Introduction

A finitely presented category can be considered a "directed graph with relations between paths of its edges".

Our notation for category data is:

Objects:
A, B, C, D, . . .

Maps/Arrows:
e:A →A, f:A →B, g:B →C, h:A →C. . .

Identity Maps/Arrows:
1:A →A, ...   (one for each object)

Composition of Maps/Arrows defined by Relations:
e = 1, g*f = h, ... (path of arrows)

File Types, Categories

In GDCT, there are three different file types associated with categories:

*.cat
These files are a text only representation of a category. These files can be both opened and saved. Since a graphical representation of the category is not saved one is generated randomly upon opening the *.cat file.

*.cgl
These files contain both a text and graphical representation of a category and can be both opened and saved. They are a concatenation of a .cat file and a .gml file.

*.gml
These files contain only a graphical representation of a category. These files can only be saved (and may be used by the VGJ applet), they can not be opened.

CAT File Format

The text representation of categories is stored in the following format. Any line that is a comment must start with the "#" character. On the line following the word "category" is the category name. Objects are listed between the words "objects" and "arrows". Arrows are listed between the words "arrows" and "relations". Relations are listed after the word "relations".

NOTE: The words "category", objects", "arrows", "relations", and "gml" are key words and cannot be used as the name of the category or as the name of an object or arrow within the category.

Objects and arrows can be a string of any length and can contain any characters excluding ":", "-", ">", "*", "#", ".", "=", ",", " ".

Relations are composed using the composition symbol "*".

An example of a typical CAT file can be found in Appendix A.

CGL File Format

A CGL file contains the information for both a text representation and a graphical representation.

The text representation is the same as the file format for CAT files. Any line that is a comment must start with the "#" character. On the line following the word "category" is the category name. Objects are listed between the words "objects" and "arrows". Arrows are listed between the words "arrows" and "relations". Relations are listed after the word "relations".

NOTE: The words "category", objects", "arrows", "relations", and "gml" are key words and cannot be used as the name of the category or as the name of an object or arrow within the category.

Objects and arrows can be a string of any length and can contain any characters excluding ":", "-", ">", "*", "#", ".", "=", ",", " ".

Relations are composed using the composition symbol "*".

The graphical representation uses a format known as gml which was developed at Auburn University for use with the Visualizing Graphs with Java (VGJ) project. It is incorporated into the cgl format by placing it at the end of the file after the keyword "gml". For more information consult the VGJ Documentation.

An example of a typical CGL file can be found in Appendix A.

Creating Categories

To create a Category in memory the user selects Categories | Create Category.

The names of objects and arrows can be strings of any length that is not a reserved word and can contain any characters excluding ":", "-", ">", "*", "#", ".", "=", ",", " ".

Enter a (descriptive!) name in the "Category name" box and type Enter.

Type the names of objects in the "Object Name" box which now appears, completing each with Enter. Press the "Objects Complete" button when done.

During creation of the category the objects and arrows are displayed in the Category Display Window. Objects may be moved about by mouse action at any time. Click on an object and drag it to a new position.

WARNING: No two objects may have the same name. If a duplicate object name is entered the program will display an error message and the new object will not be included in the category.
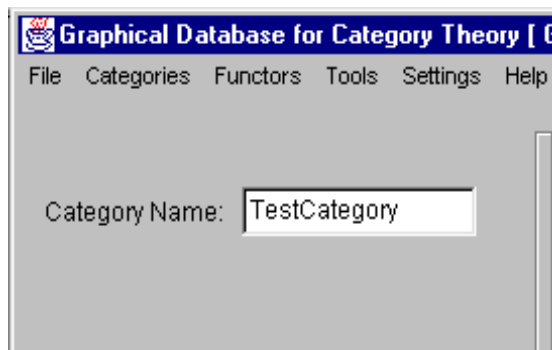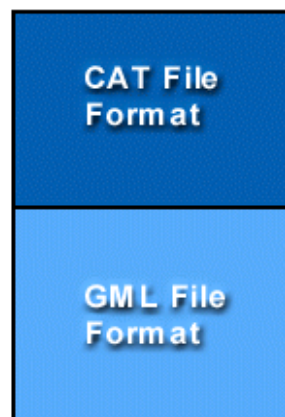
Entering arrows is very similar to entering objects. Type the names of arrows in the "Arrow Name" box which now appears, completing each with Enter. After the name of an arrow is entered, the user is prompted for the domain and then the codomain of the arrow. Press the "Arrows Complete" button when done.

