

APPENDICES

APPENDIX A: EXAMPLE FILES

Example CAT File

```
#This is an example category
category
  sumone
objects
  A, B, C, D.
arrows
  f:A->C, g:B->C, h:C->D, i:A->D,
  j:B->D.
relations
  h*f = i, h*g = j.
```

Example CGL File

```
# A commutative square.
category
  csquare
objects
  A, B, C, D.
arrows
  f:A->B, g:A->C, h:B->D, k:C->D.
relations
  h*f = k*g.
gml
  graph [
    directed 1
    node [
      id 0
      label "A"
      graphics [
        Image [
          Type ""
          Location ""
        ]
        center [
          x -48.30000000000001
          y 49.0
          z 0.0
        ]
        width 15.94
        height 27.299999999999997
        depth 20.0
      ]
      vgj [
        labelPosition "in"
        shape "Oval"
      ]
    ]
  ]
```

```

node [
  id 1
  label "B"
  graphics [
    Image [
      Type ""
      Location ""
    ]
    center [
      x -48.0
      y -53.0
      z 0.0
    ]
    width 17.36
    height 27.299999999999997
    depth 20.0
  ]
  vgj [
    labelPosition "in"
    shape "Oval"
  ]
]
node [
  id 2
  label "C"
  graphics [
    Image [
      Type ""
      Location ""
    ]
    center [
      x 51.699999999999999
      y 49.0
      z 0.0
    ]
    width 18.78
    height 27.299999999999997
    depth 20.0
  ]
  vgj [
    labelPosition "in"
    shape "Oval"
  ]
]
node [
  id 3
  label "D"
  graphics [
    Image [
      Type ""
      Location ""
    ]
    center [
      x 50.599999999999995
      y -53.0

```

```

    z 0.0
  ]
  width 18.78
  height 27.299999999999997
  depth 20.0
]
vgj [
  labelPosition "in"
  shape "Oval"
]
]
node [
  id 4
  label "relations\nh*f = k*g"
  graphics [
    Image [
      Type ""
      Location ""
    ]
    center [
      x 169.0
      y -4.0
      z 0.0
    ]
    width 20.0
    height 20.0
    depth 20.0
  ]
  vgj [
    labelPosition "center"
    shape "Oval"
  ]
]
edge [
  linestyle "solid"
  label "k"
  source 2
  target 3
]
edge [
  linestyle "solid"
  label "h"
  source 1
  target 3
]
edge [
  linestyle "solid"
  label "g"
  source 0
  target 2
]
edge [
  linestyle "solid"
  label "f"
  source 0

```

```
target 1
]
]
```

Example FUN File

```
#This is an example of an fun file
#This is the first category
category
del2
objects
0, 1, 2.
arrows
d0:0->1, d10:1->2, d11:1->2, s10:2->1.
relations
d11*d0 = d10*d0, s10*d11 = 1, s10*d10 = 1.
```

```
#This is the second category
category
del3
objects
0, 1, 2, 3.
arrows
d0:0->1, d10:1->2, d11:1->2, s10:2->1,
d20:2->3, d21:2->3, d22:2->3, s20:3->2,
s21:3->2.
relations
s10*d10 = 1, s10*d11 = 1, d11*d0 = d10*d0, d21*d10 = d20*d10,
d22*d10 = d20*d11, d22*d11 = d21*d11, s10*s21 = s10*s20, s21*d20 = d10*s10,
s20*d20 = 1, s21*d21 = 1, s20*d21 = 1, s21*d22 = 1,
s20*d22 = d11*s10.
```

```
#This is the functor information
functor
del23
objects
0 |--> 0, 1 |--> 1, 2 |--> 2.
arrows
d0 |--> d0, d10 |--> d10, d11 |--> d11, s10 |--> s10.
```

Example FGL File

```
#This is an example of an fgl file
#This is the first category
category
del2
objects
0, 1, 2.
arrows
d0:0->1, d10:1->2, d11:1->2, s10:2->1.
relations
d11*d0 = d10*d0, s10*d11 = 1, s10*d10 = 1.
gml
graph [
```

```

directed 1
node [
  id 0
  label "0"
  graphics [
    Image [
      Type ""
      Location ""
    ]
    center [
      x 25.0
      y -120.0
      z 0.0
    ]
    width 15.94
    height 27.299999999999997
    depth 20.0
  ]
  vgj [
    labelPosition "in"
    shape "Oval"
  ]
]
node [
  id 1
  label "1"
  graphics [
    Image [
      Type ""
      Location ""
    ]
    center [
      x -60.0
      y 69.0
      z 0.0
    ]
    width 15.94
    height 27.299999999999997
    depth 20.0
  ]
  vgj [
    labelPosition "in"
    shape "Oval"
  ]
]
node [
  id 2
  label "2"
  graphics [
    Image [
      Type ""
      Location ""
    ]
    center [
      x -17.0

