The 30 Year Horizon

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New Foreword

On October 1, 2001 Axiom was withdrawn from the market and ended life as a commercial product. On September 3, 2002 Axiom was released under the Modified BSD license, including this document. On August 27, 2003 Axiom was released as free and open source software available for download from the Free Software Foundation's website, Savannah.

Work on Axiom has had the generous support of the Center for Algorithms and Interactive Scientific Computation (CAISS) at City College of New York. Special thanks go to Dr. Gilbert Baumslag for his support of the long term goal.

The online version of this documentation is roughly 1000 pages. In order to make printed versions we've broken it up into three volumes. The first volume is tutorial in nature. The second volume is for programmers. The third volume is reference material. We've also added a fourth volume for developers. All of these changes represent an experiment in print-on-demand delivery of documentation. Time will tell whether the experiment succeeded.

Axiom has been in existence for over thirty years. It is estimated to contain about three hundred man-years of research and has, as of September 3, 2003, 143 people listed in the credits. All of these people have contributed directly or indirectly to making Axiom available. Axiom is being passed to the next generation. I'm looking forward to future milestones.

With that in mind I've introduced the theme of the "30 year horizon". We must invent the tools that support the Computational Mathematician working 30 years from now. How will research be done when every bit of mathematical knowledge is online and instantly available? What happens when we scale Axiom by a factor of 100, giving us 1.1 million domains? How can we integrate theory with code? How will we integrate theorems and proofs of the mathematics with space-time complexity proofs and running code? What visualization tools are needed? How do we support the conceptual structures and semantics of mathematics in effective ways? How do we support results from the sciences? How do we teach the next generation to be effective Computational Mathematicians?

The "30 year horizon" is much nearer than it appears.

Tim Daly
CAISS, City College of New York
November 10, 2003 ((iHy))

Chapter 1

The Algebra Makefile

1.1 Adding new algebra

This is a complex process by its very nature. Developers and Maintainers who undertake the process need to understand quite a lot of detail. The ultimate steps to add algebra are tedious but simple. Note that only algebra code that gets shipped with the system needs to undergo this process. User code can be compiled once the distributed algebra exists and does not need either this Makefile or this installation process.

Since understanding is the key to making correct changes to this file I'll work on explaining the details of why things need to exist.

The first idea that you need to understand is the overall process of adding algebra code. Lets assume that you have a brand new spad file, called bsd.spad containing a simple domain BSD. The steps in the process of adding this file are:

1. Find out where the algebra code lives in the lattice.
   (a) Start a new interpsys session. This will give you a clean build.
   (b))set mes auto on – This will allow us to see what algebra files get loaded during compile
   (c))co BAR.spad
   (d) We collect all the names of the algebra files BSD loaded. Look for lines that say a file is loaded. Collect all of the names of those files.
   (e) For each of the loaded files determine which layer contains the loaded file by searching this file. For instance, if BAR.spad required FSAGG then look for /FSAGG.o, which resides in layer 13.
   (f) Determine the highest layer (e.g. 13) that contains the required files and add the new algebra file (e.g. BSD.o) in the next layer (e.g. 14).
   (g) Next we need to create the graph structure information. This involves creating a two part stanza of information. For instance,

```
"BSD" [color="#88FF44",href="bookvol10.3.pdf#nameddest=BSD",
        shape=ellipse]
/*"BSD" -> {"ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"; "KONVERT"; "INT"}*/
```

```
/*"BSD" -> {"DIAGG"; "DIOPS"; "BGAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"}*/
/*"BSD" -> {"IEVALAB"; "CLAGG"; "SETAGG"; "FINITE"; "OM"; "PATMAB"}*/
"BSD" -> "FSAGG"
```

(h) The first part determines the color, shape of the graph node, and a link to the book containing the source code. The color and name of the book are related:

i. #4488FF == bookvol10.2

ii. #88FF44 == bookvol10.3

iii. #FF4488 == bookvol10.4

iv. #444488 == bookvol10.5

(i) The second part is the graph structure. All of the loaded algebra files are listed (currently as comments due to the size of the complete graph). In particular, the node that "supports" BSD is FSAGG so we make sure that the graph edge `"BSD" -> "FSAGG"` is uncommented.

2. Insert the documentation after the layer (e.g after layer 14). This documentation is used to reconstruct the full and partial graphs.
3. Insert the `${OUT}/BSD.o` file into the layer's file list. This will cause the algebra to build after all of the algebra it depends on is built.
4. Add the algebra to the books

1.2 Adding the algebra to the proper book

The algebra sources are in 4 books:

- bookvol10.2 == Category
- bookvol10.3 == Domain
- bookvol10.4 == Package
- bookvol10.5 == Numeric

The algebra in these files is structured slightly differently for each one. Follow the directions for the kind of algebra you are adding.

1.2.1 Adding a Category

1.2.2 Adding a Domain

In the Domains book we see that each domain is in alphabetic order by the **full domain name**, not by the abbreviation. So for BSD we see several parts.

The section separator

This gives a visual and logical separation for each domain.

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
\section{domain BSD BasicStochasticDifferential}
```

The input section

This is a standard input file format. It will be extracted from the book during the testing process so we can keep the test cases with the domain. The –R lines are the commented output of actually running the functions. Note that "–" is the comment character in Axiom. The "regress" function will run the code and then compare the actual output with the lines marked "–R" and report any differences.

You can create this file by:

- Start Axiom
- make a bsd.input file with all of your algebra tests
-)co BSD – compile your algebra to make sure it is up to date
-)spool BSD.output – this will put all output into a file
-)read bsd – this will read the tests and the output will be stored in BSD.output
- Modify the BSD.output file to have the same format using "–S n of N" to start the test, "–R" to prefix the actual output, and "–E n" to end the test.
- save the test as bsdtest.input
- Validate the newly formatted test file (bsdtest.input):
  - start a new Axiom
  -)co BSD – compile your new algebra
  -)read bsdtest.input – BE SURE to use the new test file format. If you did it right it will create a new file called BasicStochasticDifferential.output
  -)lisp (regress "BasicStochasticDifferential.output") – this will run the regress function which compares the actual output with the expected output and reports success or failure.
  - fix up failures and repeat until none remain
  - add the contents of bsdtest.input to the algebra file

The input section

Here we use BasicStochasticDifferential.output to create a set of test cases. These are automatically extracted as part of the build process by the function "makeInputFiles". This function is in the tangle.lisp file.

```
)set break resume
)sys rm -f BasicStochasticDifferential.output
)spool BasicStochasticDifferential.output
)set message test on
)set message auto off
)clear all
--S 1 of 2
q := D(p, x)
--R
--R
--R                      __
--R   (6)  0.1x + 0.10
```

```
--R                                              Type: Polynomial BinaryExpansion
--E 1

--S 2 of 2
g := gcd(p, q)
--R
--R
--R               __
--R   (7)  x + 1.01
--R                                              Type: Polynomial BinaryExpansion
--E 2

)spool
)lisp (bye)
```

The help section

This section becomes a help file in the distributed Axiom system. This section is automatically extracted as part of the build process by the function "makeHelpFiles". This function is in the tangle.lisp file. The help section gets typed out when the user types:

```
)help BasicStochasticDifferential
```

```
begin{chunk}{BasicStochasticDifferential.help}
====================================================================
BasicStochasticDifferential examples
====================================================================
All rational numbers have repeating binary expansions.  Operations to
access the individual bits of a binary expansion can be obtained by
converting the value to RadixExpansion(2).  More examples of
expansions are available with

The expansion (of type BinaryExpansion) of a rational number is
returned by the binary operation.

  r := binary(22/7)
      ---
   11.001
                      Type: BinaryExpansion

Arithmetic is exact.

  r + binary(6/7)
   100
                      Type: BinaryExpansion

See Also:
o )help BasicStochasticDifferential
o )help HexadecimalExpansion
o )show BasicStochasticDifferential

end{chunk}
```

The pagehead section

Next we create the format information for the book itself. This will control the display of the new algebra in the book. The "pagehead" macro formats a new section for this algebra and adds it to the proper indexing and other housekeeping sections.

The "pagepic" creates a graph image inline showing the subgraph containing this algebra from the full graph. This information is kept in this file (see the graph subsection below). The "1.00" is a scaling factor for the graph.

The "pageto" macro inserts HTML anchors into the PDF file so there is a way to navigate to algebra that is "above" this domain in the graph. There can be multiple pageto macros.

The "pagefrom" macro inserts HTML anchors into the PDF file so there is a way to navigate to algebra that is "below" this domain in the graph. There can be multiple pagefrom macros.

Together these two macros, pageto and pagefrom, allow the user to follow the thread of domains in the PDF documentation.

```
\pagehead{BasicStochasticDifferential}{BSD}
\pagepic{ps/v103basicstochasticdifferential.ps}{BSD}{1.00}
{\bf See}\\
\pageto{HexadecimalExpansion}{HEXADEC}
```

The Exports section

This shows the same information as the ")show" function in a running Axiom. The "cross" macro adds information to the index to cross reference the domain and the functions.

```
{\bf Exports:}\\
\begin{tabular}{lll}
\cross{BSD}{0} &
\cross{BSD}{1} &
\cross{BSD}{abs} \\
\cross{BSD}{associates?} &
\cross{BSD}{binary} &
\cross{BSD}{ceiling} \\
\cross{BSD}{characteristic}
\end{tabular}
```

The Code section

This is the actual algebra. Note that the "++" comments from the description section are available at runtime using the ")describe" command. They have certain format limitations so be sure to check this in the final system.

The signatures have comments. If the comments are broken into two parts and the lines of the second part of the comment start with "++X" then these will be typed out as part of the output of the command ")d op". For instance, in the code below for the "introduce!" function the comments read:

```
  introduce!: (Symbol,Symbol) -> Union(%, "failed")
   ++ introduce!(X,dX) returns \axiom{dX} as \axiom{BSD} if it
   ++ isn't already in \axiom{BSD}
   ++
   ++X introduce!(t,dt)
```

When we type ")d op introduce!" in a running Axiom we will see the example text:

```
introduce!(t,dt)
```

```
<domain BSD BasicStochasticDifferential>>=
)abbrev domain BSD BasicStochasticDifferential
++ Basic Operations: introduce!, copyBSD, copyIto, getSmgl
++ Related Domains: StochasticDifferential(R)
++ Also See:
++ AMS Classifications:
++ Keywords: stochastic differential, semimartingale.
++ Examples:
++ References:
++ Ito (1975), Kendall (1991a,b; 1993a,b; 1999a,b).
++ Description:
++ Based on Symbol: a domain of symbols
++ representing basic stochastic differentials, used
++ in StochasticDifferential(R) in the underlying
++ sparse multivariate polynomial representation.
++
++ We create new BSD only by coercion from Symbol
++ using a special function introduce! first of all to
++ add to a private set SDset. We allow a separate
++ function convertIfCan which will check whether the
++ argument has previously been declared as a BSD.
BasicStochasticDifferential(): Category == Implementation where
 INT ==> Integer
 OF  ==> OutputForm
 Category ==> OrderedSet with
  ConvertibleTo(Symbol)

  convertIfCan: Symbol -> Union(%, "failed")
   ++ convertIfCan(ds) transforms \axiom{dX} into a \axiom{BSD}
   ++ if possible (if \axiom{introduce(X,dX)} has
   ++ been invoked previously).

  convert: Symbol -> %
   ++ convert(dX) transforms \axiom{dX} into a \axiom{BSD}
   ++ if possible and otherwise produces an error.

  introduce!: (Symbol,Symbol) -> Union(%, "failed")
   ++ introduce!(X,dX) returns \axiom{dX} as \axiom{BSD} if it
   ++ isn't already in \axiom{BSD}

  d: Symbol -> Union(%,INT)
   ++ d(X) returns \axiom{dX} if \axiom{tableIto(X)=dX}
   ++ and otherwise returns \axiom{0}

  copyBSD:() -> List %
   ++ copyBSD() returns \axiom{setBSD} as a list of \axiom{BSD}.
  copyIto:() -> Table(Symbol,%)
   ++ copyIto() returns the table relating semimartingales
   ++ to basic stochastic differentials.
  getSmgl: % -> Union(Symbol,"failed")
   ++ getSmgl(bsd) returns the semimartingale \axiom{S} related
```

```
  ++ to the basic stochastic differential \axiom{bsd} by
  ++ \axiom{introduce!}

 Implementation ==> Symbol add

  Rep := Symbol

  setBSD := empty()$Set(Symbol)
  tableIto:Table(Symbol,%) := table()
  tableBSD:Table(%,Symbol) := table()

  convertIfCan(ds:Symbol):Union(%,"failed") ==
   not(member?(ds,setBSD)) => "failed"
   ds::%

  convert(ds:Symbol):% ==
   (du:=convertIfCan(ds))
    case "failed" =>
     print(hconcat(ds::Symbol::OF,
       message(" is not a stochastic differential")$OF))
     error "above causes failure in convert$BSD"
   du

  introduce!(X,dX) ==
   member?(dX,setBSD) => "failed"
   insert!(dX,setBSD)
   tableBSD(dX::%) := X
   tableIto(X) := dX::%

  d(X) ==
   search(X,tableIto) case "failed" => 0::INT
   tableIto(X)

  copyBSD() == [ds::% for ds in members(setBSD)]
  copyIto() == tableIto
  getSmgl(ds:%):Union(Symbol,"failed") == tableBSD(ds)
```

The dotabb section

This section is used to create the “ps/v103basicstochasticdifferential.ps” graph image used above. The actual code used is kept here so we can modify or reproduce the result. The first line is the current domain. The second line is the domain, category, or package that “supports” this domain in the previous layer. These three lines are create the subgraph of the main algebra graph.

```
<BINARY.dotabb>>=
"BSD" [color="#88FF44",href="bookvol10.3.pdf#nameddest=BSD",
        shape=ellipse]
"FSAGG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=FSAGG"]
"BSD" -> "FSAGG"

\end{chunk}
```

In order to actually create the graph this code gets wrapped with the graphviz information. So you pick up the above lines and insert them into a file surrounded by the graphviz commands as in:

```
digraph pic {
 fontsize=10;
 bgcolor="#ECEA81";
 node [shape=box, color=white, style=filled];

"BSD" [color="#88FF44",href="bookvol10.3.pdf#nameddest=BSD",
        shape=ellipse]
"FSAGG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=FSAGG"]
"BSD" -> "FSAGG"

}
```

Save this in a file, say bsd.dot. To create the correct postscript file use the command:

```
dot -Teps bsd.dot >ps/v103basicstochasticdifferential.eps
```

Notice that the output goes into a ps subdirectory. It is named with the v103 prefix, meaning it is intended for volume 10.3.

The REGRESS table contains the names of all of the regression files. These are the test case files we constructed for the algebra. Putting a chunk name in this table will extract the test case, run it, and run regression testing on it looking for failures. The naming convention is the same as the .input file but uses .regress so the Makefile regression stanza is invoked. So, for our example, we need to add

```
BasicStochasticDifferential.regress
```

We must also add the domain to the `$globalExposureGroupAlist` in the interpreter (book volume 5). This is a lisp cons structure where the CAR is the domain name and the CDR is the domain abbreviation. So we add the line:

```
(|BasicStochasticDifferential| . BSD)
```

1.2.3 Adding a Package

1.2.4 Adding Numerics

1.3 Rebuilding the algebra from scratch

Compile order is important. Here we try to define the ordered lattice of spad file dependencies. However this is, in reality, a graph rather than a lattice. In order to break cycles in this graph we explicitly cache a few of the intermediate generated lisp code for certain files. These are marked throughout (both here and in the various pamphlet files) with the word **BOOTSTRAP**.

If we take a cycle such as **RING** we discover that in order to compile the spad code we must load the compiled definition of **RING**. In this case we must compile the cached lisp code before we try to compile the spad file.

The cycle for **SETCAT** is longer consisting of: **SETCAT** needs **SINT** needs **UFD** needs **GCDDOM** needs **COMRING** needs **RING** needs **RNG** needs **ABELGRP** needs **CABMON** needs **ABELMON** needs **ABELSG** needs **SETCAT**.

It is highly recommended that you try to become a developer of Axiom and read the archived mailing lists before you decide to change a cached file. In the fullness of time we will rewrite the whole algebra structure into a proper lattice if possible. Alternatively we'll reimplement the compiler to handle graphs. Or deeply adopt the extensible domains. Whatever we do will be much discussed (and cause much disgust) around the campfire. If you come up with a brilliant plan that gets adopted we'll even inscribe your name on a log and add it to the fire.

In the code that follows we find the categories, packages and domains that compile with no dependencies and call this set "layer 0". Next we find the categories, packages and domains that will compile using only "layer 0" code and call this "layer 1". We walk up the lattice in this fashion adding layers. Note that at layer 3 this process runs into cycles and we create the "layer 3 bootstrap" stanzas before continuing upward.

1.4 The Algebra Lattice Layers

1.4.1 Layer 0 Bootstrap

The easiest way to find out where a spad file lives in the hierarchy is to create the following script (called 'show'):

```
echo ")co $1" | AXIOMsys >out
fgrep abbreviates out
fgrep "Loading" out | grep -v autoload
```

and then run it with "./show FOO" where the algebra source file is FOO.spad.

Each layer is followed by a layerpic chunk which gives the graphviz graph information. The graphviz header information is here:

— **layerpic** —

```
digraph pic {
 fontsize=10;
 bgcolor="\#ECEA81";
 node [shape=box, color=white, style=filled];
 ranksep=3.0;
 /* nodsep=inches */
 /* size="x,y", size="7.5,10" fits 8.5x11 page */
 /* ratio=auto */ /* page="x,y" */ /* generates multipage layout */
 /* margin=0 */

"Category" [color="\#4488FF"]
"Category" -> "."

"Domain" [color="\#88FF44"]
"Domain" -> "."

"Package" [color="\#FF4488"]
"Package" -> "."
```

————

Completed spad files

Note well that none of the algebra stanzas should include these files in the preconditions otherwise we have an infinite compile loop. These files are originally bootstrapped from lisp code when we build the system for the first time but they are forcibly recompiled at the end of the build so they reflect current code (just in case someone changes the spad code but does not re-cache the generated lisp). If you add these files as preconditions (note that they are all in the **MID** directory rather than the **OUT** directory like everything else) then the final recompile will invalidate all of the rest of the algebra targets which will get rebuilt again causing these targets to be out of date. The rest of the loop is left up to the student.

The bootstrap process works because first we ask for the compiled lisp code stanzas (the `\${MID}/BAR.o` files), THEN we ask for the final algebra code stanzas (the `\${OUT}/BAR.o` files). This is a very subtle point so think it through carefully. Notice that this is the only layer calling for `\${MID}` files. All other layers call for `\${OUT}` files. If you break this the world will no longer compile so don't change it if you don't understand it.

