimates for the CD8_0 and CD8_1 dummy variables. If you wish to see the output of the previous model, you can go to the `Log` window and scroll up through it.

Testing Subsets of Regression Parameters

The p-values displayed for the CD4 and CD8 variables, while statistically significant, are not very helpful. These p-values only apply to each dummy variable separately. Thus you know that CD4_0 has a p-value of 0.0145 and CD4_1 has a p-value of 0.0127. But you would really like to perform a multiple hypothesis test that

$$CD4\_0 = CD4\_1 = 0$$

Three commonly used asymptotic methods for testing that a subset of the regression

parameters are zero are the likelihood ratio test, the Wald test, and the asymptotic unconditional score test. The `Test` option computes all three tests. Choose from the menu:

```
Regression
Binary Response
Logistic Model ...
```

Click on the `Test` option in the ensuing dialog box. Use the `Toggle Selected for Testing Yes/No` button to select `CD4` as the model term to test. Choose the `Asymptotic` option and click `OK` to run the test. The results of the `Test` are displayed in the `Results` window. Of course in the present case since the unconditional maximum likelihood method has failed, only the asymptotic unconditional score test can be computed, for it does not require the full model to be estimated. (See Appendix A, page 445, for details). The unconditional score test yields a p-value of 0.0063.

Hypothesis Testing

Tests <CD4_0=CD4_1=0>

Type of Test	Statistics	DF	P-Value	P-Mid
Score	10.1224	2	0.0063	NA
Likelihood Ratio	?	?	?	?
Wald	?	?	?	?

Now, suppose you want to use the Monte Carlo method. Choose the `Test` and `Monte Carlo` options in the `Binary Logistic Regression` dialog box. The `Test` worksheet of the `Results` window is shown below:

Hypothesis Testing

Tests <CD4_0=CD4_1=0>

Type of Test	Statistics	DF	P-Value	P-Mid	Std. Error
Score	10.1224	2	0.0063	NA	NA
Likelihood Ratio	?	?	?	?	?
Wald	?	?	?	?	?
Exact Likelihood Ratio:Mo	13.7598	NA	0.0043	0.0028	0.0007

(10000 Monte Carlo samples with starting seed = 1096334386)

NOTE: While computing the exact p-value, for some values of sufficient statistics, the maximum likelihood estimate computation did not converge. In those situations the last maximum likelihood iteration values were used.

Once again invoke the exact option by selecting the `Test` and `Exact` options in the `Binary Logistic Regression` dialog box. The exact conditional scores test, based on the joint distribution of the sufficient statistics for CD4_0 and CD4_1, provides a p-value

of 0.0071, in good agreement with the asymptotic unconditional score test.

Hypothesis Testing

Tests <CD4_0=CD4_1=0>

Type of Test	Statistics	DF	P-Value	P-Mid
Score	10.1224	2	0.0063	NA
Likelihood Ratio	?	?	?	?
Wald	?	?	?	?
Exact Score	9.3195	NA	0.0071	0.0067

Choose from the menu,

```
Regression
Binary Response
Logistic Model ...
```

In the ensuing dialog box use the `Toggle Selected for Testing Yes/No` button to select `CD8` and to deselect `CD4` for testing. You will see that the exact conditional score test that

CD8_0 =CD8_1=0

yields a p-value of 0.0256, whereas the asymptotic unconditional score test yields a p- value of 0.0198.

3.4.2 Exploration Mode

`Exploration mode` is an advanced feature of LogXact for logistic regression using Monte Carlo estimation or testing. It enables you to interactively improve the network sampling time. For details see Chapter 10.

Obtainable Output

The information on what output items are obtainable under different types of analysis is given in Appendix H.

3.5 The LogXact Command Language

Command Bar
Submit Command File

In LogXact, commands can be issued in three different ways: by invoking the menus, by typing them in the command bar, or by submitting a batch file. The command bar and batch command files use the LogXact Command Language, whose syntax is described comprehensively in Appendix J.