As arrows are entered they are displayed in the Category Display window.

WARNINGS: No two arrows may have the same name. The domain and codomain of each arrow must be a declared object.
An arrow cannot be named "1" since this symbol reserved by the program for the identity arrow.

Next the user enters the equations among composites of the generating arrows. The "LHS of equation" box appears and the user must enter a composable path of arrows (separated by the composition symbol "*"). In the "RHS of equation" box another composable path is entered.
After the equations have been entered press the "Equations complete" button.
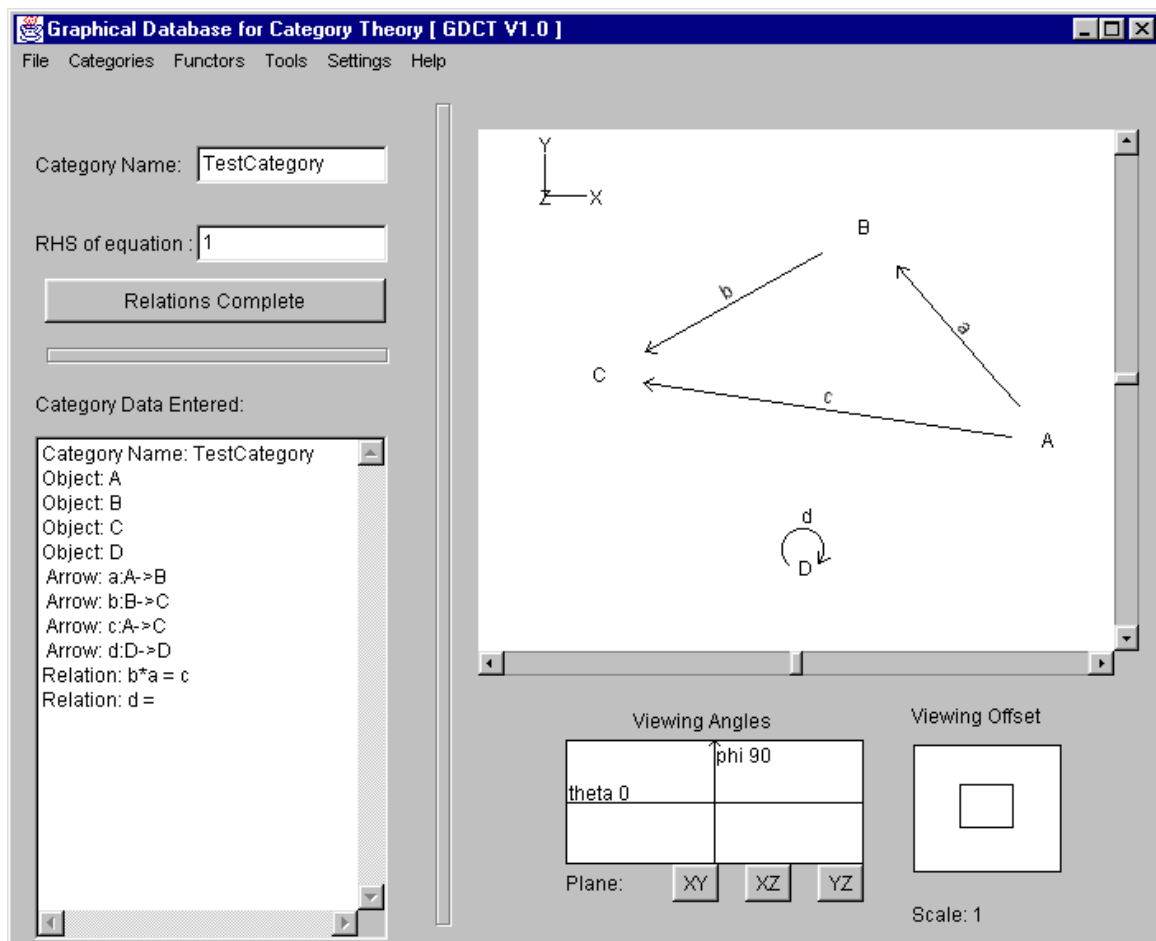
WARNING: Only valid equations are accepted. An equation is invalid if it contains arrows that are not in the category, or an undefined composition, or if the domain and codomain of the left side do not equal the domain and codomain of the right side.