```

```

        y -68.0
        z 0.0
    ]
    width 15.94
    height 27.299999999999997
    depth 20.0
]
vgj [
    labelPosition "in"
    shape "Oval"
]
]
node [
    id 4
    label "relations\nd11*d0 = d10*d0,s10*d11 = 1,s10*d10 = 1"
    graphics [
        Image [
            Type ""
            Location ""
        ]
        center [
            x 0.0
            y -150.0
            z 0.0
        ]
        width 336.85999999999996
        height 48.599999999999994
        depth 20.0
    ]
    vgj [
        labelPosition "in"
        shape "Oval"
    ]
]
edge [
    linestyle "solid"
    label "d11,d10"
    source 1
    target 2
]
edge [
    linestyle "solid"
    label "d0"
    source 0
    target 1
]
edge [
    linestyle "solid"
    label "s10"
    source 2
    target 1
]
]
]

```

#This is the second category

category

del3

objects

0, 1, 2, 3.

arrows

d0:0->1, d10:1->2, d11:1->2, s10:2->1,
 d20:2->3, d21:2->3, d22:2->3, s20:3->2,
 s21:3->2.

relations

$s_{10} \cdot d_{10} = 1$, $s_{10} \cdot d_{11} = 1$, $d_{11} \cdot d_0 = d_{10} \cdot d_0$, $d_{21} \cdot d_{10} = d_{20} \cdot d_{10}$,
 $d_{22} \cdot d_{10} = d_{20} \cdot d_{11}$, $d_{22} \cdot d_{11} = d_{21} \cdot d_{11}$, $s_{10} \cdot s_{21} = s_{10} \cdot s_{20}$, $s_{21} \cdot d_{20} = d_{10} \cdot s_{10}$,
 $s_{20} \cdot d_{20} = 1$, $s_{21} \cdot d_{21} = 1$, $s_{20} \cdot d_{21} = 1$, $s_{21} \cdot d_{22} = 1$,
 $s_{20} \cdot d_{22} = d_{11} \cdot s_{10}$.

gml

```

graph [
  directed 1
  node [
    id 0
    label "0"
    graphics [
      Image [
        Type ""
        Location ""
      ]
      center [
        x 37.0
        y 131.0
        z 0.0
      ]
      width 15.94
      height 27.299999999999997
      depth 20.0
    ]
    vgj [
      labelPosition "in"
      shape "Oval"
    ]
  ]
  node [
    id 1
    label "1"
    graphics [
      Image [
        Type ""
        Location ""
      ]
      center [
        x 0.0
        y 73.0
        z 0.0
      ]
      width 15.94
      height 27.299999999999997
      depth 20.0
    ]
  ]

```

```

    vgj [
      labelPosition "in"
      shape "Oval"
    ]
  ]
node [
  id 2
  label "2"
  graphics [
    Image [
      Type ""
      Location ""
    ]
    center [
      x 121.0
      y 139.0
      z 0.0
    ]
    width 15.94
    height 27.299999999999997
    depth 20.0
  ]
  vgj [
    labelPosition "in"
    shape "Oval"
  ]
]
node [
  id 3
  label "3"
  graphics [
    Image [
      Type ""
      Location ""
    ]
    center [
      x -52.0
      y -21.0
      z 0.0
    ]
    width 15.94
    height 27.299999999999997
    depth 20.0
  ]
  vgj [
    labelPosition "in"
    shape "Oval"
  ]
]
node [
  id 5
  label "relations\ns10*d10 = 1,s10*d11 = 1,d11*d0 = d10*d0,d21*d10 = d20*d10,d22*d10 =
d20*d11,\nd22*d11 = d21*d11,s10*s21 = s10*s20,s21*d20 = d10*s10,s20*d20 = 1,s21*d21 =
1,\ns20*d21 = 1,s21*d22 = 1,s20*d22 = d11*s10"
  graphics [

```



```

    Image [
      Type ""
      Location ""
    ]
    center [
      x 0.0
      y -150.0
      z 0.0
    ]
    width 673.4
    height 91.19999999999999
    depth 20.0
  ]
  vgj [
    labelPosition "in"
    shape "Oval"
  ]
]
edge [
  linestyle "solid"
  label "d22,d20,d21"
  source 2
  target 3
]
edge [
  linestyle "solid"
  label "d11,d10"
  source 1
  target 2
]
edge [
  linestyle "solid"
  label "s21,s20"
  source 3
  target 2
]
edge [
  linestyle "solid"
  label "d0"
  source 0
  target 1
]
edge [
  linestyle "solid"
  label "s10"
  source 2
  target 1
]
]
]

```

#This is the functor information

functor

del23

objects

0 |--> 0, 1 |--> 1, 2 |--> 2.

arrows

d0 |--> d0, d10 |--> d10, d11 |--> d11, s10 |--> s10.