Command Bar

Suppose you want to perform the following sequence of tasks in LogXact:

1. Open the HIV.CYD file
2. Make HIV the response variable
3. Make FREQ the weight variable
4. Declare variable CD4 to be a factor variable
5. Specify the model
6. Estimate the model parameters

Previously in this chapter, you have seen how to accomplish such actions through the menus and dialog boxes. Instead of using the menus, you can type and execute one command at a time in the command bar located at the bottom of the LogXact window. To open HIV.CYD from the default data file path (if it had been already defined through the menu item `Options-File Paths`), type the following in the command bar: `US HIV.CYD .` Alternatively you can type in the full file path as in the following example:

```
US C:\LOGXACT\DATA\HIV.CYD
```

Press Enter. The HIV.CYD dataset appears in the `Data Editor` as shown below.

hiv.cyd

	HIV	CD4	CD8	FREQ	var
1	1	0	2	1	
2	1	1	2	2	
3	1	0	0	4	
4	0	0	0	3	
5	1	1	1	4	
6	0	1	1	8	
7	1	2	2	1	
8	0	2	2	2	
9	1	1	0	2	
10	0	1	0	5	
11	0	2	0	2	
12	0	2	1	13	
13					
14					
15					

»» us hiv.cyd

To specify that you are going to fit `Binary Logistic Model` enter in the command bar: `LX LOGIT`.

To specify HIV as the response variable, enter in the command bar: `LX RE HIV`.
To specify FREQ as the weight variable, enter in the command bar: `LX WE FREQ`.
To declare CD4 as a factor variable, enter in the command bar: `LX FA CD4`.
To specify the model, enter in the command bar: `LX MO %Const + CD4 + CD8`.
To estimate the model parameters, enter in the command bar: `LX ES AS %Const CD4 CD8`.

Now the results will appear as shown below.

Binary Regression

Basic Information

Data file	hiv.cyd
Model	Hiv(Response = 1)=%Const+CD4+CD8(Factor: CD4)
Link type	Logit
Weight variable	Freq
Stratum variable	<Unstratified>
Analysis type	Estimate :: Asymptotic
Number of terms in model	3
Number of term(s) dropped	0
Number of observations in analysis	47
Number of records rejected	0
Number of groups	8

Summary Statistics

Statistics	Value	DF	P-Value
Deviance	4.1407	4	0.3873
Likelihood Ratio	23.9832	4	0.0001

Parameter Estimates

	Point Estimate			Confidence Interval and P-Value for Beta			
					95 %CI		2*1-sided
Model Term	Type	Beta	SE(Beta)	Type	Lower	Upper	P-Value
%Const	MLE	-4.8052	1.5797	Asymptotic	-7.9014	-1.7090	0.0024
CD4_0	MLE	5.1106	1.7338	Asymptotic	1.7124	8.5087	0.0032
CD4_1	MLE	3.0218	1.2506	Asymptotic	0.5706	5.4729	0.0157
CD8	MLE	1.5812	0.8213	Asymptotic	-0.0286	3.1910	0.0542

Submit Command File

The `Submit` item in the `Edit` menu is used to run batch jobs, using LogXact's Command Language. It processes a series of LogXact commands located in an externally created batch file. Such a file is created in LogXact by specifying `Submit (Command) File` after choosing the `New` item on the `File` menu, or by copying the contents of the `History of commands` file.

A batch file for the previous example might consist of the following LogXact commands, listed one below the other. (Command lines having the first character as "!" are taken to be comment lines and they are ignored by LogXact):

```
! A sample batch file
US HIV.CYD
LX LOGIT
LX RE HIV
LX WE FREQ
LX FA CD4
LX MO %Const + CD4 + CD8
LX ES AS %Const CD4 CD8
```

Suppose the file containing the above sequence of LogXact commands is called BATCHRUN.CMD. Then choose from the menu:

```
File
Open ...
```

Select `.CMD` as the filetype. Then select `BATCHRUN.CMD` as the file to submit in the ensuing dialog box. Now choose from the menu:

```
Edit
Submit ...
```

LogXact immediately begins processing the commands, one at a time and the results will appear as before.

This example illustrates how to run a time-consuming series of jobs without having to wait at the computer. (Jobs can, for example, be run overnight with output redirected to files.)

3.6 Getting On-Line Help

The `Help` command provides on-line help for all the LogXact commands. To activate the on-line help choose from the menu:

```
Help
Help Topics
LogXact
```

To access the online user manual in pdf format click on

```
Help
Online User Manuals
LogXact
```

3.7 Exit

To exit the current LogXact session entirely, choose from the menu:

```
File
Exit
```

You will be prompted about unsaved items