```
LAYER0BOOTSTRAP=${OUT}/XPR.o
```

— layer0 bootstrap —

```
LAYER0BOOTSTRAP=\
  ${MID}/ABELGRP.o  ${MID}/ABELGRP-.o ${MID}/ABELMON.o  ${MID}/ABELMON-.o \
  ${MID}/ABELSG.o   ${MID}/ABELSG-.o  ${MID}/ALAGG.o    ${MID}/BOOLEAN.o  \
  ${MID}/CABMON.o   ${MID}/CHAR.o     ${MID}/CLAGG.o    ${MID}/CLAGG-.o   \
  ${MID}/COMRING.o  ${MID}/DFLOAT.o   ${MID}/DIFRING.o  ${MID}/DIFRING-.o \
  ${MID}/DIVRING.o  ${MID}/DIVRING-.o ${MID}/ENTIRER.o  ${MID}/ES.o       \
  ${MID}/ES-.o      ${MID}/EUCDOM.o   ${MID}/EUCDOM-.o  ${MID}/FFIELDC.o  \
  ${MID}/FFIELDC-.o ${MID}/FPS.o      ${MID}/FPS-.o     ${MID}/GCDDOM.o   \
  ${MID}/GCDDOM-.o  ${MID}/HOAGG.o    ${MID}/HOAGG-.o   ${MID}/ILIST.o    \
  ${MID}/INS.o      ${MID}/INS-.o     ${MID}/INT.o      ${MID}/INTDOM.o   \
  ${MID}/INTDOM-.o  ${MID}/ISTRING.o  ${MID}/LIST.o     ${MID}/LNAGG.o    \
  ${MID}/LNAGG-.o   ${MID}/LSAGG.o    ${MID}/LSAGG-.o   ${MID}/MONOID.o   \
  ${MID}/MONOID-.o  ${MID}/MTSCAT.o   ${MID}/NNI.o      ${MID}/OINTDOM.o  \
  ${MID}/ORDRING.o  ${MID}/ORDRING-.o ${MID}/OUTFORM.o  ${MID}/PI.o       \
  ${MID}/PRIMARR.o  ${MID}/POLYCAT.o  ${MID}/POLYCAT-.o ${MID}/PSETCAT.o  \
  ${MID}/PSETCAT-.o ${MID}/QFCAT.o    ${MID}/QFCAT-.o   ${MID}/RCAGG.o    \
  ${MID}/RCAGG-.o   ${MID}/REF.o      ${MID}/RING.o     ${MID}/RING-.o    \
  ${MID}/RNG.o      ${MID}/RNS.o      ${MID}/RNS-.o     ${MID}/SETAGG.o   \
  ${MID}/SETAGG-.o  ${MID}/SETCAT.o   ${MID}/SETCAT-.o  ${MID}/SINT.o     \
  ${MID}/STAGG.o    ${MID}/STAGG-.o   ${MID}/SYMBOL.o   ${MID}/TSETCAT.o  \
  ${MID}/TSETCAT-.o ${MID}/UFD.o      ${MID}/UFD-.o     ${MID}/ULSCAT.o   \
  ${MID}/UPOLYC.o   ${MID}/UPOLYC-.o  ${MID}/URAGG.o    ${MID}/URAGG-.o   \
  ${MID}/VECTOR.o \
  layer0bootstrap
```

———-

— layer0 copy —

```
LAYER0COPY=\
```

```
  ${OUT}/ABELGRP.o  ${OUT}/ABELGRP-.o ${OUT}/ABELMON.o  ${OUT}/ABELMON-.o \
  ${OUT}/ABELSG.o   ${OUT}/ABELSG-.o  ${OUT}/ALAGG.o    ${OUT}/BOOLEAN.o  \
  ${OUT}/CABMON.o   ${OUT}/CHAR.o     ${OUT}/CLAGG.o    ${OUT}/CLAGG-.o   \
  ${OUT}/COMRING.o  ${OUT}/DFLOAT.o   ${OUT}/DIFRING.o  ${OUT}/DIFRING-.o \
  ${OUT}/DIVRING.o  ${OUT}/DIVRING-.o ${OUT}/ENTIRER.o  ${OUT}/ES.o        \
  ${OUT}/ES-.o      ${OUT}/EUCDOM.o   ${OUT}/EUCDOM-.o  ${OUT}/FFIELDC.o  \
  ${OUT}/FFIELDC-.o ${OUT}/FPS.o      ${OUT}/FPS-.o     ${OUT}/GCDDOM.o   \
  ${OUT}/GCDDOM-.o  ${OUT}/HOAGG.o    ${OUT}/HOAGG-.o   ${OUT}/ILIST.o    \
  ${OUT}/INS.o      ${OUT}/INS-.o     ${OUT}/INT.o      ${OUT}/INTDOM.o   \
  ${OUT}/INTDOM-.o  ${OUT}/ISTRING.o  ${OUT}/LIST.o     ${OUT}/LNAGG.o    \
  ${OUT}/LNAGG-.o   ${OUT}/LSAGG.o    ${OUT}/LSAGG-.o   ${OUT}/MONOID.o   \
  ${OUT}/MONOID-.o  ${OUT}/MTSCAT.o   ${OUT}/NNI.o      ${OUT}/OINTDOM.o  \
  ${OUT}/ORDRING.o  ${OUT}/ORDRING-.o ${OUT}/OUTFORM.o  ${OUT}/PI.o       \
  ${OUT}/PRIMARR.o  ${OUT}/POLYCAT.o  ${OUT}/POLYCAT-.o ${OUT}/PSETCAT.o  \
  ${OUT}/PSETCAT-.o ${OUT}/QFCAT.o    ${OUT}/QFCAT-.o   ${OUT}/RCAGG.o    \
  ${OUT}/RCAGG-.o   ${OUT}/REF.o      ${OUT}/RING.o     ${OUT}/RING-.o    \
  ${OUT}/RNG.o      ${OUT}/RNS.o      ${OUT}/RNS-.o     ${OUT}/SETAGG.o   \
  ${OUT}/SETAGG-.o  ${OUT}/SETCAT.o   ${OUT}/SETCAT-.o  ${OUT}/SINT.o     \
  ${OUT}/STAGG.o    ${OUT}/STAGG-.o   ${OUT}/SYMBOL.o   ${OUT}/TSETCAT.o  \
  ${OUT}/TSETCAT-.o ${OUT}/UFD.o      ${OUT}/UFD-.o     ${OUT}/ULSCAT.o   \
  ${OUT}/UPOLYC.o   ${OUT}/UPOLYC-.o  ${OUT}/URAGG.o    ${OUT}/URAGG-.o   \
  ${OUT}/VECTOR.o \
  layer0copy
```

———–

1.4.2 Layer 0

Depends on: Category Domain Package Bootstrap
Used by next layer: BASTYPE CFCAT KOERCE KONVERT TYPE

— **layer0** —

```
LAYER0=\
  ${OUT}/AHYP.o     ${OUT}/ATADDVA.o  ${OUT}/ATCENRL.o  ${OUT}/ATCS.o \
  ${OUT}/ATAPPRO.o  ${OUT}/ATARBEX.o \
  ${OUT}/ATARBPR.o  ${OUT}/ATCANCL.o  ${OUT}/ATCANON.o  ${OUT}/ATCUNOR.o \
  ${OUT}/ATFINAG.o  ${OUT}/ATJACID.o  ${OUT}/ATLR.o     ${OUT}/ATLUNIT.o \
  ${OUT}/ATMULVA.o  ${OUT}/ATNOTHR.o  ${OUT}/ATNULSQ.o \
  ${OUT}/ATNZDIV.o  ${OUT}/ATPOSET.o  ${OUT}/ATRUNIT.o \
  ${OUT}/ATSHMUT.o \
  ${OUT}/ATTREG.o   ${OUT}/ATUNIKN.o \
  ${OUT}/BASTYPE.o  ${OUT}/BASTYPE-.o \
  ${OUT}/CFCAT.o    ${OUT}/ELTAB.o    ${OUT}/ESCONT1.o ${OUT}/GRDEF.o \
  ${OUT}/INTBIT.o   ${OUT}/KOERCE.o   ${OUT}/KONVERT.o \
  ${OUT}/MAGCDOC.o  ${OUT}/MSYSCMD.o \
  ${OUT}/ODEIFTBL.o ${OUT}/OM.o       ${OUT}/OMCONN.o  ${OUT}/OMDEV.o  \
  ${OUT}/OUT.o      ${OUT}/PRIMCAT.o  ${OUT}/PRINT.o   ${OUT}/PTRANFN.o \
  ${OUT}/RFDIST.o   ${OUT}/RIDIST.o   ${OUT}/SPFCAT.o  ${OUT}/TYPE.o \
  layer0done
```

———–

— layerpic —

```
/* layer 0 */
/* depends on: Category Domain Package Bootstrap */
/* provides: BASTYPE CFCAT KOERCE KONVERT TYPE */

"AHYP" [color="#4488FF",href="bookvol10.2.pdf#nameddest=AHYP"]
"AHYP" -> "Category"

"ATADDVA"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATADDVA"];
"ATADDVA" -> "Category"

"ATCENRL"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATCENRL"];
"ATCENRL" -> "Category"

"ATCS"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATCS"];
"ATCS" -> "Category"

"ATAPPRO"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATAPPRO"];
"ATAPPRO" -> "Category"

"ATARBEX"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATARBEX"];
"ATARBEX" -> "Category"

"ATARBPR"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATARBPR"];
"ATARBPR" -> "Category"

"ATCANCL"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATCANCL"];
"ATCANCL" -> "Category"

"ATCANON"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATCANON"];
"ATCANON" -> "Category"

"ATCUNOR"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATCUNOR"];
"ATCUNOR" -> "Category"

"ATFINAG"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATFINAG"];
"ATFINAG" -> "Category"

"ATJACID"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATJACID"];
"ATJACID" -> "Category"

"ATLR"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATLR"];
"ATLR" -> "Category"

"ATLUNIT"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATLUNIT"];
"ATLUNIT" -> "Category"

"ATMULVA"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATMULVA"];
"ATMULVA" -> "Category"

"ATNOTHR"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATNOTHR"];
"ATNOTHR" -> "Category"
```

```
"ATNULSQ"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATNULSQ"];
"ATNULSQ" -> "Category"

"ATNZDIV"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATNZDIV"];
"ATNZDIV" -> "Category"

"ATRUNIT"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATRUNIT"];
"ATRUNIT" -> "Category"

"ATSHMUT"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATSHMUT"];
"ATSHMUT" -> "Category"

"ATTREG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=ATTREG"]
"ATTREG"  -> "Category"

"ATUNIKN"  [color=lightblue,href="bookvol10.2.pdf#nameddest=ATUNIKN"];
"ATUNIKN" -> "Category"

/* nobody seems to go to bastype by itself */
/* we combine these two to minimize edges in the graph */
/* note that koerce is duplicated */
"BASTYPE/KOERCE" [color="blue",href="bookvol10.2.pdf#nameddest=BASTYPE"]
"BASTYPE/KOERCE" -> "Category"
/*"BASTYPE" [color="#4488FF",href="bookvol10.2.pdf#nameddest=BASTYPE"]*/
/*"BASTYPE" -> "Category"*/
/*"BASTYPE" -> "BOOLEAN"*/
"KOERCE" [color="#4488FF",href="bookvol10.2.pdf#nameddest=KOERCE"]
"KOERCE"  -> "Category"

"BASTYPE-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=BASTYPE"]
"BASTYPE-" -> "Domain"
/*"BASTYPE-" -> "BOOLEAN"*/

"CFCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=CFCAT"]
"CFCAT"  -> "Category"

"ELTAB" [color="#4488FF",href="bookvol10.2.pdf#nameddest=ELTAB"]
"ELTAB"  -> "Category"

"ESCONT1" [color="#FF4488",href="bookvol10.4.pdf#nameddest=ESCONT1"]
"ESCONT1" -> "Package"
/*"ESCONT1" -> "DFLOAT"*/
/*"ESCONT1" -> "BOOLEAN"*/

"GRDEF" [color="#FF4488",href="bookvol10.4.pdf#nameddest=GRDEF"]
"GRDEF" -> "Package"
/*"GRDEF" -> "BOOLEAN"*/

"INTBIT" [color="#FF4488",href="bookvol10.4.pdf#nameddest=INTBIT"]
"INTBIT" -> "Package"
/*"INTBIT" -> "INT"*/

"KONVERT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=KONVERT"]
```

```
"KONVERT"  -> "Category"

"MAGCDOC" [color="#4488FF",href="bookvol10.2.pdf#nameddest=MAGCDOC"]
"MAGCDOC" -> "Category"

"MSYSCMD" [color="#FF4488",href="bookvol10.4.pdf#nameddest=MSYSCMD"]
"MSYSCMD" -> "Package"

"ODEIFTBL" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ODEIFTBL"]
"ODEIFTBL" -> "Domain"

"OM" [color="#4488FF",href="bookvol10.2.pdf#nameddest=OM"]
"OM"  -> "Category"

"OMCONN" [color="#88FF44",href="bookvol10.3.pdf#nameddest=OMCONN"]
"OMCONN" -> "Domain"

"OMDEV" [color="#88FF44",href="bookvol10.3.pdf#nameddest=OMDEV"]
"OMDEV" -> "Domain"

"OUT" [color="#FF4488",href="bookvol10.4.pdf#nameddest=OUT"]
"OUT" -> "Package"
/* "OUT" -> {"STRING", "CHAR", "SINT", "OUTFORM", "LIST", "INT"}*/
/* "OUT" -> {"PRIMARR", "A1AGG-", "ISTRING"} */

"PRIMCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=PRIMCAT"]
"PRIMCAT"  -> "Category"

"PRINT" [color="#FF4488",href="bookvol10.4.pdf#nameddest=PRINT"]
"PRINT" -> "Package"

"PTRANFN" [color="#4488FF",href="bookvol10.2.pdf#nameddest=PTRANFN"]
"PTRANFN"  -> "Category"

"RFDIST" [color="#FF4488",href="bookvol10.4.pdf#nameddest=RFDIST"]
"RFDIST" -> "Package"
/*"RFDIST" -> {"INT"; "PI"; "NNI"; "BOOLEAN"; "SINT"}*/

"RIDIST" [color="#FF4488",href="bookvol10.4.pdf#nameddest=RIDIST"]
"RIDIST" -> "Package"
/*"RIDIST" -> {"SINT"; "NNI"; "INT"}*/

"SPFCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=SPFCAT"]
"SPFCAT"  -> "Category"

"TYPE" [color="#4488FF",href="bookvol10.2.pdf#nameddest=TYPE"]
"TYPE"  -> "Category"
```

1.4.3 Layer 1

Depends on: BASTYPE CFCAT KOERCE KONVERT TYPE
Used by next layer: AGG ELTAGG FINITE FORTCAT IDPC IEVALAB LMODULE MONAD ORDSET PATMAB RETRACT RMODULE SGROUP

— **layer1** —

```
LAYER1=\
  ${OUT}/AGG.o      ${OUT}/AGG-.o     ${OUT}/ANON.o     ${OUT}/ANY1.o     \
  ${OUT}/BLMETCT.o  \
  ${OUT}/COLOR.o    ${OUT}/COMBOPC.o  ${OUT}/COMM.o     ${OUT}/COMPAR.o   \
  ${OUT}/COMPPROP.o \
  ${OUT}/DROPT1.o   ${OUT}/ELTAGG.o   ${OUT}/ELTAGG-.o  ${OUT}/EQ2.o      \
  ${OUT}/EXIT.o     ${OUT}/FILECAT.o  ${OUT}/FINITE.o   ${OUT}/FINITE-.o  \
  ${OUT}/FNCAT.o    \
  ${OUT}/FORMULA1.o ${OUT}/FORTCAT.o  ${OUT}/IDPC.o     ${OUT}/IEVALAB.o  \
  ${OUT}/IEVALAB-.o ${OUT}/ITFUN2.o   ${OUT}/ITFUN3.o   ${OUT}/ITUPLE.o   \
  ${OUT}/LIST3.o    ${OUT}/LMODULE.o  ${OUT}/LOGIC.o    ${OUT}/LOGIC-.o   \
  ${OUT}/MAPHACK1.o ${OUT}/MAPHACK2.o ${OUT}/MAPHACK3.o ${OUT}/MAPPKG1.o  \
  ${OUT}/MAPPKG2.o  ${OUT}/MAPPKG3.o  ${OUT}/MKBCFUNC.o ${OUT}/MKFUNC.o   \
  ${OUT}/MKRECORD.o ${OUT}/MKUCFUNC.o ${OUT}/MONAD.o    ${OUT}/MONAD-.o   \
  ${OUT}/NIPROB.o   ${OUT}/NONE.o     ${OUT}/NONE1.o    ${OUT}/NUMINT.o   \
  ${OUT}/ODECAT.o   ${OUT}/ODEPROB.o  ${OUT}/OMENC.o    ${OUT}/ONECOMP2.o \
  ${OUT}/OPTCAT.o   ${OUT}/OPTPROB.o  ${OUT}/ORDCOMP2.o ${OUT}/ORDSET.o   \
  ${OUT}/ORDSET-.o  ${OUT}/PALETTE.o  ${OUT}/PARPCURV.o ${OUT}/PARPC2.o   \
  ${OUT}/PARSCURV.o ${OUT}/PARSC2.o   ${OUT}/PARSURF.o  ${OUT}/PARSU2.o   \
  ${OUT}/PATAB.o    ${OUT}/PATMAB.o   ${OUT}/PATRES2.o  ${OUT}/PATTERN1.o \
  ${OUT}/PDECAT.o   ${OUT}/PDEPROB.o  ${OUT}/PLOT1.o    ${OUT}/PPCURVE.o  \
  ${OUT}/PSCURVE.o  ${OUT}/REAL.o     ${OUT}/REPDB.o    ${OUT}/REPSQ.o    \
  ${OUT}/RESLATC.o  ${OUT}/RETRACT.o  ${OUT}/RETRACT-.o ${OUT}/RMODULE.o  \
  ${OUT}/SEGBIND2.o ${OUT}/SEGCAT.o   ${OUT}/SETCATD.o  \
  ${OUT}/SEXCAT.o   ${OUT}/SGROUP.o   \
  ${OUT}/SGROUP-.o  ${OUT}/SPACEC.o   ${OUT}/SPLNODE.o  ${OUT}/STEP.o     \
  ${OUT}/STNSR.o    \
  ${OUT}/STREAM1.o  ${OUT}/STREAM2.o  ${OUT}/STREAM3.o  ${OUT}/SUCH.o     \
  ${OUT}/TEX1.o     ${OUT}/UDVO.o     ${OUT}/YSTREAM.o \
  layer1done
```

———-

— **layerpic** —

```
/* layer 1 */
/* depends on: BASTYPE CFCAT KOERCE KONVERT TYPE */
/* provides: FORTCAT RETRACT SEGCAT */

"AGG"  [color="#4488FF",href="bookvol10.2.pdf#nameddest=AGG"]
"AGG" -> "TYPE"
/*"AGG" -> "NNI"*/
/*"AGG" -> "INT"*/
```

```
"AGG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=AGG"]
"AGG-" -> "TYPE"
/*"AGG-" -> "NNI"*/
/*"AGG-" -> "INT"*/

"ANON" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ANON"]
/*"ANON" -> "SETCAT"*/
"ANON" -> "BASTYPE/KOERCE"
/*"ANON" -> "KOERCE"*/

"ANY1" [color="#FF4488",href="bookvol10.4.pdf#nameddest=ANY1"]
"ANY1" -> "TYPE"

"BLMETCT"  [color="#4488FF",href="bookvol10.2.pdf#nameddest=BLMETCT"]
"BLMETCT" -> {"SETCAT", "BASTYPE/KOERCE"}

"CABMON" [color="#4488FF",href="bookvol10.2.pdf#nameddest=CABMON",
           shape=ellipse]
/*"CABMON" -> {"ABELMON"; "ABELSG"; "SETCAT"}*/
"CABMON" -> "BASTYPE/KOERCE"
/*"CABMON" -> "KOERCE"*/

"COLOR" [color="#88FF44",href="bookvol10.3.pdf#nameddest=COLOR"]
/*"COLOR" -> "ABELSG"*/
/*"COLOR" -> "SETCAT"*/
"COLOR" -> "BASTYPE/KOERCE"
/*"COLOR" -> {"KOERCE"; "DFLOAT"; "INT"; "FPS-"; "RNS-"; "NNI"; "PI"}*/
/*"COLOR" -> "BOOLEAN"*/

"COMBOPC" [color="#4488FF",href="bookvol10.2.pdf#nameddest=COMBOPC"]
"COMBOPC" -> "CFCAT"

"COMM" [color="#88FF44",href="bookvol10.3.pdf#nameddest=COMM"]
/*"COMM" -> "SETCAT"*/
"COMM" -> "BASTYPE/KOERCE"
/*"COMM" -> {"KOERCE"; "BOOLEAN"}*/

"COMPAR" [color="#4488FF",href="bookvol10.2.pdf#nameddest=COMPAR"]
/*"COMPAR" -> "SETCAT"*/
"COMPAR" -> "BASTYPE/KOERCE"

"COMPPROP" [color="#88FF44",href="bookvol10.3.pdf#nameddest=COMPPROP"]
/*"COMPPROP" -> "SETCAT"*/
"COMPPROP" -> "BASTYPE/KOERCE"
/*"COMPPROP" -> {"KOERCE"; "BOOLEAN"}*/

"DROPT1" [color="#FF4488",href="bookvol10.4.pdf#nameddest=DROPT1"]
"DROPT1" -> "TYPE"

"ELTAGG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=ELTAGG"]
/*"ELTAGG" -> "ELTAB"*/
/*"ELTAGG" -> "SETCAT"*/
"ELTAGG" -> "BASTYPE/KOERCE"
/*"ELTAGG" -> "KOERCE"*/
```

```
"ELTAGG" -> "TYPE"

"ELTAGG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ELTAGG"]
/*"ELTAGG-" -> {"ELTAB"; "SETCAT"}*/
"ELTAGG-" -> "BASTYPE/KOERCE"
/*"ELTAGG-" -> "KOERCE"*/
"ELTAGG-" -> "TYPE"

"EQ2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=EQ2"]
"EQ2" -> "TYPE"

"EXIT" [color="#88FF44",href="bookvol10.3.pdf#nameddest=EXIT"]
/*"EXIT" -> "SETCAT"*/
"EXIT" -> "BASTYPE/KOERCE"
/*"EXIT" -> "KOERCE"*/

"FILECAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=FILECAT"]
/*"FILECAT" -> "SETCAT"*/
"FILECAT" -> "BASTYPE/KOERCE"
/*"FILECAT" -> "KOERCE"*/