This completes the creation of the new category.

WARNING:　The newly created category is stored in memory. To save the category to disk select File | Save Category and select graphical (.cgl) or text (.cat) format. A save dialogue window opens.

Opening Categories

In order to open a text category file (.CAT) select File | Open Category | Open Category(CAT) or Categories | Open Category | Open Category(CAT). This opens a file selection window. Opening graphical category files (.CGL) is similar. An alternative method to open a .cgl category file is to press CTRL+O. To open a category simply double click on the category's name or click once on the category name and press the OK button.
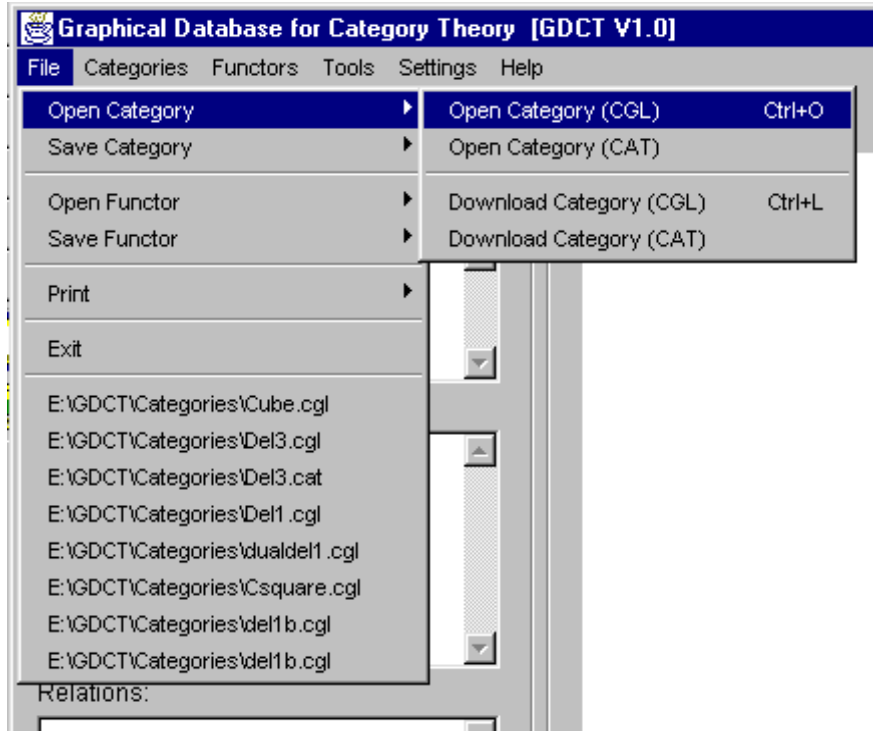
If there is any error in the format of the selected file an error message is displayed and the open is aborted.

The most recent category files can also be opened by clicking on one of their names in the File menu.
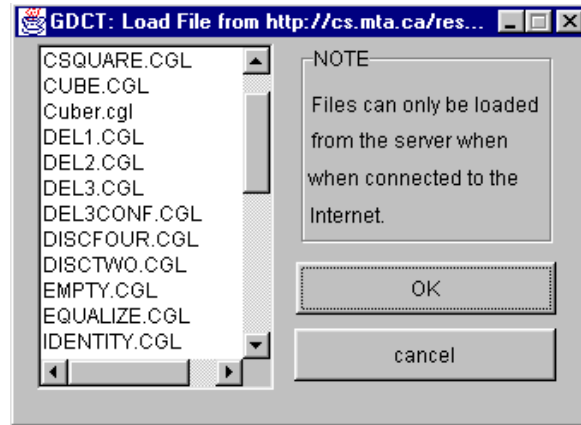
Downloading Categories

In order to download a a text category file (.cat) select File | Open Category | Download Category(CAT) or Categories | Open Category | Download Category(CAT).