APPENDIX B: MENU ITEM SHORTCUTS

The following short cuts to menu items are supported in Graphical Database for Category Theory:

CTRL+C	Create a Category
CTRL+H	Display Help File for GDCT
CTRL+F	Open a FGL Functor File
CTRL+G	Save a FGL Functor File
CTRL+D	Download a CGL Category File
CTRL+O	Open a CGL Category File
CTRL+S	Save a CGL Category File

APPENDIX C: MISC. INFORMATION

Version Information

The Graphical Database for Category Theory is a research project at Mount Allison University that now includes over 80 Java source files and over 30000 lines of code. Version 1.0 of the GDCT was released as a preliminary version which provides the basic functionality and demonstrates the abilities of the final version of the application. Currently, the below list of known problems is being dealt with and will be fixed by September 2000. It is the goal of the GDCT Development Team to have a stable version of the application available for download by that date.

Version 1.0: Released March 20, 2000

This is the preliminary version of Graphical Database for Category Theory The release information for this version is available at <http://mathcs.mta.ca/research/rosebrugh/gdct/v1release.htm>.

Version 1.1: Release Date Summer 2000

This version of GDCT will contain the following fixes and enhancements:

- The help file system has been rewrote and now includes a complete set of help files which will better enable the user to use the software
- Contact information in the bug report dialog has been updated
- Upon closing the application, a dialog window now prompts the user to see if they want to save changes in modified categories. This dialog window also tells the user what modifications were made so that they can more accurately judge if they want to save these changes.
- The display of categories in the "Make Confluent Tool was changed so that a category isn't redrawn randomly. Instead, GDCT will only update the label of the node containing the list of relations.
- In "Add Data" for categories, the category is no longer redrawn randomly. New data is now added to the existing graphical representation as opposed to creating a new random representation.
- In "Remove Data" the problem where not all data is removed in some categories has been fixed Also, in "Remove Data" for categories, the text display is updated and the graphical display is updated as data is removed.
- In "View GML", the problem with the search feature not working right away has been corrected.
- The "Make Confluent" algorithm has been extensively error checked and all known bugs have been

fixed.

- Bugs in "Make Dual Category" have been fixed and the make display of a newly created dual category is no longer determined randomly. Instead, the display is based on the display of the category that was originally used to create the dual category.
- The "Equality of Composites" tool has been tested and all problems have been fixed.
- In the "Initial Object" and "Terminal Object" tools a warning is now displayed if the endomorphism limit has been reached.
- GDCT 1.0 was developed using Borland JBuilder 2.0 and used some borland libraries such as `borland.jbcl.control` and `borland.jbcl.layout`. This caused certain compiling problems in non-Borland environments. To correct this situation, all elements of borland libraries have been removed.

Known Bugs

Below is a list of known bugs in the current version of the GDCT application. If you have encountered additional bugs please fill out a comment form at <http://mathcs.mta.ca/research/rosebrugh/gdct/contact.htm>.

- The "Initial Object" algorithm needs to be rechecked when it is applied to categories with identity arrows in relations.
- The "Terminal Object" algorithm needs to be rechecked when it is applied to categories with identity arrows in relations.
- The "Sum" algorithm needs to be fixed.
- Using a modified "Sum" algorithm the "Product" algorithm needs to be completely developed
- In "Graphical Functor Settings" when the Category layout display is changed, the category graphical representations can no longer be scrolled and objects and arrows can no longer be selected. Animation of functor and other settings still work.



Proposed Enhancements

Below is a list of enhancements that will be made to the GDCT application. If you have ideas for additional enhancements please fill out a comment form at <http://mathcs.mta.ca/research/rosebrugh/gdct/contact.htm>.

- Open for *.FGL files
- Download for *.FGL files Open Recent for local *.FGL, *.FUN files
- Open Recent for server *.CAT, *.CGL, *.FUN, *.FGL files
- "Server Settings" should be saved in a file so that the user doesn't have to change them every time the program is started. The current default settings should remain in a class file to be displayed in the event that the file containing the current settings is unavailable.
- "Endomorphism Limit" should be saved in a file as above for "Server Settings".