"FINITE" [color="#4488FF",href="bookvol10.2.pdf#nameddest=FINITE"]
/*"FINITE" -> "SETCAT"*/
"FINITE" -> "BASTYPE/KOERCE"
/*"FINITE" -> "KOERCE"*/

"FNCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=FNCAT"]
/*"FNCAT" -> "SETCAT"*/
"FNCAT" -> "BASTYPE/KOERCE"
/*"FNCAT" -> "KOERCE"*/

"FORMULA1" [color="#FF4488",href="bookvol10.4.pdf#nameddest=FORMULA1"]
/*"FORMULA1" -> "SETCAT"*/
"FORMULA1" -> "BASTYPE/KOERCE"
/*"FORMULA1" -> "KOERCE"*/

"FORTCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=FORTCAT"]
"FORTCAT" -> "TYPE"
/*"FORTCAT" -> "KOERCE"*/

"IDPC" [color="#4488FF",href="bookvol10.2.pdf#nameddest=IDPC"]
/*"IDPC" -> "SETCAT"*/
"IDPC" -> "BASTYPE/KOERCE"
/*"IDPC" -> "KOERCE"*/

"IEVALAB" [color="#4488FF",href="bookvol10.2.pdf#nameddest=IEVALAB"]
/*"IEVALAB" -> "SETCAT"*/
"IEVALAB" -> "BASTYPE/KOERCE"
/*"IEVALAB" -> "KOERCE"*/
"IEVALAB" -> "TYPE"

"IEVALAB-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=IEVALAB"]
/*"IEVALAB-" -> "SETCAT"*/
"IEVALAB-" -> "BASTYPE/KOERCE"
```

```
/*"IEVALAB-" -> "KOERCE"*/
"IEVALAB-" -> "TYPE"

"ITFUN2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=ITFUN2"]
"ITFUN2" -> "TYPE"

"ITFUN3" [color="#FF4488",href="bookvol10.4.pdf#nameddest=ITFUN3"]
"ITFUN3" -> "TYPE"

"ITUPLE" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ITUPLE"]
/*"ITUPLE" -> "KOERCE"*/
"ITUPLE" -> "TYPE"

"LIST3" [color="#FF4488",href="bookvol10.4.pdf#nameddest=LIST3"]
"LIST3" -> "TYPE"
/*"LIST3" -> {"INT"; "LIST"; "ILIST"}*/

"LOGIC" [color="#4488FF",href="bookvol10.2.pdf#nameddest=LOGIC"]
"LOGIC" -> "BASTYPE/KOERCE"

"LOGIC-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=LOGIC"]
"LOGIC-" -> "BASTYPE/KOERCE"

"MAPHACK1" [color="#FF4488",href="bookvol10.4.pdf#nameddest=MAPHACK1"]
/*"MAPHACK1" -> "SETCAT"*/
"MAPHACK1" -> "BASTYPE/KOERCE"
/*"MAPHACK1" -> {"KOERCE"; "SINT"; "NNI"; "INT"}*/

"MAPHACK2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=MAPHACK2"]
/*"MAPHACK2" -> "SETCAT"*/
"MAPHACK2" -> "BASTYPE/KOERCE"
/*"MAPHACK2" -> "KOERCE"*/

"MAPHACK3" [color="#FF4488",href="bookvol10.4.pdf#nameddest=MAPHACK3"]
/*"MAPHACK3" -> "SETCAT"*/
"MAPHACK3" -> "BASTYPE/KOERCE"
/*"MAPHACK3" -> "KOERCE"*/

"MAPPKG1" [color="#FF4488",href="bookvol10.4.pdf#nameddest=MAPPKG1"]
/*"MAPPKG1" -> "SETCAT"*/
"MAPPKG1" -> "BASTYPE/KOERCE"
/*"MAPPKG1" -> {"KOERCE"; "SINT"; "NNI"; "INT"; "BOOLEAN"}*/

"MAPPKG2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=MAPPKG2"]
/*"MAPPKG2" -> "SETCAT"*/
"MAPPKG2" -> "BASTYPE/KOERCE"
/*"MAPPKG2" -> "KOERCE"*/

"MAPPKG3" [color="#FF4488",href="bookvol10.4.pdf#nameddest=MAPPKG3"]
/*"MAPPKG3" -> "SETCAT"*/
"MAPPKG3" -> "BASTYPE/KOERCE"
/*"MAPPKG3" -> "KOERCE"*/

"MKBCFUNC" [color="#FF4488",href="bookvol10.4.pdf#nameddest=MKBCFUNC"]
```

```
"MKBCFUNC" -> "KONVERT"
"MKBCFUNC" -> "TYPE"

"MKFUNC" [color="#FF4488",href="bookvol10.4.pdf#nameddest=MKFUNC"]
"MKFUNC" -> "KONVERT"
/*"MKFUNC" -> {"INT"; "LIST"}*/

"MKRECORD" [color="#FF4488",href="bookvol10.4.pdf#nameddest=MKRECORD"]
"MKRECORD" -> "TYPE"

"MKUCFUNC" [color="#FF4488",href="bookvol10.4.pdf#nameddest=MKUCFUNC"]
"MKUCFUNC" -> "KONVERT"
"MKUCFUNC" -> "TYPE"

"MONAD" [color="#4488FF",href="bookvol10.2.pdf#nameddest=MONAD"]
/*"MONAD" -> "SETCAT"*/
"MONAD" -> "BASTYPE/KOERCE"
/*"MONAD" -> {"KOERCE"; "PI"; "NNI"; "INT"; "SINT"}*/

"MONAD-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=MONAD"]
/*"MONAD-" -> "SETCAT"*/
"MONAD-" -> "BASTYPE/KOERCE"
/*"MONAD-" -> {"KOERCE"; "PI"; "NNI"; "INT"; "SINT"}*/

"NIPROB" [color="#88FF44",href="bookvol10.3.pdf#nameddest=NIPROB"]
/*"NIPROB" -> "SETCAT"*/
"NIPROB" -> "BASTYPE/KOERCE"
/*"NIPROB" -> "KOERCE"*/

"NONE" [color="#88FF44",href="bookvol10.3.pdf#nameddest=NONE"]
/*"NONE" -> "SETCAT"*/
"NONE" -> "BASTYPE/KOERCE"
/*"NONE" -> "KOERCE"*/

"NONE1" [color="#FF4488",href="bookvol10.4.pdf#nameddest=NONE1"]
"NONE1" -> "TYPE"

"NUMINT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=NUMINT"]
/*"NUMINT" -> "SETCAT"*/
"NUMINT" -> "BASTYPE/KOERCE"
/*"NUMINT" -> "KOERCE"*/

"ODECAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=ODECAT"]
/*"ODECAT" -> "SETCAT"*/
"ODECAT" -> "BASTYPE/KOERCE"
/*"ODECAT" -> "KOERCE"*/

"ODEPROB" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ODEPROB"]
/*"ODEPROB" -> "SETCAT"*/
"ODEPROB" -> "BASTYPE/KOERCE"
/*"ODEPROB" -> "KOERCE"*/

"OMENC" [color="#88FF44",href="bookvol10.3.pdf#nameddest=OMENC"]
/*"OMENC" -> "SETCAT"*/
```

```
"OMENC" -> "BASTYPE/KOERCE"
/*"OMENC" -> {"KOERCE"; "SINT"}*/

"ONECOMP2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=ONECOMP2"]
/*"ONECOMP2" -> "SETCAT"*/
"ONECOMP2" -> "BASTYPE/KOERCE"
/*"ONECOMP2" -> "KOERCE"*/

"OPTCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=OPTCAT"]
/*"OPTCAT" -> "SETCAT"*/
"OPTCAT" -> "BASTYPE/KOERCE"
/*"OPTCAT" -> "KOERCE"*/

"OPTPROB" [color="#88FF44",href="bookvol10.3.pdf#nameddest=OPTPROB"]
/*"OPTPROB" -> "SETCAT"*/
"OPTPROB" -> "BASTYPE/KOERCE"
/*"OPTPROB" -> "KOERCE"*/

"ORDCOMP2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=ORDCOMP2"]
/*"ORDCOMP2" -> "SETCAT"*/
"ORDCOMP2" -> "BASTYPE/KOERCE"
/*"ORDCOMP2" -> {"KOERCE"; "SINT"}*/

"ORDSET" [color="#4488FF",href="bookvol10.2.pdf#nameddest=ORDSET"]
/*"ORDSET" -> "SETCAT"*/
"ORDSET" -> "BASTYPE/KOERCE"
/*"ORDSET" -> {"KOERCE"; "BOOLEAN"}*/

"ORDSET-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ORDSET"]
/*"ORDSET-" -> "SETCAT"*/
"ORDSET-" -> "BASTYPE/KOERCE"
/*"ORDSET-" -> {"KOERCE"; "BOOLEAN"}*/

"PALETTE" [color="#88FF44",href="bookvol10.3.pdf#nameddest=PALETTE"]
/*"PALETTE" -> "SETCAT"*/
"PALETTE" -> "BASTYPE/KOERCE"
/*"PALETTE" -> {"KOERCE"; "INT"; "LIST"; "ILIST"; "LSAGG-"; "STAGG-"}*/

"PARPCURV" [color="#88FF44",href="bookvol10.3.pdf#nameddest=PARPCURV"]
"PARPCURV" -> "TYPE"
/*"PARPCURV" -> "NNI"*/
/*"PARPCURV" -> "INT"*/

"PARPC2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=PARPC2"]
"PARPC2" -> "TYPE"
/*"PARPC2" -> "NNI"*/
/*"PARPC2" -> "INT"*/

"PARSCURV" [color="#88FF44",href="bookvol10.3.pdf#nameddest=PARSCURV"]
"PARSCURV" -> "TYPE"
/*"PARSCURV" -> "NNI"*/
/*"PARSCURV" -> "INT"*/

"PARSC2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=PARSC2"]
```

```
"PARSC2" -> "TYPE"
/*"PARSC2" -> "NNI"*/
/*"PARSC2" -> "INT"*/

"PARSURF" [color="#88FF44",href="bookvol10.3.pdf#nameddest=PARSURF"]
"PARSURF" -> "TYPE"
/*"PARSURF" -> "NNI"*/
/*"PARSURF" -> "INT"*/

"PARSU2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=PARSU2"]
"PARSU2" -> "TYPE"
/*"PARSU2" -> "NNI"*/
/*"PARSU2" -> "INT"*/

"PATAB" [color="#4488FF",href="bookvol10.2.pdf#nameddest=PATAB"]
"PATAB" -> "KONVERT"

"PATMAB" [color="#4488FF",href="bookvol10.2.pdf#nameddest=PATMAB"]
/*"PATMAB" -> "SETCAT"*/
"PATMAB" -> "BASTYPE/KOERCE"
/*"PATMAB" -> "KOERCE"*/

"PATRES2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=PATRES2"]
/*"PATRES2" -> "SETCAT"*/
"PATRES2" -> "BASTYPE/KOERCE"
/*"PATRES2" -> "KOERCE" */

"PATTERN1" [color="#FF4488",href="bookvol10.4.pdf#nameddest=PATTERN1"]
/*"PATTERN1" -> "SETCAT"*/
"PATTERN1" -> "BASTYPE/KOERCE"
/*"PATTERN1" -> "KOERCE"*/
"PATTERN1" -> "TYPE"
/*"PATTERN1" -> {"INT"; "LIST"; "ILIST"; "LSAGG-"; "STAGG-"; "BOOLEAN"}*/

"PDECAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=PDECAT"]
/*"PDECAT" -> "SETCAT"*/
"PDECAT" -> "BASTYPE/KOERCE"
/*"PDECAT" -> "KOERCE"*/

"PDEPROB" [color="#88FF44",href="bookvol10.3.pdf#nameddest=PDEPROB"]
/*"PDEPROB" -> "SETCAT"*/
"PDEPROB" -> "BASTYPE/KOERCE"
/*"PDEPROB" -> "KOERCE"*/

"PLOT1" [color="#FF4488",href="bookvol10.4.pdf#nameddest=PLOT1"]
"PLOT1" -> "KONVERT"

"PPCURVE" [color="#4488FF",href="bookvol10.2.pdf#nameddest=PPCURVE"]
"PPCURVE" -> "KOERCE"

"REAL" [color="#4488FF",href="bookvol10.2.pdf#nameddest=REAL"]
"REAL" -> "KONVERT"

"REF" [color="#88FF44",href="bookvol10.3.pdf#nameddest=REF",
```

```
          shape=ellipse]
"REF" -> "TYPE"
/*"REF" -> "SETCAT"*/
"REF" -> "BASTYPE/KOERCE"
/*"REF" -> "KOERCE"*/

"REPDB" [color="#FF4488",href="bookvol10.4.pdf#nameddest=REPDB"]
/*"REPDB" -> "SETCAT"*/
"REPDB" -> "BASTYPE/KOERCE"
/*"REPDB" -> {"KOERCE"; "PI"; "NNI"; "INT"}*/

"REPSQ" [color="#FF4488",href="bookvol10.4.pdf#nameddest=REPSQ"]
/*"REPSQ" -> "SETCAT"*/
"REPSQ" -> "BASTYPE/KOERCE"
/*"REPSQ" -> {"KOERCE"; "PI"; "NNI"; "INT"}*/

"RESLATC" [color="#FF4488",href="bookvol10.4.pdf#nameddest=RESLATC"]
"RESLATC" -> "TYPE"

"RETRACT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=RETRACT"]
"RETRACT" -> "TYPE"

"RETRACT-" [color="#4488FF",href="bookvol10.2.pdf#nameddest=RETRACT"]
"RETRACT-" -> "TYPE"

"RMODULE" [color="#4488FF",href="bookvol10.2.pdf#nameddest=RMODULE"]
/*"RMODULE" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
"RMODULE" -> "BASTYPE/KOERCE"
/*"RMODULE" -> "KOERCE"*/

"SEGBIND2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=SEGBIND2"]
"SEGBIND2" -> "TYPE"

"SEGCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=SEGCAT"]
"SEGCAT" -> "TYPE"

"SETCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=SETCAT",
          shape=ellipse]
"SETCAT" -> "BASTYPE/KOERCE"
/*"SETCAT" -> "KOERCE"*/
/*"SETCAT" -> "SINT"*/

"SETCAT-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=SETCAT",
          shape=ellipse]
"SETCAT-" -> "BASTYPE/KOERCE"
/*"SETCAT-" -> {"KOERCE"; "SINT"}*/

"SETCATD" [color="#4488FF",href="bookvol10.2.pdf#nameddest=SETCATD"]
/*"SETCATD" -> "SETCAT"*/
"SETCATD" -> "BASTYPE/KOERCE"

"SEXCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=SEXCAT"]
/*"SEXCAT" -> "SETCAT"*/
"SEXCAT" -> "BASTYPE/KOERCE"
```

```
/*"SEXCAT" -> "KOERCE"*/

/* We combine LMODULE and SGROUP to minimize edges */
"LMODULE/SGROUP" [color="blue",href="bookvol10.2.pdf#nameddest=LMODULE"]
"LMODULE/SGROUP" -> "BASTYPE/KOERCE"
/*"LMODULE" [color="#4488FF",href="bookvol10.2.pdf#nameddest=LMODULE"]*/
/*"LMODULE" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"LMODULE" -> {"BASTYPE/KOERCE"; "KOERCE"}*/

"SGROUP" [color="#4488FF",href="bookvol10.2.pdf#nameddest=SGROUP"]
/*"SGROUP" -> "SETCAT"*/
"SGROUP" -> "BASTYPE/KOERCE"
/*"SGROUP" -> "KOERCE"*/

"SGROUP-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=SGROUP"]
/*"SGROUP" -> "SETCAT"*/
"SGROUP-" -> "BASTYPE/KOERCE"
/*"SGROUP-" -> "KOERCE"*/

"SPACEC" [color="#4488FF",href="bookvol10.2.pdf#nameddest=SPACEC"]
/*"SPACEC" -> "SETCAT"*/
"SPACEC" -> "BASTYPE/KOERCE"
/*"SPACEC" -> "KOERCE"*/

"SPLNODE" [color="#88FF44",href="bookvol10.3.pdf#nameddest=SPLNODE"]
/*"SPLNODE" -> "SETCAT"*/
"SPLNODE" -> "BASTYPE/KOERCE"
/*"SPLNODE" -> {"KOERCE"; "AGG"}*/
"SPLNODE" -> "TYPE"
/*"SPLNODE" -> "BOOLEAN"*/

"STEP" [color="#4488FF",href="bookvol10.2.pdf#nameddest=STEP"]
/*"STEP" -> "SETCAT"*/
"STEP" -> "BASTYPE/KOERCE"
/*"STEP" -> "KOERCE"*/

"STNSR" [color="#FF4488",href="bookvol10.4.pdf#nameddest=STNSR"]
"STNSR" -> "TYPE"

"STREAM1" [color="#FF4488",href="bookvol10.4.pdf#nameddest=STREAM1"]
"STREAM1" -> "TYPE"

"STREAM2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=STREAM2"]
"STREAM2" -> "TYPE"

"STREAM3" [color="#FF4488",href="bookvol10.4.pdf#nameddest=STREAM3"]
"STREAM3" -> "TYPE"

"SUCH" [color="#88FF44",href="bookvol10.3.pdf#nameddest=SUCH"]
/*"SUCH" -> "SETCAT"*/
"SUCH" -> "BASTYPE/KOERCE"
/*"SUCH" -> "KOERCE"*/

"TEX1" [color="#FF4488",href="bookvol10.4.pdf#nameddest=TEX1"]
```

```
/*"TEX1" -> "SETCAT"*/
"TEX1" -> "BASTYPE/KOERCE"
/*"TEX1" -> "KOERCE"*/

"UDVO" [color="#FF4488",href="bookvol10.4.pdf#nameddest=UDVO"]
/*"UDVO" -> {"INT"; "LIST"; "ILIST"; "ORDSET"; "SETCAT"}*/
"UDVO" -> "BASTYPE/KOERCE"
/*"UDVO" -> "KOERCE"*/

"YSTREAM" [color="#FF4488",href="bookvol10.4.pdf#nameddest=YSTREAM"]
"YSTREAM" -> "TYPE"
/*"YSTREAM" -> {"INT"; "SINT"; "NNI"}*/
```

———-

1.4.4 Layer 2

Depends on: AGG ELTAGG FINITE FORTCAT IDPC IEVALAB LMODULE MONAD ORDSET PATMAB RETRACT RMODULE SGROUP SETCATD
Used by next layer: BMODULE CACHSET ELEMFUN EVALAB GROUP IXAGG MONADWU NARNG OASGP PDRING

— **layer2** —

```
LAYER2=\
  ${OUT}/AFSPCAT.o  \
  ${OUT}/API.o      ${OUT}/ASP29.o    ${OUT}/ATRIG.o    ${OUT}/ATRIG-.o   \
  ${OUT}/BEZIER.o   ${OUT}/BLHN.o     \
  ${OUT}/BLQT.o     ${OUT}/BMODULE.o  ${OUT}/CACHSET.o  \
  ${OUT}/CHARNZ.o   ${OUT}/CHARZ.o    ${OUT}/DVARCAT.o  ${OUT}/DVARCAT-.o \
  ${OUT}/ELEMFUN.o  ${OUT}/ELEMFUN-.o ${OUT}/ESTOOLS2.o ${OUT}/EVALAB.o   \
  ${OUT}/EVALAB-.o  ${OUT}/FAMONC.o   ${OUT}/FCOMP.o    ${OUT}/FEVALAB.o  \
  ${OUT}/FEVALAB-.o ${OUT}/FMC.o      ${OUT}/FMFUN.o    ${OUT}/FORTFN.o   \
  ${OUT}/FPATMAB.o  ${OUT}/FVC.o      ${OUT}/FVFUN.o    ${OUT}/GROUP.o    \
  ${OUT}/GROUP-.o   ${OUT}/IDPAG.o    ${OUT}/IDPAM.o    ${OUT}/IDPO.o     \
  ${OUT}/INCRMAPS.o ${OUT}/INTRET.o   ${OUT}/IXAGG.o    ${OUT}/IXAGG-.o   \
  ${OUT}/KERNEL2.o  ${OUT}/LALG.o     ${OUT}/LALG-.o    ${OUT}/LINEXP.o   \
  ${OUT}/MODMONOM.o ${OUT}/MONADWU.o  ${OUT}/MONADWU-.o ${OUT}/MRF2.o     \
  ${OUT}/NARNG.o    ${OUT}/NARNG-.o   ${OUT}/NSUP2.o    ${OUT}/OASGP.o    \
  ${OUT}/ODVAR.o    ${OUT}/OPQUERY.o  ${OUT}/ORDFIN.o   ${OUT}/ORDMON.o   \
  ${OUT}/PATMATCH.o ${OUT}/PERMCAT.o  ${OUT}/PDRING.o   ${OUT}/PDRING-.o  \
  ${OUT}/PLACESC.o  ${OUT}/PRSPCAT.o  \
  ${OUT}/SDVAR.o    ${OUT}/SEGXCAT.o  ${OUT}/SUP2.o     ${OUT}/TRIGCAT.o  \
  ${OUT}/TRIGCAT-.o ${OUT}/ULS2.o     ${OUT}/UP2.o \
  layer2done
```

———-

— **layerpic** —