Downloading a graphical category file (.cgl) is similar, select File | Open Category | Download Category(CGL) or Categories | Open Category | Download Category(CGL). An alternative method to download graphical category files is to press CTRL+D.

Choosing any of the above options will display a list of categories in a selection box in a new frame. The categories listed are located on the server specified in the frame's title bar. To select a category to download

simply double click on the category's name or click once on the category name and press the OK button. Either of these methods will display the downloaded category. If the program cannot locate the files on the server an error message will be displayed. This could result from the user not being connected to the Internet or as a result of a server error.

To change the settings for downloading categories, select Settings | Set Server. This displays a dialog for changing the default server and directories from which categories and functors can be loaded using the appropriate load command.

Saving Categories

In order to save a category file (.cgl) select File | Save Category | Save Category(CGL) or Categories | Save Category | Save Category(CGL). This opens a file selection window. Saving text category files (.cat) or simply the VGJ graph file (.gml) is similar. A shortcut to save a .cgl category file is to press CTRL+S. To save a category to an existing file simply double click on the category file name. A new file is created by typing its name in the dialogue and clicking OK.
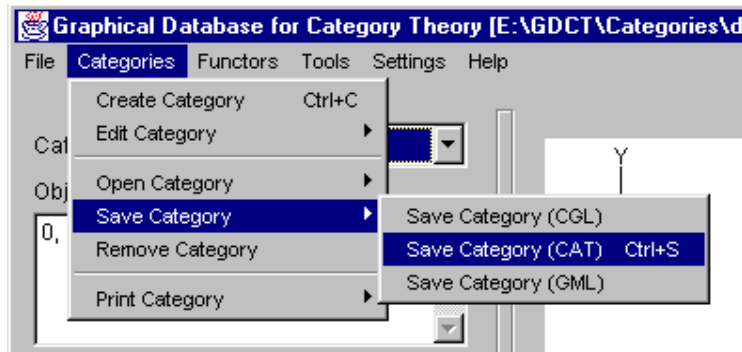
Removing Categories

Selecting Categories | Remove Category opens a list of the categories currently in memory. Select from the list and click OK to remove a category.
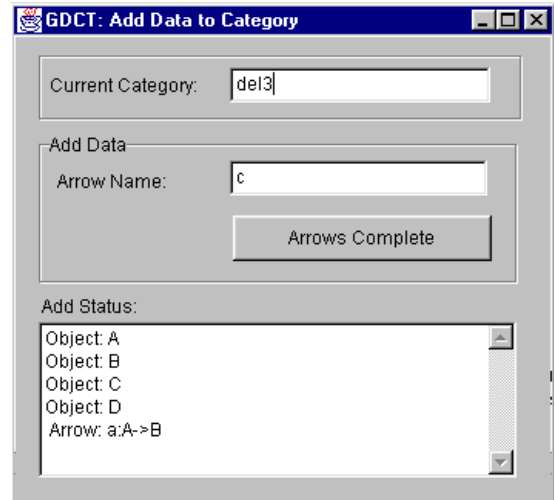
Printing Categories

To print the text version of the currently displayed category, select File | Print | Print Category (Text). To print the graphical version select File | Print | Print Category (Graphical).

To save the graphical version of the currently displayed category to a postscript file, select File | Print | Print Category (Postscript).

Adding Data

Selecting Categories | Edit Category | Add Data opens a dialogue which allows addition of objects, arrows and relations to the current category. To add objects type their names in the box. When finished click Objects Complete, then arrows may be added: type the name, then the domain and codomain; when finished click Arrows Complete. To add relations the left and right sides must be specified; when finished click Relations Complete.

WARNING: The domain and codomain of a new arrow must already exist, and the sides of a relation must be composable paths. An arrow can be removed only if it does not appear in any current relations. An object can be removed only if it is neither the domain nor codomain of a current arrow. Adding data only affects the version of a category in memory. To save any changes to disk use the Save Category dialogue.

Removing Data

Selecting Categories | Edit Category | Remove data opens a dialogue with lists of the objects, arrows and relations of the current category. Select items from the lists and click Remove to delete the data from the category.
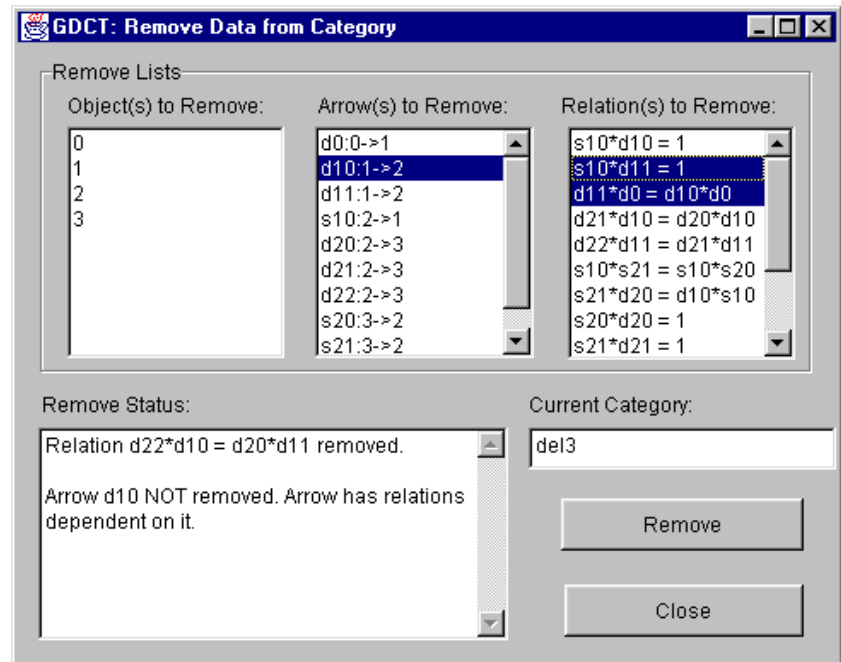
WARNING: An arrow can be removed only if it does not appear in any current relations. An object can be removed only if it is neither the domain nor codomain of a current arrow. Removing data only affects the version of a category in memory. To save any changes to disk use the Save Category dialogue.

Changing a Category Name

To change the name of the currently displayed category, the user selects Categories | Edit Category | Change Name.
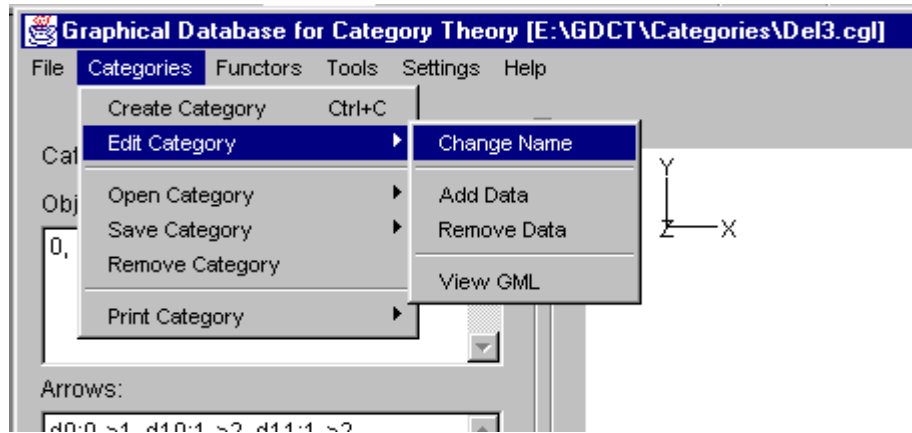
Selecting this option will display a dialog in which the user can enter the new name.