```
/* layer 2 */
/* AGG ELTAGG FINITE FORTCAT IDPC IEVALAB LMODULE MONAD ORDSET */
```

```
/* PATMAB RETRACT RMODULE SEGCAT SGROUP SETCATD */

"AFSPCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=AFSPCAT",
          shape=ellipse]
"AFSPCAT" -> "SETCATD"
/*"AFSPCAT" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/

"ABELGRP" [color="#4488FF",href="bookvol10.2.pdf#nameddest=ABELGRP",
           shape=ellipse]
/*"ABELGRP" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"ABELGRP" -> {"KOERCE"; "RING"; "RNG"; "SGROUP"; "MONOID"}*/
"ABELGRP" -> "LMODULE/SGROUP"
/*"ABELGRP" -> "INT"*/

"ABELGRP-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ABELGRP",
           shape=ellipse]
/*"ABELGRP-" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"ABELGRP-" -> {"KOERCE"; "RING"; "RNG"; "SGROUP"; "MONOID"}*/
"ABELGRP-" -> "LMODULE/SGROUP"
/*"ABELGRP-" -> "INT"*/

"ABELMON" [color="#4488FF",href="bookvol10.2.pdf#nameddest=ABELMON",
           shape=ellipse]
/*"ABELMON" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "RING"; "RNG"}*/
/*"ABELMON" -> {"ABELGRP"; "CABMON"; "SGROUP"; "MONOID"}*/
"ABELMON" -> "LMODULE/SGROUP"
/*"ABELMON" -> {"NNI"; "INT"}*/

"ABELMON-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ABELMON",
           shape=ellipse]
/*"ABELMON-" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "RING"; "RNG"}*/
/*"ABELMON-" -> {"ABELGRP"; "CABMON"; "SGROUP"; "MONOID"}*/
"ABELMON-" -> "LMODULE/SGROUP"
/*"ABELMON-" -> {"NNI"; "INT"}*/

"ABELSG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=ABELSG",
           shape=ellipse]
/*"ABELSG" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "RING"; "RNG"; "ABELGRP"}*/
/*"ABELSG" -> {"CABMON"; "ABELMON"; "SGROUP"; "MONOID"}*/
"ABELSG" -> "LMODULE/SGROUP"

"ABELSG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ABELSG",
           shape=ellipse]
/*"ABELSG-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "RING"; "RNG"; "ABELGRP"}*/
/*"ABELSG-" -> {"CABMON"; "ABELMON"; "SGROUP"; "MONOID"}*/
"ABELSG-" -> "LMODULE/SGROUP"

"API"  [color="#FF4488",href="bookvol10.4.pdf#nameddest=API"]
/*"API" -> {"INT"; "LIST"; "ILIST"}*/
"API" -> "ORDSET"
/*"API" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/

"ATRIG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=ATRIG"]
/*"ATRIG" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
```

```
/*"ATRIG" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"ATRIG" -> "LMODULE/SGROUP"

"ATRIG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ATRIG"]
/*"ATRIG-" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"ATRIG-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"ATRIG-" -> "LMODULE/SGROUP"

"BEZIER" [color="#FF4488",href="bookvol10.4.pdf#nameddest=BEZIER"]
/*"BEZIER" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"BEZIER" -> {"SETCAT"; "BASTYPE"; "KOERCE" "SGROUP"; "MONOID"; "LMODULE"} */
"BEZIER" -> "LMODULE/SGROUP"

"BLQT" [color="#88FF44",href="bookvol10.3.pdf#nameddest=BLQT"]
"BLQT" -> "BLMETCT"
/*"BLQT" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/

"BLQT" [color="#88FF44",href="bookvol10.3.pdf#nameddest=BLQT"]
"BLQT" -> "BLMETCT"
/*"BLQT" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "INT"; "LIST"; "ILIST"; "LSAGG-"}*/
/*"BLQT" -> {"STAGG-"; "PI"; "NNI"}*/

"BMODULE" [color="#4488FF",href="bookvol10.2.pdf#nameddest=BMODULE"]
/*"BMODULE" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"BMODULE" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"BMODULE" -> "LMODULE/SGROUP"
"BMODULE" -> "RMODULE"

"CACHSET" [color="#4488FF",href="bookvol10.2.pdf#nameddest=CACHSET"]
"CACHSET" -> "ORDSET"
/*"CACHSET" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/

"CHARNZ" [color="#4488FF",href="bookvol10.2.pdf#nameddest=CHARNZ"]
/*"CHARNZ" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"CHARNZ" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"CHARNZ" -> "LMODULE/SGROUP"

"CHARZ" [color="#4488FF",href="bookvol10.2.pdf#nameddest=CHARZ"]
/*"CHARZ" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"CHARZ" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"CHARZ" -> "LMODULE/SGROUP"

"DIFRING" [color="#4488FF",href="bookvol10.2.pdf#nameddest=DIFRING",
           shape=ellipse]
/*"DIFRING" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"DIFRING" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"DIFRING" -> "LMODULE/SGROUP"
/*"DIFRING" -> {"SINT"; "NNI"; "INT"}*/

"DIFRING-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=DIFRING",
           shape=ellipse]
/*"DIFRING-" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"DIFRING-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"DIFRING-" -> "LMODULE/SGROUP"
```

```
/*"DIFRING-" -> {"SINT"; "NNI"; "INT"}*/

"DVARCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=DVARCAT"]
"DVARCAT" -> "ORDSET"
/*"DVARCAT" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/
"DVARCAT" -> "RETRACT"
/*"DVARCAT" -> {"NNI"; "INT"; "BOOLEAN"}*/

"DVARCAT-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=DVARCAT"]
"DVARCAT-" -> "ORDSET"
/*"DVARCAT-" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/
"DVARCAT-" -> "RETRACT"
/*"DVARCAT-" -> {"NNI"; "INT"; "BOOLEAN"}*/

"ELEMFUN" [color="#4488FF",href="bookvol10.2.pdf#nameddest=ELEMFUN"]
/*"ELEMFUN" -> "MONOID"*/
"ELEMFUN" -> "SGROUP"
/*"ELEMFUN" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/

"ELEMFUN-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ELEMFUN"]
/*"ELEMFUN-" -> "MONOID"*/
"ELEMFUN-" -> "SGROUP"
/*"ELEMFUN-" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/

"ESTOOLS2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=ESTOOLS2"]
/*"ESTOOLS2" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"ESTOOLS2" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"ESTOOLS2" -> "LMODULE/SGROUP"

"EVALAB" [color="#4488FF",href="bookvol10.2.pdf#nameddest=EVALAB"]
"EVALAB" -> "IEVALAB"
/*"EVALAB" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/

"EVALAB-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=EVALAB"]
"EVALAB-" -> "IEVALAB"
/*"EVALAB-" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/

"FAMONC" [color="#4488FF",href="bookvol10.2.pdf#nameddest=FAMONC"]
/*"FAMONC" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
"FAMONC" -> "RETRACT"

"FCOMP" [color="#88FF44",href="bookvol10.3.pdf#nameddest=FCOMP"]
"FCOMP" -> "ORDSET"
/*"FCOMP" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "BOOLEAN"}*/

"FEVALAB" [color="#4488FF",href="bookvol10.2.pdf#nameddest=FEVALAB"]
/*"FEVALAB" -> {"ELTAB"; "EVALAB"}*/
"FEVALAB" -> "IEVALAB"
/*"FEVALAB" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/

"FEVALAB-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=FEVALAB"]
/*"FEVALAB-" -> {"ELTAB"; "EVALAB"}*/
"FEVALAB-" -> "IEVALAB"
/*"FEVALAB-" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/
```

```
"FMC" [color="#4488FF",href="bookvol10.2.pdf#nameddest=FMC"]
"FMC" -> "FORTCAT"
/*"FMC" -> {"TYPE"; "KOERCE"}*/

"FMFUN" [color="#4488FF",href="bookvol10.2.pdf#nameddest=FMFUN"]
"FMFUN" -> "FORTCAT"
/*"FMFUN" -> {"TYPE"; "KOERCE"}*/

"FORTFN" [color="#4488FF",href="bookvol10.2.pdf#nameddest=FORTFN"]
"FORTFN" -> "FORTCAT"
/*"FORTFN" -> {"TYPE"; "KOERCE"}*/

"FPATMAB" [color="#4488FF",href="bookvol10.2.pdf#nameddest=FPATMAB"]
/*"FPATMAB" -> "TYPE"*/
"FPATMAB" -> "PATMAB"
/*"FPATMAB" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/

"FVC" [color="#4488FF",href="bookvol10.2.pdf#nameddest=FVC"]
"FVC" -> "FORTCAT"
/*"FVC" -> {"TYPE"; "KOERCE"}*/

"FVFUN" [color="#4488FF",href="bookvol10.2.pdf#nameddest=FVFUN"]
"FVFUN" -> "FORTCAT"
/*"FVFUN" -> {"TYPE"; "KOERCE"}*/

"GROUP" [color="#4488FF",href="bookvol10.2.pdf#nameddest=GROUP"]
/*"GROUP" -> "MONOID"*/
"GROUP" -> "SGROUP"
/*"GROUP" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "INT"}*/

"GROUP-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=GROUP"]
/*"GROUP-" -> "MONOID"*/
"GROUP-" -> "SGROUP"
/*"GROUP-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "INT"}*/

"IDPAG" [color="#88FF44",href="bookvol10.3.pdf#nameddest=IDPAG"]
/*"IDPAG" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"IDPAG" -> {"BASTYPE"; "KOERCE"}*/
"IDPAG" -> "IDPC"
"IDPAG" -> "ORDSET"
/*"IDPAG" -> {"INT"; "BOOLEAN"; "LIST"; "ILIST"}*/

"IDPAM" [color="#88FF44",href="bookvol10.3.pdf#nameddest=IDPAM"]
/*"IDPAM" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
"IDPAM" -> "IDPC"
"IDPAM" -> "ORDSET"
/*"IDPAM" -> {"INT"; "LIST"; "ILIST"; "BOOLEAN"; "NNI"}*/

"IDPO" [color="#88FF44",href="bookvol10.3.pdf#nameddest=IDPO"]
"IDPO" -> "IDPC"
/*"IDPO" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/
"IDPO" -> "ORDSET"
/*"IDPO" -> {"INT"; "LIST"; "BOOLEAN"; "ILIST"}*/
```

```
"INCRMAPS" [color="#FF4488",href="bookvol10.4.pdf#nameddest=INCRMAPS"]
/*"INCRMAPS" -> "MONOID"*/
"INCRMAPS" -> "SGROUP"
/*"INCRMAPS" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "ABELSG"}*/

"INTRET" [color="#FF4488",href="bookvol10.4.pdf#nameddest=INTRET"]
"INTRET" -> "RETRACT"

"IXAGG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=IXAGG"]
/*"IXAGG" -> "HOAGG"*/
"IXAGG" -> "AGG"
/*"IXAGG" -> {"TYPE"; "SETCAT"; "BASTYPE"; "KOERCE"; "EVALAB"; "IEVALAB"}*/
"IXAGG" -> "ELTAGG"
/*"IXAGG" -> "ELTAB"*/
"IXAGG" -> "ORDSET"

"IXAGG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=IXAGG"]
/*"IXAGG-" -> "HOAGG"*/
"IXAGG-" -> "AGG"
/*"IXAGG-" -> {"TYPE"; "SETCAT"; "BASTYPE"; "KOERCE"; "EVALAB"; "IEVALAB"}*/
"IXAGG-" -> "ELTAGG"
/*"IXAGG-" -> "ELTAB"*/
"IXAGG-" -> "ORDSET"

"KERNEL2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=KERNEL2"]
"KERNEL2" -> "ORDSET"
/*"KERNEL2" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "INT"; "LIST"; "NNI"}*/

"LALG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=LALG"]
/*"LALG" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"LALG" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"LALG" -> "LMODULE/SGROUP"

"LALG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=LALG"]
/*"LALG-" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"LALG-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"LALG-" -> "LMODULE/SGROUP"

"LINEXP" [color="#4488FF",href="bookvol10.2.pdf#nameddest=LINEXP"]
/*"LINEXP" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"LINEXP" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"LINEXP" -> "LMODULE/SGROUP"

"MODMONOM" [color="#88FF44",href="bookvol10.3.pdf#nameddest=MODMONOM"]
"MODMONOM" -> "ORDSET"
/*"MODMONOM" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/

"MONADWU" [color="#4488FF",href="bookvol10.2.pdf#nameddest=MONADWU"]
"MONADWU" -> "MONAD"
/*"MONADWU" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "NNI"; "INT"; "SINT"}*/

"MONADWU-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=MONADWU"]
"MONADWU-" -> "MONAD"
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```
/*"MONADWU-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "NNI"; "INT"; "SINT"}*/

"MONOID" [color="#4488FF",href="bookvol10.2.pdf#nameddest=MONOID",
          shape=ellipse]
"MONOID" -> "SGROUP"
/*"MONOID" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "NNI"; "INT"}*/

"MONOID-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=MONOID",
          shape=ellipse]
"MONOID-" -> "SGROUP"
/*"MONOID-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "NNI"; "INT"}*/

"MRF2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=MRF2"]
/*"MRF2" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"MRF2" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"MRF2" -> "LMODULE/SGROUP"

"NARNG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=NARNG"]
/*"NARNG" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"NARNG" -> {"BASTYPE"; "KOERCE"}*/
"NARNG" -> "MONAD"

"NARNG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=NARNG"]
/*"NARNG-" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"NARNG-" -> {"BASTYPE"; "KOERCE"}*/
"NARNG-" -> "MONAD"

"NSUP2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=NSUP2"]
/*"NSUP2" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"NSUP2" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"NSUP2" -> "LMODULE/SGROUP"

"OASGP" [color="#4488FF",href="bookvol10.2.pdf#nameddest=OASGP"]
"OASGP" -> "ORDSET"
/*"OASGP" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "ABELMON"; "ABELSG"}*/

"ODVAR" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ODVAR"]
/*"ODVAR" -> "DVARCAT"*/
"ODVAR" -> "ORDSET"
/*"ODVAR" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/
"ODVAR" -> "RETRACT"

"OPQUERY" [color="#FF4488",href="bookvol10.4.pdf#nameddest=OPQUERY"]
"OPQUERY" -> "ORDSET"
/*"OPQUERY" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/

"ORDFIN" [color="#4488FF",href="bookvol10.2.pdf#nameddest=ORDFIN"]
"ORDFIN" -> "ORDSET"
/*"ORDFIN" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/
"ORDFIN" -> "FINITE"

"ORDMON" [color="#4488FF",href="bookvol10.2.pdf#nameddest=ORDMON"]
"ORDMON" -> "ORDSET"
/*"ORDMON" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "MONOID"}*/
```

```
"ORDMON" -> "SGROUP"

"PATMATCH" [color="#FF4488",href="bookvol10.4.pdf#nameddest=PATMATCH"]
/*"PATMATCH" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/
"PATMATCH" -> "PATMAB"
/*"PATMATCH" -> {"KONVERT"; "BOOLEAN"}*/
"PATMATCH" -> "RETRACT"
/*"PATMATCH" -> {"INT"; "LIST"; "ILIST"; "RING"; "RNG"; "ABELGRP"}*/
/*"PATMATCH" -> {"CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"}*/
"PATMATCH" -> "LMODULE/SGROUP"

"PDRING"  [color="#4488FF",href="bookvol10.2.pdf#nameddest=PDRING"]
/*"PDRING" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"PDRING" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"PDRING" -> "LMODULE/SGROUP"
/*"PDRING" -> {"SINT"; "NNI"; "INT"}*/

"PDRING-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=PDRING"]
/*"PDRING-" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"PDRING-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"PDRING-" -> "LMODULE/SGROUP"
/*"PDRING-" -> {"SINT"; "NNI"; "INT"}*/

"PERMCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=PERMCAT"]
/*"PERMCAT" -> {"GROUP"; "MONOID"}*/
"PERMCAT" -> "SGROUP"
/*"PERMCAT" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/
"PERMCAT" -> "ORDSET"
"PERMCAT" -> "FINITE"

"PI" [color="#88FF44",href="bookvol10.3.pdf#nameddest=PI",
          shape=ellipse]
/*"PI" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
"PI" -> "ORDSET"
/*"PI" -> "MONOID"*/
"PI" -> "SGROUP"
/*"PI" -> {"NNI"; "INT"}*/

"RING" [color="#4488FF",href="bookvol10.2.pdf#nameddest=RING",
          shape=ellipse]
/*"RING" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"RING" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"RING" -> "LMODULE/SGROUP"

"RING-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=RING",
          shape=ellipse]
/*"RING-" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"RING-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"RING-" -> "LMODULE/SGROUP"

"RNG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=RNG",
          shape=ellipse]
/*"RNG" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"RNG" -> "KOERCE"*/
```

```
"RNG" -> "SGROUP"

"PLACESC" [color="#4488FF",href="bookvol10.2.pdf#nameddest=PLACESC",
          shape=ellipse]
"PLACESC" -> "SETCATD"
/*"PLACESC" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/

"PRSPCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=PRSPCAT",
          shape=ellipse]
"PRSPCAT" -> "SETCATD"
/*"PRSPCAT" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/

"SDVAR" [color="#88FF44",href="bookvol10.3.pdf#nameddest=SDVAR"]
/*"SDVAR" -> "DVARCAT"*/
"SDVAR" -> "ORDSET"
/*"SDVAR" -> {"SETCAT"; "BASTYPE"; "KOERCE"}*/
"SDVAR" -> "RETRACT"
/*"SDVAR" -> {"NNI"; "INT"}*/

"SEGXCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=SEGXCAT"]
"SEGXCAT" -> "SEGCAT"
/*"SEGXCAT" -> "TYPE"*/

"SUP2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=SUP2"]
/*"SUP2" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"SUP2" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"SUP2" -> "LMODULE/SGROUP"

"TRIGCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=TRIGCAT"]
/*"TRIGCAT" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"TRIGCAT" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"TRIGCAT" -> "LMODULE/SGROUP"

"TRIGCAT-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=TRIGCAT"]
/*"TRIGCAT-" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"TRIGCAT-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"TRIGCAT-" -> "LMODULE/SGROUP"

"ULS2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=ULS2"]
/*"ULS2" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"ULS2" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"ULS2" -> "LMODULE/SGROUP"

"UP2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=UP2"]
/*"UP2" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"UP2" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
"UP2" -> "LMODULE/SGROUP"
```

1.4.5 Layer 3

Depends on: BMODULE CACHSET ELEMFUN EVALAB GROUP IXAGG MONADWU NARNG OASGP PDRING
Used by next layer: BGAGG BRAGG ELAGG- GRMOD MODULE OAMON

— **layer3** —

```
LAYER3=\
  ${OUT}/AUTOMOR.o  ${OUT}/BGAGG.o   ${OUT}/BGAGG-.o   ${OUT}/BRAGG.o    \
  ${OUT}/BRAGG-.o   ${OUT}/CARTEN2.o ${OUT}/CHARPOL.o  ${OUT}/COMPLEX2.o \
  ${OUT}/DIFEXT.o   ${OUT}/DIFEXT-.o ${OUT}/DLAGG.o    ${OUT}/DSTRCAT.o  \
  ${OUT}/ELAGG.o    \
  ${OUT}/ELAGG-.o   ${OUT}/ES1.o     ${OUT}/ES2.o      ${OUT}/GRMOD.o    \
  ${OUT}/GRMOD-.o   ${OUT}/HYPCAT.o  ${OUT}/HYPCAT-.o  ${OUT}/LORER.o    \
  ${OUT}/MKCHSET.o  \
  ${OUT}/MODRING.o  ${OUT}/MODULE.o  ${OUT}/MODULE-.o  ${OUT}/NASRING.o  \
  ${OUT}/NASRING-.o ${OUT}/OAMON.o   ${OUT}/SORTPAK.o  ${OUT}/ZMOD.o \
  layer3done
```

———-

— **layerpic** —

```
/* layer 3 */
/* depends on: BMODULE CACHSET ELEMFUN EVALAB GROUP IXAGG MONADWU NARNG */
/* OASGP PDRING */

"AUTOMOR" [color="#88FF44",href="bookvol10.3.pdf#nameddest=AUTOMOR"]
"AUTOMOR" -> "GROUP"
/*"AUTOMOR" -> {"MONOID"; "SGROUP"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"AUTOMOR" -> {"ELTAB"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"AUTOMOR" -> {"ABELSG"; "LMODULE"; "INT"; "SINT"; "NNI"}*/

"BGAGG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=BGAGG"]
/*"BGAGG" -> {"HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
"BGAGG" -> "EVALAB"
/*"BGAGG" -> "IEVALAB"*/

"BGAGG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=BGAGG"]
/*"BGAGG-" -> {"HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
"BGAGG-" -> "EVALAB"
/*"BGAGG-" -> "IEVALAB"*/

"BRAGG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=BRAGG"]
/*"BRAGG" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"}*/
/*"BRAGG" -> "KOERCE"*/
"BRAGG" -> "EVALAB"
/*"BRAGG" -> {"IEVALAB"; "BOOLEAN"; "INT"; "LIST"; "ILIST"; "LSAGG-"}*/
/*"BRAGG" -> {"STAGG-"; "SETAGG"; "CLAGG"; "KONVERT"; "NNI"}*/

"BRAGG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=BRAGG"]
/*"BRAGG-" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"}*/
```

```
/*"BRAGG-" -> "KOERCE"*/
"BRAGG-" -> "EVALAB"
/*"BRAGG-" -> {"IEVALAB"; "BOOLEAN"; "INT"; "LIST"; "ILIST"; "LSAGG-"}*/
/*"BRAGG-" -> {"STAGG-"; "SETAGG"; "CLAGG"; "KONVERT"; "NNI"}*/

"CARTEN2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=CARTEN2"]
/*"CARTEN2" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"CARTEN2" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"CARTEN2" -> {"MONOID"; "LMODULE"}*/
"CARTEN2" -> "BMODULE"
/*"CARTEN2" -> "RMODULE"*/

"CHARPOL" [color="#FF4488",href="bookvol10.4.pdf#nameddest=CHARPOL"]
/*"CHARPOL" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"CHARPOL" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"CHARPOL" -> {"MONOID"; "LMODULE"}*/
"CHARPOL" -> "BMODULE"
/*"CHARPOL" -> {"RMODULE"; "NNI"; "INT"; "SINT"; "PI"}*/

"COMPLEX2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=COMPLEX2"]
/*"COMPLEX2" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"COMPLEX2" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"COMPLEX2" -> {"MONOID"; "LMODULE"}*/
"COMPLEX2" -> "BMODULE"
/*"COMPLEX2" -> "RMODULE"*/

"COMRING" [color="#4488FF",href="bookvol10.2.pdf#nameddest=COMRING",
           shape=ellipse]
/*"COMRING" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"COMRING" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"COMRING" -> {"MONOID"; "LMODULE"}*/
"COMRING" -> "BMODULE"
/*"COMRING" -> "RMODULE"*/

"DIFEXT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=DIFEXT"]
/*"DIFEXT" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"DIFEXT" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"*}/
/*"DIFEXT" -> "DIFRING"*/
"DIFEXT" -> "PDRING"
/*"DIFEXT" -> {"SINT"; "NNI"; "INT"}*/

"DIFEXT-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=DIFEXT"]
/*"DIFEXT-" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"DIFEXT-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"DIFEXT-" -> {"LMODULE"; "DIFRING"}*/
"DIFEXT-" -> "PDRING"
/*"DIFEXT-" -> {"SINT"; "NNI"; "INT"}*/

"DLAGG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=DLAGG"]
/*"DLAGG" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
"DLAGG" -> "EVALAB"
/*"DLAGG" -> "IEVALAB"*/

"DSTRCAT"  [color="#4488FF",href="bookvol10.2.pdf#nameddest=DSTRCAT"]
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/*"DSTRCAT" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"}*/
"DSTRCAT" -> "EVALAB"
/*"DSTRCAT" -> {"KOERCE"; "IEVALAB"}*/

"ELAGG"  [color="#4488FF",href="bookvol10.2.pdf#nameddest=ELAGG"]
/*"ELAGG" -> "LNAGG"*/
"ELAGG" -> "IXAGG"
/*"ELAGG" -> {"HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
"ELAGG" -> "EVALAB"
/*"ELAGG" -> {"IEVALAB"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"; "NNI"}*/
/*"ELAGG" -> {"INT"; "ORDSET"}*/

"ELAGG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ELAGG"]
/*"ELAGG-" -> "LNAGG"*/
"ELAGG-" -> "IXAGG"
/*"ELAGG-" -> {"HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
"ELAGG-" -> "EVALAB"
/*"ELAGG-" -> {"IEVALAB"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"; "NNI"}*/
/*"ELAGG-" -> {"INT"; "ORDSET"}*/

/* Note that ENTIRER has a circular self reference */
"ENTIRER" [color="#4488FF",href="bookvol10.2.pdf#nameddest=ENTIRER",
           shape=ellipse]
/*"ENTIRER" -> {"ENTIRER"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"ENTIRER" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"ENTIRER" -> {"MONOID"; "LMODULE"}*/
"ENTIRER" -> "BMODULE"
/*"ENTIRER" -> "RMODULE"*/

"ES1" [color="#FF4488",href="bookvol10.4.pdf#nameddest=ES1"]
/*"ES1" -> {"ES"; "ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"; "RETRACT"}*/
/*"ES1" -> "IEVALAB"*/
"ES1" -> "EVALAB"
/*"ES1" -> "TYPE"*/

"ES2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=ES2"]
/*"ES2" -> {"ES"; "ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"; "RETRACT"}*/
/*"ES2" -> "IEVALAB"*/
"ES2" -> "EVALAB"

"GRMOD" [color="#4488FF",href="bookvol10.2.pdf#nameddest=GRMOD"]
/*"GRMOD" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "COMRING"; "RING"; "RNG"}*/
/*"GRMOD" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"}*/
/*"GRMOD" -> {"MONOID"; "LMODULE"}*/
"GRMOD" -> "BMODULE"
/*"GRMOD" -> "RMODULE"*/

"GRMOD-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=GRMOD"]
/*"GRMOD-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "COMRING"; "RING"; "RNG"}*/
/*"GRMOD-" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"}*/
/*"GRMOD-" -> {"MONOID"; "LMODULE"}*/
"GRMOD-" -> "BMODULE"
/*"GRMOD-" -> "RMODULE"*/
```

```
"HYPCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=HYPCAT"]
/*"HYPCAT" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"HYPCAT" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"HYPCAT" -> "LMODULE"*/
"HYPCAT" -> "ELEMFUN"

"HYPCAT-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=HYPCAT"]
/*"HYPCAT-" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"HYPCAT-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"HYPCAT-" -> "LMODULE"*/
"HYPCAT-" -> "ELEMFUN"

"LORER" [color="#4488FF",href="bookvol10.2.pdf#nameddest=LORER"]
/*"LORER" -> {"ENTIRER"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"LORER" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"LORER" -> {"MONOID"; "LMODULE"; "RMODULE"}*/
"LORER" -> "BMODULE"

"MKCHSET" [color="#88FF44",href="bookvol10.3.pdf#nameddest=MKCHSET"]
"MKCHSET" -> "CACHSET"
/*"MKCHSET" -> {"ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"; "NNI"; "INT"}*/

"MODRING" [color="#88FF44",href="bookvol10.3.pdf#nameddest=MODRING"]
/*"MODRING" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"MODRING" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"MODRING" -> {"LMODULE"; "COMRING"}*/
"MODRING" -> "BMODULE"
/*"MODRING" -> {"RMODULE"; "BOOLEAN"}*/

"MODULE" [color="#4488FF",href="bookvol10.2.pdf#nameddest=MODULE"]
/*"MODULE" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"MODULE" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"MODULE" -> {"MONOID"; "LMODULE"}*/
"MODULE" -> "BMODULE"
/*"MODULE" -> "RMODULE"*/

"MODULE-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=MODULE"]
/*"MODULE-" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"MODULE-" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"MODULE-" -> {"MONOID"; "LMODULE"}*/
"MODULE-" -> "BMODULE"
/*"MODULE-" -> "RMODULE"*/

"NASRING" [color="#4488FF",href="bookvol10.2.pdf#nameddest=NASRING"]
"NASRING" -> "NARNG"
/*"NASRING" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"NASRING" -> {"BASTYPE"; "KOERCE"; "MONAD"}*/
"NASRING" -> "MONADWU"

"NASRING-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=NASRING"]
"NASRING-" -> "NARNG"
/*"NASRING-" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"NASRING-" -> {"BASTYPE"; "KOERCE"; "MONAD"}*/
"NASRING-" -> "MONADWU"
```

```
"OAMON" [color="#4488FF",href="bookvol10.2.pdf#nameddest=OAMON"]
"OAMON" -> "OASGP"
/*"OAMON" -> {"ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"; "ABELMON"; "ABELSG"}*/

"SETAGG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=SETAGG",
          shape=ellipse]
/*"SETAGG" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "CLAGG"; "HOAGG"; "AGG"*/
/*"SETAGG" -> "TYPE"*/
"SETAGG" -> "EVALAB"
/*"SETAGG" -> {"IEVALAB"; "KONVERT"}*/

"SETAGG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=SETAGG",
          shape=ellipse]
/*"SETAGG-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "CLAGG"; "HOAGG"; "AGG"}*/
/*"SETAGG-" -> "TYPE"*/
"SETAGG-" -> "EVALAB"
/*"SETAGG-" -> {"IEVALAB"; "KONVERT"}*/

"SORTPAK" [color="#FF4488",href="bookvol10.4.pdf#nameddest=SORTPAK"]
/*"SORTPAK" -> "TYPE"*/
"SORTPAK" -> "IXAGG"
/*"SORTPAK" -> {"HOAGG"; "AGG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
"SORTPAK" -> "EVALAB"
/*"SORTPAK" -> {"IEVALAB"; "ELTAGG"; "ELTAB"; "SINT"; "NNI"; "INT"}*/
/*"SORTPAK" -> {"BOOLEAN"; "PI"; "ORDSET"; "URAGG"; "RCAGG"}*/

"ZMOD" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ZMOD"]
/*"ZMOD" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"ZMOD" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"ZMOD" -> "LMODULE"*/
"ZMOD" -> "BMODULE"
/*"ZMOD" -> {"RMODULE"; "FINITE"; "KONVERT"; "STEP"; "SINT"; "INT"}*/
/*"ZMOD" -> {"PI"; "NNI"; "INS-"; "EUCDOM-"}*/
```

———-

1.4.6 Layer 4

Depends on: BGAGG BRAGG ELAGG- GRMOD MODULE OAMON
Used by next layer: ALGEBRA ALGEBRA- BTCAT OCAMON QUAGG SKAGG

— **layer4** —

```
LAYER4=\
  ${OUT}/ALGEBRA.o ${OUT}/ALGEBRA-.o ${OUT}/BTCAT.o  ${OUT}/BTCAT-.o \
  ${OUT}/FMCAT.o   ${OUT}/IDPOAM.o   ${OUT}/IFAMON.o ${OUT}/GRALG.o  \
  ${OUT}/GRALG-.o  ${OUT}/NAALG.o    ${OUT}/NAALG-.o ${OUT}/OCAMON.o \
  ${OUT}/PRQAGG.o  ${OUT}/QUAGG.o    ${OUT}/SKAGG.o  \
  layer4done
```

———-

— **layerpic** —

```
/* layer 4 */
/* dpends on: BGAGG BRAGG GRMOD MODULE OAMON */

"ALGEBRA" [color="#4488FF",href="bookvol10.2.pdf#nameddest=ALGEBRA"]
/*"ALGEBRA" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"ALGEBRA" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"ALGEBRA" -> "LMODULE"*/
"ALGEBRA" -> "MODULE"
/*"ALGEBRA" -> {"BMODULE"; "RMODULE"; "COMRING"}*/

"ALGEBRA-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ALGEBRA"]
/*"ALGEBRA-" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"ALGEBRA-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"ALGEBRA-" -> "LMODULE"*/
"ALGEBRA-" -> "MODULE"
/*"ALGEBRA-" -> {"BMODULE"; "RMODULE"; "COMRING"}*/

"BTCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=BTCAT"]
"BTCAT" -> "BRAGG"
/*"BTCAT" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"}*/
/*"BTCAT" -> {"KOERCE"; "EVALAB"; "IEVALAB"; "NNI"; "INT"}*/

"BTCAT-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=BTCAT"]
"BTCAT-" -> "BRAGG"
/*"BTCAT-" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"}*/
/*"BTCAT-" -> {"KOERCE"; "EVALAB"; "IEVALAB"; "NNI"; "INT"}*/

"FMCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=FMCAT"]
/*"FMCAT" -> {"BMODULE"; "LMODULE"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"FMCAT" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "RMODULE"; "RETRACT"}*/
"FMCAT" -> "MODULE"

"IDPOAM" [color="#88FF44",href="bookvol10.3.pdf#nameddest=IDPOAM"]
"IDPOAM" -> "OAMON"
/*"IDPOAM" -> {"OASGP"; "ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"; "ABELMON"}*/
/*"IDPOAM" -> {"ABELSG"; "IDPC"; "INT"; "LIST"; "ILIST"; "BOOLEAN"}*/

"IFAMON" [color="#88FF44",href="bookvol10.3.pdf#nameddest=IFAMON"]
/*"IFAMON" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"IFAMON" -> {"FAMONC"; "RETRACT"; "INT"; "LIST"; "ILIST"}*/
"IFAMON" -> "OAMON"
/*"IFAMON" -> {"OASGP"; "ORDSET"}*/

"GRALG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=GRALG"]
"GRALG" -> "GRMOD"
/*"GRALG" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "RETRACT"; "COMRING"; "RING"}*/
/*"GRALG" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"}*/
/*"GRALG" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/

"GRALG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=GRALG"]
"GRALG-" -> "GRMOD"
```

```
/*"GRALG-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "RETRACT"; "COMRING"; "RING"}*/
/*"GRALG-" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"}*/
/*"GRALG-" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/

"NAALG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=NAALG"]
/*"NAALG" -> {"NARNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"NAALG" -> {"BASTYPE"; "KOERCE"; "MONAD"}*/
"NAALG" -> "MODULE"
/*"NAALG" -> {"BMODULE"; "LMODULE"; "RMODULE"; "COMRING"; "RING"; "RNG"}*/
/*"NAALG" -> {"SGROUP"; "MONOID"; "PI"; "NNI"; "INT"}*/

"NAALG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=NAALG"]
/*"NAALG-" -> {"NARNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"NAALG-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "MONAD"}*/
"NAALG-" -> "MODULE"
/*"NAALG-" -> {"BMODULE"; "LMODULE"; "RMODULE"; "COMRING"; "RING"; "RNG"}*/
/*"NAALG-" -> {"SGROUP"; "MONOID"; "PI"; "NNI"; "INT"}*/

"OCAMON" [color="#4488FF",href="bookvol10.2.pdf#nameddest=OCAMON"]
"OCAMON" -> "OAMON"
/*"OCAMON" -> {"OASGP"; "ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"OCAMON" -> {"ABELMON"; "ABELSG"; "CABMON"}*/

"PRQAGG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=PRQAGG"]
"PRQAGG" -> "BGAGG"
/*"PRQAGG" -> {"HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"PRQAGG" -> {"EVALAB"; "IEVALAB"}*/

"QUAGG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=QUAGG"]
"QUAGG" -> "BGAGG"
/*"QUAGG" -> {"HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"QUAGG" -> {"EVALAB"; "IEVALAB"}*/

"SKAGG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=SKAGG"]
"SKAGG" -> "BGAGG"
/*"SKAGG" -> {"HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"SKAGG" -> {"EVALAB"; "IEVALAB"}*/
```

———-

1.4.7 Layer 5

Depends on: ALGEBRA ALGEBRA- BTCAT OCAMON QUAGG SKAGG
Used by next layer: MLO OAGROUP OAMONS PID XALG

— **layer5** —

```
LAYER5=\
  ${OUT}/BSTREE.o  ${OUT}/BTOURN.o   ${OUT}/CARD.o     ${OUT}/DRAWHACK.o \
  ${OUT}/DQAGG.o   ${OUT}/FACTFUNC.o ${OUT}/FMTC.o     ${OUT}/FR2.o      \
  ${OUT}/FRAC2.o   ${OUT}/FRUTIL.o   ${OUT}/ITAYLOR.o  ${OUT}/MLO.o      \
```

```
  ${OUT}/NEWTON.o  ${OUT}/OAGROUP.o  ${OUT}/OAMONS.o   ${OUT}/OP.o       \
  ${OUT}/PID.o     ${OUT}/RANDSRC.o  ${OUT}/UNISEG2.o  ${OUT}/XALG.o     \
  layer5done
```

———-

— **layerpic** —

```
/* layer 5 */
/* depends on: ALGEBRA ALGEBRA- BTCAT OCAMON QUAGG SKAGG */

"BSTREE" [color="#88FF44",href="bookvol10.3.pdf#nameddest=BSTREE"]
"BSTREE" -> "BTCAT"
/*"BSTREE" -> {"BRAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"}*/
/*"BSTREE" -> {"BASTYPE"; "KOERCE"; "EVALAB"; "IEVALAB"; "ORDSET"}*/
/*"BSTREE" -> {"INT"; "LIST"; "ILIST"}*/

"BTOURN" [color="#88FF44",href="bookvol10.3.pdf#nameddest=BTOURN"]
"BTOURN" -> "BTCAT"
/*"BTOURN" -> {"BRAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"}*/
/*"BTOURN" -> {"BASTYPE"; "KOERCE"; "EVALAB"; "IEVALAB"; "ORDSET"}*/
/*"BTOURN" -> {"INT"; "LIST"; "ILIST"}*/

"CARD" [color="#88FF44",href="bookvol10.3.pdf#nameddest=CARD"]
/*"CARD" -> {"ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"; "ABELMON"; "ABELSG"}*/
/*"CARD" -> {"MONOID"; "SGROUP"; "RETRACT"; "BOOLEAN"; "INT"; "NNI"; "INS-"}*/
/*"CARD" -> {"EUCDOM-"; "UFD-"; "GCDDOM-"; "INTDOM-"}*/
"CARD" -> "ALGEBRA-"
/*"CARD" -> {"DIFRING-"; "ORDRING-"; "MODULE-"; "RING-"; "ABELGRP-"}*/

"DRAWHACK" [color="#FF4488",href="bookvol10.4.pdf#nameddest=DRAWHACK"]
/*"DRAWHACK" -> {"ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"; "INTDOM"}*/
/*"DRAWHACK" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"DRAWHACK" -> {"ABELSG"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"DRAWHACK" -> "RMODULE"*/
"DRAWHACK" -> "ALGEBRA"
/*"DRAWHACK" -> {"MODULE"; "ENTIRER"; "KONVERT"}*/

"DQAGG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=DQAGG"]
"DQAGG" -> "SKAGG"
/*"DQAGG" -> {"BGAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"}*/
/*"DQAGG" -> {"KOERCE"; "EVALAB"; "IEVALAB"}*/
"DQAGG" -> "QUAGG"

"FACTFUNC" [color="#FF4488",href="bookvol10.4.pdf#nameddest=FACTFUNC"]
/*"FACTFUNC" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"FACTFUNC" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"FACTFUNC" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
"FACTFUNC" -> "ALGEBRA"
/*"FACTFUNC" -> {"MODULE"; "ENTIRER"; "INT"; "LIST"; "ILIST"; "INS-"}*/
/*"FACTFUNC" -> {"EUCDOM-"; "UFD-"; "GCDDOM-"; "NNI"; "LSAGG-"; "STAGG-"}*/
/*"FACTFUNC" -> "ELAGG-"*/
```

```
"FMTC" [color="#4488FF",href="bookvol10.2.pdf#nameddest=FMTC"]
/*"FMTC" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"FMTC" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"FMTC" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
"FMTC" -> "ALGEBRA"
/*"FMTC" -> {"MODULE"; "ENTIRER"; "ORDSET"; "RETRACT"}*/

"FR2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=FR2"]
/*"FR2" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"FR2" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"FR2" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
"FR2" -> "ALGEBRA"
/*"FR2" -> {"MODULE"; "ENTIRER"}*/

"FRAC2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=FRAC2"]
/*"FRAC2" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"FRAC2" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"FRAC2" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
"FRAC2" -> "ALGEBRA"
/*"FRAC2" -> {"MODULE"; "ENTIRER"}*/

"FRUTIL" [color="#FF4488",href="bookvol10.4.pdf#nameddest=FRUTIL"]
/*"FRUTIL" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"FRUTIL" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"FRUTIL" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
"FRUTIL" -> "ALGEBRA"
/*"FRUTIL" -> {"MODULE"; "ENTIRER"; "INT"; "LIST"; "ILIST"; "PI"; "NNI"}*/
/*"FRUTIL" -> {"LSAGG-"; "STAGG-"}*/

"ITAYLOR" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ITAYLOR"]
/*"ITAYLOR" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"ITAYLOR" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"ITAYLOR" -> {"LMODULE"; "INTDOM"; "COMRING"; "BMODULE"; "RMODULE"}*/
"ITAYLOR" -> "ALGEBRA"
/*"ITAYLOR" -> {"MODULE"; "ENTIRER"; "SINT"; "NNI"; "INT"; "BOOLEAN"}*/

"MLO" [color="#4488FF",href="bookvol10.2.pdf#nameddest=MLO"]
/*"MLO" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"MLO" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"MLO" -> {"BMODULE"; "RMODULE"}*/
"MLO" -> "ALGEBRA"
/*"MLO" -> "MODULE"*/

"NEWTON" [color="#FF4488",href="bookvol10.4.pdf#nameddest=NEWTON"]
/*"NEWTON" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"NEWTON" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"NEWTON" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
"NEWTON" -> "ALGEBRA"
/*"NEWTON" -> {"MODULE"; "ENTIRER"; "INT"; "LIST"; "ILIST"; "NNI"}*/
/*"NEWTON" -> {"LSAGG-"; "STAGG-"}*/

/* The PID/OAGROUP node is added to the graph to simplify the layout*/
/* Note that PID and OAGROUP also exist */
"PID/OAGROUP" [color="blue",href="bookvol10.2.pdf#nameddest=OAGROUP"]
```

```
"PID/OAGROUP" -> "OCAMON"
"PID/OAGROUP" -> "ALGEBRA"

"OAGROUP" [color="#4488FF",href="bookvol10.2.pdf#nameddest=OAGROUP"]
"OAGROUP" -> "OCAMON"
/*"OAGROUP" -> {"OAMON"; "OASGP"; "ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"OAGROUP" -> {"ABELMON"; "ABELSG"; "CABMON"; "ABELGRP"}*/

"PID" [color="#4488FF",href="bookvol10.2.pdf#nameddest=PID"]
/*"PID" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"PID" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"PID" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
"PID" -> "ALGEBRA"
/*"PID" -> {"MODULE"; "ENTIRER"}*/

"OAMONS" [color="#4488FF",href="bookvol10.2.pdf#nameddest=OAMONS"]
"OAMONS" -> "OCAMON"
/*"OAMONS" -> {"OAMON"; "OASGP"; "ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"OAMONS" -> {"ABELMON"; "ABELSG"; "CABMON"}*/

"OP" [color="#88FF44",href="bookvol10.3.pdf#nameddest=OP"]
/*"OP" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"OP" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "RETRACT"}*/
/*"OP" -> {"ELTAB"; "CHARZ"; "CHARNZ"}*/
"OP" -> "ALGEBRA"
/*"OP" -> {"MODULE"; "BMODULE"; "RMODULE"; "COMRING"; "ORDSET"}*/

"RANDSRC" [color="#FF4488",href="bookvol10.4.pdf#nameddest=RANDSRC"]
/*"RANDSRC" -> {"INT"; "PI"; "NNI"; "INS-"; "EUCDOM-"; "UFD-"; "GCDDOM-"}*/
/*"RANDSRC" -> "INTDOM-"*/
"RANDSRC" -> "ALGEBRA-"
/*"RANDSRC" -> {"DIFRING-"; "ORDRING-"; "MODULE-"; "RING-"; "ABELGRP-"}*/
/*"RANDSRC" -> "ABELMON-"*/

"UNISEG2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=UNISEG2"]
/*"UNISEG2" -> {"TYPE"; "ORDRING"; "OAGROUP"*/
"UNISEG2" -> "OCAMON"
/*"UNISEG2" -> {"OAMON"; "OASGP"; "ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"UNISEG2" -> {"ABELMON"; "ABELSG"; "CABMON"; "ABELGRP"; "RING"; "RNG"}*/
/*"UNISEG2" -> {"SGROUP"; "MONOID"; "LMODULE"}*/

"XALG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=XALG"]
/*"XALG" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"XALG" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"XALG" -> {"BMODULE"; "RMODULE"}*/
"XALG" -> "ALGEBRA"
/*"XALG" -> "MODULE"*/
```

1.4.8 Layer6

Depends on: MLO OAGROUP OAMONS PID XALG
Used by next layer: AMR FIELD FIELD- FLAGG FLAGG- FRETRCT PADICCT RADCAT XFALG

— **layer6** —

```
LAYER6=\
  ${OUT}/AMR.o      ${OUT}/AMR-.o     ${OUT}/DEGRED.o  ${OUT}/DIVCAT.o   \
  ${OUT}/DLP.o      \
  ${OUT}/EAB.o      ${OUT}/ESTOOLS1.o ${OUT}/FAGROUP.o ${OUT}/FAMONOID.o \
  ${OUT}/FIELD.o    ${OUT}/FIELD-.o   ${OUT}/FLAGG.o   ${OUT}/FLAGG-.o   \
  ${OUT}/FLINEXP.o  ${OUT}/FLINEXP-.o ${OUT}/FRETRCT.o ${OUT}/FRETRCT-.o \
  ${OUT}/FSERIES.o  ${OUT}/FT.o       ${OUT}/IDPOAMS.o ${OUT}/INFINITY.o \
  ${OUT}/LA.o       ${OUT}/MAPPKG4.o  ${OUT}/OMLO.o    ${OUT}/ORTHPOL.o  \
  ${OUT}/PRODUCT.o  ${OUT}/PADICCT.o  ${OUT}/PMPRED.o  ${OUT}/PMASS.o   \
  ${OUT}/PTFUNC2.o  ${OUT}/RADCAT.o   ${OUT}/RADCAT-.o ${OUT}/RATRET.o  \
  ${OUT}/RADUTIL.o  ${OUT}/UPXS2.o    ${OUT}/XFALG.o   ${OUT}/ZLINDEP.o \
  layer6done
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————-

— **layerpic** —

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/* layer 6 */
/* MLO OAGROUP OAMONS PID XALG */

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"AMR" -> "PID/OAGROUP"
/*"AMR" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "DIFRING"}*/
/*"AMR" -> {"KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"}*/
/*"AMR" -> "STEP"*/

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/*"FAGROUP" -> {"DIFRING"; "KONVERT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"}*/
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/*"FLAGG" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
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/*"FT" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"}*/
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/*"FT" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
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/*"INS" -> "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
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"MAPPKG4" -> "PID/OAGROUP"
/*"MAPPKG4" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"MAPPKG4" -> {"ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"}*/
/*"MAPPKG4" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "OM"}*/

"NNI" [color="#88FF44",href="bookvol10.3.pdf#nameddest=NNI",
          shape=ellipse]
"NNI" -> "OAMONS"
/*"NNI" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "SETCAT"; "BASTYPE"}*/
/*"NNI" -> {"KOERCE"; "ABELMON"; "ABELSG"; "CABMON"; "MONOID"; "SGROUP"}*/
/*"NNI" -> {"NNI"; "INT"; "BOOLEAN"}*/

"OINTDOM" [color="#4488FF",href="bookvol10.2.pdf#nameddest=OINTDOM",
          shape=ellipse]
/*"OINTDOM" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"OINTDOM" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"OINTDOM" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
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/*"OINTDOM" -> {"MODULE"; "ENTIRER"; "ORDRING"}*/
"OINTDOM" -> "OAGROUP"
/*"OINTDOM" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/

"OMLO" [color="#88FF44",href="bookvol10.3.pdf#nameddest=OMLO"]
"OMLO" -> "MLO"
/*"OMLO" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"OMLO" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"OMLO" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "DIFRING"; "COMRING"}*/

"ORDRING" [color="#4488FF",href="bookvol10.2.pdf#nameddest=ORDRING",
          shape=ellipse]
"ORDRING" -> "OAGROUP"
/*"ORDRING" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "SETCAT"; "BASTYPE"}*/
/*"ORDRING" -> {"KOERCE"; "ABELMON"; "ABELSG"; "CABMON"; "ABELGRP"}*/
/*"ORDRING" -> {"RING"; "RNG"; "SGROUP"; "MONOID"; "LMODULE"; "INT"}*/

"ORDRING-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ORDRING",
          shape=ellipse]
"ORDRING-" -> "OAGROUP"
/*"ORDRING-" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "SETCAT"; "BASTYPE"}*/
/*"ORDRING-" -> {"KOERCE"; "ABELMON"; "ABELSG"; "CABMON"; "ABELGRP"; "RING"}*/
/*"ORDRING-" -> {"RNG"; "SGROUP"; "MONOID"; "LMODULE"; "INT"}*/

"ORTHPOL" [color="#FF4488",href="bookvol10.4.pdf#nameddest=ORTHPOL"]
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/*"ORTHPOL" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"ORTHPOL" -> {"LMODULE"; "BMODULE"; "RMODULE"; "NNI"; "INT"; "SINT"}*/
/*"ORTHPOL" -> {"MONOID-"; "ABELMON-"; "ORDSET-"; "SGROUP-"; "PI"; "INS-"}*/
/*"ORTHPOL" -> {"ALGEBRA"; "MODULE"; "INS"; "UFD"; "GCDDOM"; "INTDOM"}*/
/*"ORTHPOL" -> {"ENTIRER"; "EUCDOM"}*/
"ORTHPOL" -> "PID/OAGROUP"
/*"ORTHPOL" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"ORTHPOL" -> {"ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"}*/
/*"ORTHPOL" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"}*/
/*"ORTHPOL" -> "STEP"*/

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/*"PRODUCT" -> {"SGROUP"; "ABELMON"; "ABELSG"; "CABMON"; "GROUP"; {"ABELGRP"}*/
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/*"PRODUCT" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "BOOLEAN"; "NNI"}*/
/*"PRODUCT" -> "INT"*/

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/*"PADICCT" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"PADICCT" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"PADICCT" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "CHARZ"}*/

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/*"PMPRED" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"}*/
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/*"PMPRED" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"PMPRED" -> {"ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"}*/
/*"PMPRED" -> {"CFCAT"; "REAL"; "CHARZ"; "STEP"}*/

"PMASS" [color="#FF4488",href="bookvol10.4.pdf#nameddest=PMASS"]
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/*"PMASS" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"PMASS" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"}*/
"PMASS" -> "PID/OAGROUP"
/*"PMASS" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"PMASS" -> {"ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"}*/
/*"PMASS" -> {"CFCAT"; "REAL"; "CHARZ"; "STEP"}*/

"PTFUNC2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=PTFUNC2"]
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/*"PTFUNC2" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"}*/
"PTFUNC2" -> "PID/OAGROUP"
/*"PTFUNC2" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"PTFUNC2" -> {"ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"}*/
/*"PTFUNC2" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "OM"}*/

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/*"RADCAT" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"RADCAT" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"RADCAT" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"}*/
"RADCAT" -> "PID/OAGROUP"
/*"RADCAT" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"RADCAT" -> {"ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"}*/
/*"RADCAT" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"}*/

"RADCAT-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=RADCAT"]
/*"RADCAT-" -> {"INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"}*/
/*"RADCAT-" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
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/*"RADCAT-" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"RADCAT-" -> "EUCDOM"*/
"RADCAT-" -> "PID/OAGROUP"
/*"RADCAT-" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"RADCAT-" -> {"OASGP"; "ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"}*/
/*"RADCAT-" -> {"LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"}*/

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/*"RATRET" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"RATRET" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"RATRET" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
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/*"RATRET" -> "EUCDOM"*/
"RATRET" -> "PID/OAGROUP"
/*"RATRET" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"RATRET" -> {"ORDSET"; "DIFRING"; "KONVERT"; "LINEXP"; "PATMAB"; "CFCAT"}*/
/*"RATRET" -> {"REAL"; "CHARZ"; "STEP"}*/

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/*"RADUTIL" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"RADUTIL" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"RADUTIL" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"RADUTIL" -> "EUCDOM"*/
"RADUTIL" -> "PID/OAGROUP"
/*"RADUTIL" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"RADUTIL" -> {"ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"}*/
/*"RADUTIL" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"}*/

/* Note that SINT references itself! */
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/*"SINT" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"SINT" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"SINT" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"}*/
"SINT" -> "PID/OAGROUP"
/*"SINT" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"SINT" -> {"ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"}*/
/*"SINT" -> {"CFCAT"; "REAL"; "CHARZ"; "STEP"; "LOGIC"; "OM"; "SINT"; "INT"}*/

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/*"STAGG" -> {"KOERCE"; "EVALAB"; "IEVALAB"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
/*"STAGG" -> {"ELTAB"; "CLAGG"; "KONVERT"; "BOOLEAN"; "SINT"; "NNI"; "INT"}*/
/*"STAGG" -> {"INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"}*/
/*"STAGG" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"}*/
/*"STAGG" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"STAGG" -> {"ENTIRER"; "EUCDOM"}*/
"STAGG" -> "PID/OAGROUP"
/*"STAGG" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"STAGG" -> {"ORDSET"; "DIFRING"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"}*/
/*"STAGG" -> {"REAL"; "CHARZ"; "STEP"; "OM"; "LIST"; "ILIST"}*/

"STAGG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=STAGG",
          shape=ellipse]
/*"STAGG-" -> {"URAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"}*/
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/*"STAGG-" -> {"ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"; "BOOLEAN"; "SINT"}*/
/*"STAGG-" -> {"NNI"; "INT"; "INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"STAGG-" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"STAGG-" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"STAGG-" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"}*/
"STAGG-" -> "PID/OAGROUP"
/*"STAGG-" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
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/*"STAGG-" -> {"ORDSET"; "DIFRING"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"}*/
/*"STAGG-" -> {"REAL"; "CHARZ"; "STEP"; "OM"; "LIST"; "ILIST"}*/

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/*"UPXS2" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"UPXS2" -> {"INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"; "BMODULE"}*/
/*"UPXS2" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"}*/
"UPXS2" -> "PID/OAGROUP"
/*"UPXS2" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"UPXS2" -> {"ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"}*/
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/*"XFALG" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
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/*"XFALG" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "RETRACT"}*/

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/*"ZLINDEP" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"ZLINDEP" -> {"MONOID"; "LMODULE"; "INS"; "UFD"; "GCDDOM"; "INTDOM"}*/
/*"ZLINDEP" -> {"COMRING"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"ZLINDEP" -> {"ENTIRER"; "EUCDOM"}*/
"ZLINDEP" -> "PID/OAGROUP"
/*"ZLINDEP" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"ZLINDEP" -> {"OASGP"; "ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"}*/
/*"ZLINDEP" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "OM"}*/
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———-

1.4.9 Layer7

Depends on: AMR FIELD FIELD- FLAGG FLAGG- FRETRCT PADICCT RADCAT XFALG
Used by next layer: A1AGG A1AGG- ARR2CAT FAMR FPC LIECAT LZSTAGG OREPCAT PSCAT TRANFUN VSPACE XPOLYC

— **layer7** —

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LAYER7=\
  ${OUT}/A1AGG.o    ${OUT}/A1AGG-.o   ${OUT}/ARR2CAT.o  ${OUT}/ARR2CAT-.o \
  ${OUT}/ASP34.o    ${OUT}/BBTREE.o   ${OUT}/BFUNCT.o   ${OUT}/BLAS1.o    \
  ${OUT}/BPADIC.o   \
  ${OUT}/BTREE.o    ${OUT}/CRAPACK.o  ${OUT}/DEQUEUE.o  ${OUT}/DIRRING.o  \
  ${OUT}/DIV.o      ${OUT}/DLIST.o    \
  ${OUT}/DRAWCX.o   ${OUT}/DRAWPT.o   ${OUT}/D01GBFA.o  ${OUT}/D02EJFA.o  \
  ${OUT}/D03FAFA.o  ${OUT}/FAMR.o     ${OUT}/FAMR-.o    ${OUT}/FIELD.o    \
  ${OUT}/FLASORT.o  \
  ${OUT}/FLAGG2.o   ${OUT}/FGROUP.o   ${OUT}/FM.o       ${OUT}/FM1.o      \
  ${OUT}/FPC.o      ${OUT}/FPC-.o     ${OUT}/FMONOID.o  ${OUT}/INDE.o     \
  ${OUT}/IPADIC.o   ${OUT}/IROOT.o    ${OUT}/IR2.o      ${OUT}/LEXP.o     \
```

```
  ${OUT}/LIECAT.o   ${OUT}/LIECAT-.o  ${OUT}/LIST2.o    ${OUT}/LIST2MAP.o \
  ${OUT}/LMOPS.o    ${OUT}/LZSTAGG.o  ${OUT}/LZSTAGG-.o ${OUT}/MAGMA.o    \
  ${OUT}/MESH.o     ${OUT}/MOEBIUS.o  ${OUT}/MODFIELD.o ${OUT}/MODOP.o    \
  ${OUT}/MRING.o    ${OUT}/MTHING.o   ${OUT}/NCNTFRAC.o ${OUT}/NCODIV.o   \
  ${OUT}/NUMTUBE.o  ${OUT}/ODR.o      ${OUT}/OFMONOID.o ${OUT}/ONECOMP.o  \
  ${OUT}/ORDCOMP.o  ${OUT}/OREPCAT.o  ${OUT}/OREPCAT-.o ${OUT}/OWP.o      \
  ${OUT}/PACPERC.o  \
  ${OUT}/PADIC.o    ${OUT}/PATTERN2.o ${OUT}/PATLRES.o  ${OUT}/PARTPERM.o \
  ${OUT}/PBWLB.o    ${OUT}/PENDTREE.o ${OUT}/PGE.o      ${OUT}/PGROEB.o   \
  ${OUT}/PINTERP.o  ${OUT}/PLOTTOOL.o ${OUT}/PFR.o      ${OUT}/PMDOWN.o   \
  ${OUT}/PMINS.o    ${OUT}/PMLSAGG.o  ${OUT}/PMTOOLS.o  ${OUT}/PRTITION.o \
  ${OUT}/PSCAT.o    ${OUT}/PSCAT-.o   ${OUT}/QFORM.o    ${OUT}/QUEUE.o    \
  ${OUT}/SCACHE.o   ${OUT}/SEG.o      ${OUT}/SEG2.o     ${OUT}/SEXOF.o    \
  ${OUT}/STACK.o    ${OUT}/STTAYLOR.o ${OUT}/TABLBUMP.o ${OUT}/TABLEAU.o  \
  ${OUT}/TOPSP.o    ${OUT}/TRANFUN.o  ${OUT}/TRANFUN-.o ${OUT}/TUBE.o     \
  ${OUT}/UDPO.o     ${OUT}/UNISEG.o   ${OUT}/VIEW.o     ${OUT}/VSPACE.o   \
  ${OUT}/VSPACE-.o  ${OUT}/XPOLYC.o   ${OUT}/XPR.o \
  layer7done
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———-

— layerpic —

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/* layer 7 */
/* depends on: AMR FIELD FIELD- FLAGG FLAGG- FRETRCT PADICCT RADCAT XFALG */

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"A1AGG" -> "FLAGG"
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/*"A1AGG" -> {"BASTYPE"; "KOERCE"; "EVALAB"; "IEVALAB"; "ELTAGG"; "ELTAB"}*/
/*"A1AGG" -> {"CLAGG"; "KONVERT"; "ORDSET"; "INS"; "UFD"; "GCDDOM"}*/
/*"A1AGG" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"A1AGG" -> {"ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"A1AGG" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"; "PID"}*/
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/*"A1AGG" -> {"DIFRING"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"}*/
/*"A1AGG" -> {"CHARZ"; "STEP"; "OM"; "BOOLEAN"; "SINT"; "INT"}*/
/*"A1AGG" -> {"NNI"; "LIST"; "ILIST"; "LSAGG"; "STAGG"; "URAGG"}*/
/*"A1AGG" -> {"RCAGG"; "ELAGG"}*/

"A1AGG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=A1AGG"]
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/*"A1AGG-" -> {"LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"}*/
/*"A1AGG-" -> {"BASTYPE"; "KOERCE"; "EVALAB"; "IEVALAB"; "ELTAGG"; "ELTAB"}*/
/*"A1AGG-" -> {"CLAGG"; "KONVERT"; "ORDSET"; "INS"; "UFD"; "GCDDOM"}*/
/*"A1AGG-" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"A1AGG-" -> {"ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"A1AGG-" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"}*/
/*"A1AGG-" -> {"PID"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"A1AGG-" -> {"OASGP"; "DIFRING"; "RETRACT"; "LINEXP"; "PATMAB"}*/
/*"A1AGG-" -> {"CFCAT"; "REAL"; "CHARZ"; "STEP"; "OM"}*/
/*"A1AGG-" -> {"BOOLEAN"; "SINT"; "INT"; "NNI"; "LIST"; "ILIST"}*/
/*"A1AGG-" -> {"LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "ELAGG"}*/
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/*"ARR2CAT" -> {"EVALAB"; "IEVALAB"}*/
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/*"ARR2CAT" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
/*"ARR2CAT" -> {"ORDSET"; "BOOLEAN"; "NNI"; "INT"; "SINT"; "LIST"}*/
/*"ARR2CAT" -> {"ILIST"; "INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"ARR2CAT" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"ARR2CAT" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"ARR2CAT" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"}*/
/*"ARR2CAT" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "DIFRING"}*/
/*"ARR2CAT" -> {"RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"}*/
/*"ARR2CAT" -> {"CHARZ"; "STEP"; "OM"}*/

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/*"ARR2CAT-" -> {"EVALAB"; "IEVALAB"}*/
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/*"ARR2CAT-" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
/*"ARR2CAT-" -> {"ORDSET"; "BOOLEAN"; "NNI"; "INT"; "SINT"; "LIST"; "ILIST"}*/
/*"ARR2CAT-" -> {"INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"}*/
/*"ARR2CAT-" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"}*/
/*"ARR2CAT-" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"ARR2CAT-" -> {"MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"}*/
/*"ARR2CAT-" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
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/*"ASP34" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
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/*"BLAS1" -> {"KONVERT" "RETRACT"}*/
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"CLAGG" -> "FLAGG"
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/*"CLAGG-" -> {"RCAGG"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"}*/
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/*"FLASORT" -> {"OASGP"; "DIFRING"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"}*/
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/*"PATLRES" -> {"ORDSET"; "ELAGG"; "BOOLEAN"}*/

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/*"PARTPERM" -> {"STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"}*/
/*"PARTPERM" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "EVALAB"; "IEVALAB"}*/
/*"PARTPERM" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
"PARTPERM" -> "FLAGG"
/*"PARTPERM" -> {"ORDSET"; "ELAGG"; "OM"}*/

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/*"PBWLB" -> {"LIST"; "ILIST"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"}*/
/*"PBWLB" -> {"HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "LNAGG"}*/
/*"PBWLB" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
"PBWLB" -> "FLAGG"
/*"PBWLB" -> {"ELAGG"; "OM"; "LSAGG-"; "BOOLEAN"; "NNI"}*/

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/*"PENDTREE" -> {"URAGG-"; "LNAGG-"; "RCAGG-"; "IXAGG-"; "CLAGG-"; "HOAGG-"}*/
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/*"PENDTREE" -> {"ORDSET-"; "AGG-"; "ELTAGG-"; "SETCAT-"; "BASTYPE-"}*/

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/*"PGE" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"PGE" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"PGE" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"}*/
/*"PGE" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"PGE" -> {"DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"}*/
/*"PGE" -> {"REAL"; "CHARZ"; "STEP"; "SINT"; "NNI"; "INT"}*/
/*"PGE" -> {"LIST"; "ILIST"; "LSAGG-"; "LSAGG"; "STAGG"; "URAGG"}*/
/*"PGE" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
/*"PGE" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"}*/
"PGE" -> "FLAGG"
/*"PGE" -> {"ELAGG"; "OM"; "STAGG-"; "ELAGG-"; "PI"}*/

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/*"PGROEB" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
/*"PGROEB" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
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/*"PGROEB" -> {"ORDSET"; "ELAGG"; "OM"; "INT"; "LIST"; "ILIST"}*/

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/*"PINTERP" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"PINTERP" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"PINTERP" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"PINTERP" -> {"ENTIRER"; "UFD"; "DIVRING"}*/

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/*"PLOTTOOL" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"PLOTTOOL" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"PLOTTOOL" -> {"UFD"; "DIVRING"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"PLOTTOOL" -> {"OAMON"; "OASGP"; "ORDSET"; "REAL"; "KONVERT"; "RETRACT"}*/
"PLOTTOOL" -> "RADCAT"
/*"PLOTTOOL" -> {"PATMAB"; "CHARZ"}*/

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/*"PFR" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
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/*"PFR" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/
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/*"PFR" -> {"CLAGG"; "KONVERT"}*/
"PFR" -> "FLAGG"
/*"PFR" -> {"ORDSET"; "ELAGG"; "OM"; "PI"; "NNI"; "INS"; "OINTDOM"}*/
/*"PFR" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "DIFRING"}*/
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/*"PRTITION" -> {"HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "LNAGG"}*/
/*"PRTITION" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"}*/
"PRTITION" -> "FLAGG"
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/*"PRTITION" -> {"DIFRING"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"}*/
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/*"PMINS" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"; "PID"}*/
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/*"PMTOOLS" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
/*"PMTOOLS" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"}*/
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/*"PSCAT" -> {"LMODULE"; "BMODULE"; "RMODULE"; "COMRING"; "ALGEBRA"}*/
/*"PSCAT" -> {"MODULE"; "CHARZ"; "CHARNZ"; "INTDOM"; "ENTIRER"; "OAMON"}*/
/*"PSCAT" -> {"OASGP"; "ORDSET"; "INT"; "INS"; "UFD"; "GCDDOM"; "EUCDOM"}*/
/*"PSCAT" -> {"PID"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "DIFRING"}*/
/*"PSCAT" -> {"KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"}*/
/*"PSCAT" -> "STEP"*/
"PSCAT" -> "FIELD"
/*"PSCAT" -> "DIVRING"*/

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"PSCAT-" -> "AMR"
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/*"PSCAT-" -> {"INT"; "INS"; "UFD"; "GCDDOM"; "EUCDOM"; "PID"; "OINTDOM"}*/
/*"PSCAT-" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "DIFRING"; "KONVERT"}*/
/*"PSCAT-" -> {"RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "STEP"}*/
"PSCAT-" -> "FIELD"
/*"PSCAT-" -> "DIVRING"*/

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/*"QFORM" -> {"BASTYPE"; "KOERCE"}*/
"QFORM" -> "FIELD"
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/*"QFORM" -> {"RNG"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
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/*"QUEUE" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
"QUEUE" -> "FLAGG"
/*"QUEUE" -> {"ORDSET"; "ELAGG"; "OM"; "STAGG-"; "ELAGG-"}*/
"QUEUE" -> "FLAGG-"
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/*"QUEUE" -> "URAGG-"*/

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/*"RCAGG" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
"RCAGG" -> "FLAGG"
/*"RCAGG" -> {"ORDSET"; "ELAGG"; "OM"; "INT"; "LIST"; "ILIST"}*/

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/*"RCAGG-" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
"RCAGG-" -> "FLAGG"
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/*"RNS" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"; "PID"}*/
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/*"RNS" -> {"ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"}*/
/*"RNS" -> {"CFCAT"; "REAL"; "CHARZ"; "STEP"; "FPS"; "RNS"}*/
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/*"RNS" -> "DIVRING"*/
"RNS" -> "RADCAT"
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/*"RNS-" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"RNS-" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"RNS-" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"}*/
/*"RNS-" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"RNS-" -> {"DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"}*/
/*"RNS-" -> {"REAL"; "CHARZ"; "STEP"; "FPS"; "RNS"}*/
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/*"SCACHE" -> {"IEVALAB"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"}*/
/*"SCACHE" -> "KONVERT"*/
"SCACHE" -> "FLAGG"
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/*"SEG" -> {"OASGP"; "ORDSET"; "ABELMON"; "ABELSG"; "CABMON"; "ABELGRP"}*/
/*"SEG" -> {"RING"; "RNG"; "SGROUP"; "MONOID"; "LMODULE"; "LIST"}*/
/*"SEG" -> {"ILIST"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"}*/
/*"SEG" -> {"AGG"; "EVALAB"; "IEVALAB"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
/*"SEG" -> {"ELTAB"; "CLAGG"; "KONVERT"}*/
"SEG" -> "FLAGG"
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/*"SEG2" -> {"LMODULE"; "INT"; "LIST"; "BOOLEAN"; "ILIST"; "LSAGG"}*/
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"SEXOF" -> "FLAGG"
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/*"STTAYLOR" -> {"LMODULE"; "SINT"; "NNI"; "INT"; "LIST"; "ILIST"}*/
/*"STTAYLOR" -> {"LSAGG-"; "STAGG-"; "PI"; "ALGEBRA"; "MODULE"; "BMODULE"}*/
/*"STTAYLOR" -> {"RMODULE"; "INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"STTAYLOR" -> {"ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"STTAYLOR" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "DIFRING"; "KONVERT"}*/
/*"STTAYLOR" -> {"RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"}*/
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/*"TABLBUMP" -> {"ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"; "INT"; "LIST"}*/
/*"TABLBUMP" -> {"BOOLEAN"; "ILIST"; "LSAGG-"; "STAGG-"; "PI"; "NNI"}*/
/*"TABLBUMP" -> "ELAGG-"*/
"TABLBUMP" -> "FLAGG-"
/*"TABLBUMP" -> {"LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"}*/
/*"TABLBUMP" -> {"TYPE"; "EVALAB"; "IEVALAB"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
/*"TABLBUMP" -> {"ELTAB"; "CLAGG"; "KONVERT"}*/
"TABLBUMP" -> "FLAGG"
/*"TABLBUMP" -> "ELAGG"*/

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/*"TABLEAU" -> {"LSAGG-"; "SINT"; "NNI"; "LSAGG"; "STAGG"; "URAGG"}*/
/*"TABLEAU" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
/*"TABLEAU" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
"TABLEAU" -> "FLAGG"
/*"TABLEAU" -> {"ORDSET"; "ELAGG"; "OM"; "STAGG-"}*/

"TOPSP" [color="#FF4488",href="bookvol10.4.pdf#nameddest=TOPSP"]
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/*"TOPSP" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"TOPSP" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"TOPSP" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/
/*"TOPSP" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"TOPSP" -> {"REAL"; "KONVERT"; "RETRACT"}*/
"TOPSP" -> "RADCAT"
/*"TOPSP" -> {"PATMAB"; "CHARZ"}*/

"TRANFUN" [color="#4488FF",href="bookvol10.2.pdf#nameddest=TRANFUN"]
/*"TRANFUN" -> {"TRIGCAT"; "ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "RING"}*/
/*"TRANFUN" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"TRANFUN" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"TRANFUN" -> {"PI"; "NNI"; "INT"}*/
"TRANFUN" -> "FIELD"
/*"TRANFUN" -> {"EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"; "BMODULE"}*/
/*"TRANFUN" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/

"TRANFUN-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=TRANFUN"]
/*"TRANFUN-" -> {"TRIGCAT"; "ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "RING"}*/
/*"TRANFUN-" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"TRANFUN-" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "PI"}*/
/*"TRANFUN-" -> {"NNI"; "INT"}*/
"TRANFUN-" -> "FIELD"
/*"TRANFUN-" -> {"EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"; "BMODULE"}*/
/*"TRANFUN-" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/

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"TUBE" -> "FIELD"
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/*"TUBE" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"TUBE" -> {"BASTYPE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"TUBE" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/
/*"TUBE" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"TUBE" -> {"REAL"; "KONVERT"; "RETRACT"}*/
"TUBE" -> "RADCAT"
/*"TUBE" -> {"PATMAB"; "CHARZ"; "BOOLEAN"}*/

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/*"UDPO" -> {"BOOLEAN"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"}*/
/*"UDPO" -> {"AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "LNAGG"; "IXAGG"}*/
/*"UDPO" -> {"ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
"UDPO" -> "FLAGG"
/*"UDPO" -> {"ORDSET"; "ELAGG"; "OM"; "LSAGG-"; "STAGG-"; "ELAGG-"}*/

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/*"UFD" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"UFD" -> {"MODULE"; "ENTIRER"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"}*/
/*"UFD" -> {"HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "LNAGG"}*/
/*"UFD" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
"UFD" -> "FLAGG"
/*"UFD" -> {"ORDSET"; "ELAGG"; "OM"; "INT"; "LIST"; "ILIST"; "NNI"}*/

"UFD-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=UFD",
          shape=ellipse]
/*"UFD-" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"UFD-" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"UFD-" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"UFD-" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "LSAGG"}*/
/*"UFD-" -> {"STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"}*/
/*"UFD-" -> {"EVALAB"; "IEVALAB"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
/*"UFD-" -> {"ELTAB"; "CLAGG"; "KONVERT"}*/
"UFD-" -> "FLAGG"
/*"UFD-" -> {"ORDSET"; "ELAGG"; "OM"; "INT"; "LIST"; "ILIST"; "NNI"}*/

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/*"UNISEG" -> {"INT"; "BOOLEAN"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"UNISEG" -> {"OASGP"; "ORDSET"; "ABELMON"; "ABELSG"; "CABMON"}*/
/*"UNISEG" -> {"ABELGRP"; "RING"; "RNG"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"UNISEG" -> {"LIST"; "ILIST"; "LSAGG-"; "STAGG-"; "ELAGG-"}*/
"UNISEG" -> "FLAGG-"
/*"UNISEG" -> {"URAGG-"; "LNAGG-"; "RCAGG-"; "IXAGG-"; "CLAGG-"; "HOAGG-"}*/
/*"UNISEG" -> {"ORDSET-"; "AGG-"; "ELTAGG-"; "SETCAT-"; "BASTYPE-"}*/

"URAGG" [color="#4488FF",href="bookvol10.2.pdf#nameddest=URAGG",
          shape=ellipse]
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/*"URAGG" -> {"KOERCE"; "EVALAB"; "IEVALAB"; "BOOLEAN"; "INT"; "LIST"}*/
/*"URAGG" -> {"ILIST"; "LSAGG"; "STAGG"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
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/*"URAGG" -> {"ELTAB"; "CLAGG"; "KONVERT"}*/
"URAGG" -> "FLAGG"
/*"URAGG" -> {"ORDSET"; "ELAGG"; "OM"; "NNI"; "SINT"}*/

"URAGG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=URAGG",
          shape=ellipse]
/*"URAGG-" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"}*/
/*"URAGG-" -> {"KOERCE"; "EVALAB"; "IEVALAB"; "BOOLEAN"; "INT"; "LIST"}*/
/*"URAGG-" -> {"ILIST"; "LSAGG"; "STAGG"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
/*"URAGG-" -> {"ELTAB"; "CLAGG"; "KONVERT"}*/
"URAGG-" -> "FLAGG"
/*"URAGG-" -> {"ORDSET"; "ELAGG"; "OM"; "NNI"; "SINT"}*/

"VIEW" [color="#FF4488",href="bookvol10.4.pdf#nameddest=VIEW"]
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"VIEW" -> "FIELD"
/*"VIEW" -> {"EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"}*/
/*"VIEW" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"VIEW" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"VIEW" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"VIEW" -> {"UFD"; "DIVRING"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"VIEW" -> {"OASGP"; "ORDSET"; "REAL"; "KONVERT"; "RETRACT"}*/
"VIEW" -> "RADCAT"
/*"VIEW" -> {"PATMAB"; "CHARZ"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"}*/
/*"VIEW" -> {"HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "LNAGG"}*/
/*"VIEW" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"}*/
"VIEW" -> "FLAGG"
/*"VIEW" -> {"ELAGG"; "OM"; "ILIST"; "SINT"; "PI"; "NNI"}*/

"VSPACE" [color="#4488FF",href="bookvol10.2.pdf#nameddest=VSPACE"]
"VSPACE" -> "FIELD"
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/*"VSPACE" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"VSPACE" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"VSPACE" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"VSPACE" -> {"UFD"; "DIVRING"}*/

"VSPACE-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=VSPACE"]
"VSPACE-" -> "FIELD"
/*"VSPACE-" -> {"EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"}*/
/*"VSPACE-" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"VSPACE-" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"VSPACE-" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"VSPACE-" -> {"UFD"; "DIVRING"}*/

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"XPOLYC" -> "XFALG"
/*"XPOLYC" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"XPOLYC" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"XPOLYC" -> {"LMODULE"; "XALG"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"XPOLYC" -> {"MODULE"; "RETRACT"}*/

"XPR" [color="#88FF44",href="bookvol10.3.pdf#nameddest=XPR"]
/*"XPR" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
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/*"XPR" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
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/*"XPR" -> {"RETRACT"; "COMRING"; "ORDMON"; "ORDSET"; "LSAGG"; "STAGG"}*/
/*"XPR" -> {"URAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"}*/
/*"XPR" -> {"IEVALAB"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"}*/
/*"XPR" -> "KONVERT"*/
"XPR" -> "FLAGG"
/*"XPR" -> {"ELAGG"; "OM"; "INT"; "LIST"; "ILIST"; "LSAGG-"; "STAGG-"}*/
/*"XPR" -> "ELAGG-"*/
"XPR" -> "FLAGG-"
/*"XPR" -> {"URAGG-"; "BOOLEAN"; "NNI"}*/
"XPR" -> "FIELD"
/*"XPR" -> {"EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "ENTIRER"; "UFD"}*/
/*"XPR" -> "DIVRING"*/
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———-

1.4.10 Layer8

Depends on: A1AGG A1AGG- ARR2CAT FAMR FPC LIECAT LZSTAGG OREPCAT PSCAT TRANFUN VSPACE XPOLYC PACPERC
Used by next layer: BTAGG FLALG MATCAT SRAGG VECTCAT

— **layer8** —

```
LAYER8=\
  ${OUT}/AFFSP.o    \
  ${OUT}/APPLYORE.o ${OUT}/ARRAY1.o   ${OUT}/ARRAY12.o  ${OUT}/ARRAY2.o   \
  ${OUT}/ASTACK.o   ${OUT}/BTAGG.o    ${OUT}/BTAGG-.o   ${OUT}/COMBINAT.o \
  ${OUT}/CSTTOOLS.o ${OUT}/D01FCFA.o  ${OUT}/E04MBFA.o  ${OUT}/FAMR2.o    \
  ${OUT}/FARRAY.o   ${OUT}/FLALG.o    ${OUT}/FSFUN.o \
  ${OUT}/GALUTIL.o  ${OUT}/HEAP.o     \
  ${OUT}/IARRAY1.o  ${OUT}/IARRAY2.o  ${OUT}/IFARRAY.o  ${OUT}/INTCAT.o   \
  ${OUT}/INTHEORY.o ${OUT}/IRREDFFX.o ${OUT}/LFCAT.o    ${OUT}/LODOCAT.o  \
  ${OUT}/LODOCAT-.o ${OUT}/LWORD.o    ${OUT}/MATCAT.o   ${OUT}/MATCAT-.o  \
  ${OUT}/MATSTOR.o  ${OUT}/ORESUP.o   ${OUT}/OREPCTO.o  ${OUT}/OREUP.o    \
  ${OUT}/PACFFC.o   \
  ${OUT}/PLOT3D.o   ${OUT}/POLYVEC.o \
  ${OUT}/PR.o       ${OUT}/PREASSOC.o ${OUT}/PRIMARR2.o \
  ${OUT}/PROJSP.o   \
  ${OUT}/REDORDER.o ${OUT}/SRAGG.o    ${OUT}/SRAGG-.o   ${OUT}/STREAM.o   \
  ${OUT}/SYMPOLY.o  ${OUT}/TS.o       ${OUT}/TUPLE.o    ${OUT}/UPSCAT.o   \
  ${OUT}/UPSCAT-.o  ${OUT}/U8VEC.o    ${OUT}/U16VEC.o   ${OUT}/U32VEC.o   \
  ${OUT}/VECTCAT.o  ${OUT}/VECTCAT-.o ${OUT}/XDPOLY.o   \
  ${OUT}/XEXPPKG.o  ${OUT}/XF.o       ${OUT}/XF-.o      ${OUT}/XPBWPOLY.o \
  ${OUT}/XPOLY.o    ${OUT}/XRPOLY.o \
  layer8done
```

———-

— **layerpic** —

```
/* layer 8 */
/* depends on: A1AGG A1AGG- ARR2CAT FAMR FPC LIECAT LZSTAGG OREPCAT PSCAT */
/* TRANFUN VSPACE XPOLYC PACPREC */

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/*"AFFSP" -> {"EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"}*/
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/*"AFFSP" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"AFFSP" -> {"ENTIRER"; "UFD"; "DIVRING"; "INT"; "LIST"; "ILIST"; "LSAGG-"}*/
/*"AFFSP" -> {"PI"; "NNI"; "FFIELDC"}*/
"AFFSP" -> "FPC"
"AFFSP" -> "PACPERC"
/*"AFFSP" -> {"CHARNZ"; "FINITE"; "STEP"; "DIFRING"; "STAGG-"; "ELAGG-"}*/
/*"AFFSP" -> {"FLAGG-"; "URAGG-"; "LNAGG-"; "RCAGG-"; "IXAGG-"; "CLAGG-"}*/
/*"AFFSP" -> {"HOAGG-"; "ORDSET-"; "AGG-"; "ELTAGG-"; "SETCAT-"; "BASTYPE-"}*/
/*"AFFSP" -> {"LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"}*/
/*"AFFSP" -> {"EVALAB"; "IEVALAB"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"}*/
/*"AFFSP" -> {"CLAGG"; "KONVERT"; "FLAGG"; "ORDSET"; "ELAGG"; "OM"}*/
/*"AFFSP" -> {"BOOLEAN"}*/

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/*"APPLYORE" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"APPLYORE" -> "LMODULE"*/
"APPLYORE" -> "OREPCAT"
/*"APPLYORE" -> {"BMODULE"; "RMODULE"; "FRETRCT"; "RETRACT"; "ALGEBRA"}*/
/*"APPLYORE" -> {"MODULE"; "SINT"; "NNI"; "INT"}*/

"ARRAY1" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ARRAY1"]
"ARRAY1" -> "A1AGG"
/*"ARRAY1" -> {"FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"}*/
/*"ARRAY1" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "EVALAB"; "IEVALAB"; "ELTAGG"}*/
/*"ARRAY1" -> {"ELTAB"; "CLAGG"; "KONVERT"; "ORDSET"; "INT"; "LSAGG"}*/
/*"ARRAY1" -> {"STAGG"; "URAGG"; "RCAGG"; "ELAGG"; "OM"; "LIST"; "ILIST"}*/
/*"ARRAY1" -> {"NNI"; "INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"ARRAY1" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"ARRAY1" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"ARRAY1" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"}*/
/*"ARRAY1" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"ARRAY1" -> {"DIFRING"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"}*/
/*"ARRAY1" -> {"REAL"; "CHARZ"; "STEP"}*/

"ARRAY12" [color="#FF4488",href="bookvol10.4.pdf#nameddest=ARRAY12"]
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"ARRAY12" -> "A1AGG"
/*"ARRAY12" -> {"FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "SETCAT"}*/
/*"ARRAY12" -> {"BASTYPE"; "KOERCE"; "EVALAB"; "IEVALAB"; "ELTAGG"}*/
/*"ARRAY12" -> {"ELTAB"; "CLAGG"; "KONVERT"; "ORDSET"}*/

"ARRAY2" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ARRAY2"]
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/*"ARRAY2" -> {"EVALAB"; "IEVALAB"}*/
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"ARRAY2" -> "A1AGG"
/*"ARRAY2" -> {"FLAGG"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"}*/
/*"ARRAY2" -> {"KONVERT"; "ORDSET"; "INT"}*/

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/*"ASTACK" -> {"BASTYPE"; "KOERCE"; "EVALAB"; "IEVALAB"; "INT"}*/
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/*"ASTACK" -> {"FLAGG"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"}*/
/*"ASTACK" -> {"KONVERT"; "ORDSET"; "ELAGG"; "LIST"; "ILIST"; "SINT"}*/
/*"ASTACK" -> {"NNI"; "LSAGG-"; "STAGG-"; "ELAGG-"; "FLAGG-"; "URAGG-"}*/
/*"ASTACK" -> {"LNAGG-"; "RCAGG-"; "IXAGG-"; "CLAGG-"; "HOAGG-"}*/
/*"ASTACK" -> {"ORDSET-"; "AGG-"; "ELTAGG-"; "SETCAT-"; "BASTYPE-"}*/
/*"ASTACK" -> {"INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"}*/
/*"ASTACK" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"}*/
/*"ASTACK" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"ASTACK" -> {"MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"}*/
/*"ASTACK" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "DIFRING"}*/
/*"ASTACK" -> {"RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"}*/
/*"ASTACK" -> {"STEP"; "OM"}*/

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/*"BTAGG" -> {"ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"; "LOGIC"}*/
"BTAGG" -> "A1AGG"
/*"BTAGG" -> {"FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"}*/
/*"BTAGG" -> {"IEVALAB"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/

"BTAGG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=BTAGG"]
/*"BTAGG-" -> {"ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"; "LOGIC"}*/
"BTAGG-" -> "A1AGG"
/*"BTAGG-" -> {"FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"}*/
/*"BTAGG-" -> {"IEVALAB"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/

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/*"COMBINAT" -> {"INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"}*/
/*"COMBINAT" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"COMBINAT" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"COMBINAT" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"COMBINAT" -> {"ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"}*/
/*"COMBINAT" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"COMBINAT" -> {"DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"}*/
/*"COMBINAT" -> {"CFCAT"; "REAL"; "CHARZ"; "STEP"; "NNI"; "INT"; "OM"}*/
"COMBINAT" -> "A1AGG"
/*"COMBINAT" -> {"FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"}*/
/*"COMBINAT" -> {"EVALAB"; "IEVALAB"; "ELTAGG"; "ELTAB"; "CLAGG"}*/
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"CSTTOOLS" -> "LZSTAGG"
/*"CSTTOOLS" -> {"STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"; "SETCAT"}*/
/*"CSTTOOLS" -> {"BASTYPE"; "KOERCE"; "EVALAB"; "IEVALAB"; "LNAGG"}*/
/*"CSTTOOLS" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"; "SINT"}*/
/*"CSTTOOLS" -> {"NNI"; "INT"}*/
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/*"D01FCFA" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"D01FCFA" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"D01FCFA" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/
/*"D01FCFA" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"D01FCFA" -> {"ORDSET"; "REAL"; "KONVERT"; "RETRACT"; "RADCAT"}*/
/*"D01FCFA" -> {"PATMAB"; "CHARZ"; "SINT"; "LSAGG"; "STAGG"; "URAGG"}*/
/*"D01FCFA" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
/*"D01FCFA" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "FLAGG"}*/
/*"D01FCFA" -> {"ELAGG"; "OM"; "INT"; "LIST"; "ILIST"; "NNI"; "LSAGG-"}*/
/*"D01FCFA" -> {"STAGG-"; "DIFRING"}*/
"D01FCFA" -> "TRANFUN"
/*"D01FCFA" -> {"TRIGCAT"; "ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "SPFCAT"}*/
/*"D01FCFA" -> {"PI"; "MONOID-"; "ABELMON-"; "ORDSET-"; "SGROUP-"}*/
/*"D01FCFA" -> {"DFLOAT"; "INS-"; "EUCDOM-"; "UFD-"; "GCDDOM-"; "INTDOM-"}*/
/*"D01FCFA" -> {"ALGEBRA-"; "DIFRING-"; "ORDRING-"; "MODULE-"; "RING-"}*/
/*"D01FCFA" -> "ABELGRP-"*/

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/*"E04MBFA" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"E04MBFA" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/
/*"E04MBFA" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"E04MBFA" -> {"ORDSET"; "REAL"; "KONVERT"; "RETRACT"; "RADCAT"}*/
/*"E04MBFA" -> {"PATMAB"; "CHARZ"; "DIFRING"; "OM"}*/
"E04MBFA" -> "TRANFUN"
/*"E04MBFA" -> {"TRIGCAT"; "ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "SPFCAT"}*/
/*"E04MBFA" -> {"INT"; "NNI"; "LIST"; "ILIST"; "LSAGG-"; "STAGG-"}*/
/*"E04MBFA" -> {"LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"}*/
/*"E04MBFA" -> {"TYPE"; "EVALAB"; "IEVALAB"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
/*"E04MBFA" -> {"ELTAB"; "CLAGG"; "FLAGG"; "ELAGG"; "ELAGG-"; "DFLOAT"}*/
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/*"FAMR2" -> {"SGROUP"; "MONOID"; "LMODULE"}*/
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/*"FARRAY" -> {"ELTAB"; "CLAGG"; "KONVERT"; "ORDSET"; "ELAGG"; "INS"}*/
/*"FARRAY" -> {"UFD"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"}*/
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/*"FARRAY" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"}*/
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/*"FARRAY" -> {"MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"}*/
/*"FARRAY" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "DIFRING"}*/
/*"FARRAY" -> {"RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"}*/
/*"FARRAY" -> {"STEP"; "OM"}*/

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/*"FSFUN" -> {"ENTIRER"; "LORER"; "UFD"; "DIVRING"; "ORDRING"; "OAGROUP"}*/
/*"FSFUN" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "REAL"; "KONVERT"}*/
/*"FSFUN" -> {"RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"; "INT"; "DIFRING"; "OM"}*/
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/*"FSFUN" -> {"INS"; "OINTDOM"; "LINEXP"; "CFCAT"; "STEP"; "SINT" }*/
/*"FSFUN" -> {"MONOID-"; "ABELMON-"; "INS-"; "EUCDOM-"; "UFD-"; "GCDDOM-"}*/
/*"FSFUN" -> {"INTDOM-"; "ALGEBRA-"; "DIFRING-"; "ORDRING-"; "MODULE-"}*/
/*"FSFUN" -> {"RING-"; "ABELGRP-"}*/

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/*"GALUTIL" -> {"COMRING"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"GALUTIL" -> {"ENTIRER"; "UFD"; "DIVRING"; "ORDRING"; "OAGROUP"}*/
/*"GALUTIL" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "REAL"; "KONVERT"}*/
/*"GALUTIL" -> {"RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"; "INT"; "NNI"; "PI"}*/
"GALUTIL" -> "A1AGG"
/*"GALUTIL" -> {"FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"}*/
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"HEAP" -> "A1AGG"
/*"HEAP" -> "SINT"*/

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/*"IARRAY1" -> {"ELTAB"; "CLAGG"; "KONVERT"; "ORDSET"; "SINT"; "NNI"}*/
/*"IARRAY1" -> {"INT"; "INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"IARRAY1" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"IARRAY1" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"IARRAY1" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"}*/
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/*"IFARRAY" -> {"INT"; "PRIMARR"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"}*/
/*"IFARRAY" -> {"OM"; "LIST"; "ILIST"; "NNI"; "LSAGG-"; "STAGG-"}*/
/*"IFARRAY" -> {"SINT"; "INS-"; "EUCDOM-"; "UFD-"; "GCDDOM-"; "INTDOM-"}*/
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/*"IFARRAY" -> {"ABELGRP-"; "ABELMON-"; "PI"; "INS"; "UFD"; "GCDDOM"}*/
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/*"IFARRAY" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
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/*"INTCAT" -> {"TRIGCAT"; "ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "RADCAT"}*/
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/*"INTHEORY" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"INTHEORY" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"INTHEORY" -> {"ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"}*/
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/*"INTHEORY" -> {"KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"}*/
/*"INTHEORY" -> {"REAL"; "CHARZ"; "STEP"; "SINT"; "PI"; "INS-"; "EUCDOM-"}*/
/*"INTHEORY" -> {"UFD-"; "GCDDOM-"; "INTDOM-"; "ALGEBRA-"; "DIFRING-"}*/
/*"INTHEORY" -> {"ORDRING-"; "MODULE-"; "RING-"; "ABELGRP-"; "ABELMON-"}*/
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/*"IRREDFFX" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"IRREDFFX" -> {"ENTIRER"; "UFD"; "DIVRING"; "CHARNZ"; "FINITE"; "STEP"}*/
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"LODOCAT-" -> "OREPCAT"
/*"LODOCAT-" -> {"BMODULE"; "RMODULE"; "FRETRCT"; "RETRACT"; "ALGEBRA"}*/
/*"LODOCAT-" -> {"MODULE"; "ELTAB"; "NNI"; "INT"; "BOOLEAN"; "FIELD"}*/
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/*"LWORD" -> {"ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"; "FLAGG"; "ELAGG"}*/
/*"LWORD" -> {"OM"; "INT"; "LIST"; "ILIST"; "LSAGG-"; "STAGG-"; "ELAGG-"}*/
/*"LWORD" -> {"FLAGG-"; "URAGG-"; "LNAGG-"; "RCAGG-"; "IXAGG-"; "CLAGG-"}*/
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"LWORD" -> "A1AGG"
/*"LWORD" -> "SINT"*/
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/*"MATCAT" -> {"EVALAB"; "IEVALAB"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"MATCAT" -> {"ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"MATCAT" -> {"FLAGG"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"}*/
/*"MATCAT" -> {"KONVERT"; "ORDSET"; "NNI"; "INT"; "BOOLEAN"; "SINT"}*/
/*"MATCAT" -> {"LIST"; "ILIST"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "ELAGG"}*/
/*"MATCAT" -> {"OM"; "INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"MATCAT" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"MATCAT" -> {"EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"MATCAT" -> {"OAMON"; "OASGP"; "DIFRING"; "RETRACT"; "LINEXP"; "PATMAB"}*/
/*"MATCAT" -> {"CFCAT"; "REAL"; "CHARZ"; "STEP"; "FIELD"; "DIVRING"; "INS-"}*/

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/*"MATCAT-" -> {"ELAGG"; "OM"; "INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"MATCAT-" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
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/*"MATSTOR" -> {"FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"}*/
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/*"MTSCAT" -> {"MTSCAT"; "PDRING"; "RING"; "RNG"; "ABELGRP"; "SGROUP"}*/
/*"MTSCAT" -> {"MONOID"; "LMODULE"}*/
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/*"MTSCAT" -> {"AMR"; "BMODULE"; "RMODULE"; "COMRING"; "ALGEBRA"}*/
/*"MTSCAT" -> {"MODULE"; "CHARZ"; "CHARNZ"; "INTDOM"; "ENTIRER"; "IEVALAB"}*/
/*"MTSCAT" -> {"EVALAB"; "RADCAT"}*/
"MTSCAT" -> "TRANFUN"
/*"MTSCAT" -> {"TRIGCAT"; "ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"}*/

"ORESUP" -> "OREPCAT"
/*"ORESUP" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"ORESUP" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
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/*"ORESUP" -> {"ALGEBRA"; "MODULE"; "INTDOM"; "COMRING"; "ENTIRER"}*/
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/*"ORESUP" -> {"INS"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"ORESUP" -> {"OAMON"; "OASGP"; "ORDSET"; "DIFRING"; "KONVERT"; "LINEXP"}*/
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/*"OREPCTO" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
"OREPCTO" -> "OREPCAT"
/*"OREPCTO" -> {"BMODULE"; "RMODULE"; "FRETRCT"; "RETRACT"; "ALGEBRA"}*/
/*"OREPCTO" -> {"MODULE"; "BOOLEAN"; "NNI"; "INT"; "SINT"; "INTDOM"}*/
/*"OREPCTO" -> {"COMRING"; "ENTIRER"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"}*/
/*"OREPCTO" -> {"UFD"; "DIVRING"}*/

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/*"OREUP" -> {"ALGEBRA"; "MODULE"; "NNI"; "INT"; "FIELD"; "EUCDOM"}*/
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"PACFFC" -> "FPC"
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/*"PACFFC" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"PACFFC" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
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/*"PLOT3D" -> {"RNS-"; "FIELD-"; "FPS"; "RNS"; "FIELD"; "EUCDOM"}*/
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/*"POLYVEC" -> {"DIFRING" "RETRACT" "LINEXP" "PATMAB" "CFCAT" "REAL"}*/
/*"POLYVEC" -> {"CHARZ" "STEP" "INS-" "EUCDOM-" "UFD-" "GCDDOM-" "INTDOM-"}*/
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/*"PR" -> {"IXAGG-"; "NNI"; "PI"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"}*/
/*"PR" -> {"UFD"; "DIVRING"; "INS"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
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/*"PRIMARR" -> {"ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"}*/
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/*"REDORDER" -> {"ENTIRER"; "UFD"; "DIVRING"; "LODOCAT"}*/
"REDORDER" -> "OREPCAT"
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/*"REDORDER" -> {"LIST"; "ILIST"; "LSAGG-"; "STAGG-"; "ELAGG-"; "BOOLEAN"}*/
/*"REDORDER" -> "NNI"*/
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/*"SRAGG" -> {"ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"SRAGG" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
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/*"SRAGG" -> {"OAMON"; "OASGP"; "DIFRING"; "RETRACT"; "LINEXP"; "PATMAB"}*/
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/*"STREAM" -> {"ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"; "INT"; "LIST"; "ILIST"}*/
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/*"SYMPOLY" -> {"MODULE"; "CHARZ"; "CHARNZ"; "INTDOM"; "ENTIRER"}*/
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/*"TUPLE" -> {"PRIMARR"; "NNI"}*/
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/*"TUPLE" -> {"RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"}*/
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/*"U8VEC" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
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/*"U16VEC" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"}*/
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/*"U16VEC" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "DIFRING"; "RETRACT"}*/
/*"U16VEC" -> {"LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "OM"}*/

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"U32VEC" -> "A1AGG"
/*"U32VEC" -> {"FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"}*/
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/*"U32VEC" -> {"CLAGG"; "KONVERT"; "ORDSET"; "INT"; "SINT"; "NNI"; "INS"}*/
/*"U32VEC" -> {"UFD"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"}*/
/*"U32VEC" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"}*/
/*"U32VEC" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"U32VEC" -> {"MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"}*/
/*"U32VEC" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "DIFRING"; "RETRACT"}*/
/*"U32VEC" -> {"LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "OM"}*/

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/*"VECTCAT" -> {"INTDOM"; "COMRING"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"VECTCAT" -> {"MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"}*/
/*"VECTCAT" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "DIFRING"}*/
/*"VECTCAT" -> {"RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"}*/
/*"VECTCAT" -> {"STEP"; "OM"; "PI"; "RADCAT"}*/

"VECTCAT-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=VECTCAT"]
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/*"VECTCAT-" -> {"FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"}*/
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/*"XDPOLY" -> {"RMODULE"; "RETRACT"; "MODULE"}*/
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/*"XDPOLY" -> {"XFALG"; "RING"; "RNG"; "SGROUP"; "MONOID"; "XALG"}*/
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/*"XF" -> {"ENTIRER"; "UFD"; "DIVRING"; "RETRACT"}*/
"XF" -> "VSPACE"
/*"XF" -> "CHARZ"*/
"XF" -> "FPC"
/*"XF" -> {"CHARNZ"; "FINITE"; "BOOLEAN"; "NNI"; "INT"}*/

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"XF-" -> "VSPACE"
/*"XF-" -> "CHARZ"*/
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/*"XF-" -> {"CHARNZ"; "FINITE"; "BOOLEAN"; "NNI"; "INT"}*/

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1.4.11 Layer9

Depends on: BTAGG FLALG LODOCAT MATCAT SRAGG VECTCAT XF PROJSP PACFFC
Used by next layer: IVECTOR PTCAT STRICAT

— **layer9** —

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LAYER9=\
  ${OUT}/AFFPL.o    ${OUT}/BITS.o     ${OUT}/DFMAT.o    ${OUT}/DFVEC.o   \
  ${OUT}/DIRPROD2.o ${OUT}/IMATRIX.o  ${OUT}/INTRVL.o  \
  ${OUT}/IVECTOR.o  ${OUT}/LOCPOWC.o  \
  ${OUT}/LODO1.o    ${OUT}/LODO2.o    ${OUT}/LPOLY.o   \
  ${OUT}/LSMP.o     ${OUT}/LSMP1.o    ${OUT}/MAMA.o     ${OUT}/MATCAT2.o  \
  ${OUT}/PROJPL.o   ${OUT}/PTCAT.o    ${OUT}/STRICAT.o  ${OUT}/TRIMAT.o   \
  ${OUT}/U8MAT.o    ${OUT}/U16MAT.o   ${OUT}/U32MAT.o \
  layer9done
```

———-

— **layerpic** —

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/* layer 9 */
/* Depends on: BTAGG FLALG INTCAT LODOCAT MATCAT SRAGG UPSCAT VECTCAT */
/* AFFSP */

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/*"AFFPL" -> {"ENTIRER"; "UFD"; "DIVRING"}*/

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/*"BITS" -> {"FINITE"; "INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"BITS" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"BITS" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
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/*"BITS" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "DIFRING"}*/
/*"BITS" -> {"RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"}*/
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/*"DFMAT" -> {"OAMON"; "OASGP"; "ORDSET"; "REAL"; "KONVERT"; "RETRACT"}*/
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/*"DIRPROD2" -> {"ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"; "ORDSET"}*/
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/*"LODO2" -> {"LMODULE"; "BMODULE"; "RMODULE"; "FRETRCT"; "RETRACT"}*/
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/*"LPOLY" -> {"KOERCE"; "RMODULE"; "FMCAT"; "RETRACT"; "COMRING"}*/
/*"LPOLY" -> {"RING"; "RNG"; "SGROUP"; "MONOID"; "ORDSET"; "LSAGG"}*/
/*"LPOLY" -> {"STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"}*/
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/*"LPOLY" -> {"ELTAB"; "CLAGG"; "KONVERT"; "FLAGG"; "ELAGG"}*/
/*"LPOLY" -> {"OM"; "INT"; "LIST"; "ILIST"; "LSAGG-"; "STAGG-"}*/
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/*"LPOLY" -> {"CLAGG-"; "HOAGG-"; "ORDSET-"; "AGG-"; "ELTAGG-"; "SETCAT-"}*/
/*"LPOLY" -> {"BASTYPE-"; "BOOLEAN"; "NNI"; "FIELD"; "EUCDOM"; "PID"}*/
/*"LPOLY" -> {"GCDDOM"; "INTDOM"; "ALGEBRA"; "ENTIRER"; "UFD"; "DIVRING"}*/

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/*"LSMP" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"LSMP" -> {"UFD"; "DIVRING"; "FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"}*/
/*"LSMP" -> {"TYPE"; "EVALAB"; "IEVALAB"; "ELTAGG"; "ELTAB"; "CLAGG"}*/
/*"LSMP" -> {"KONVERT"; "ORDSET"}*/
"LSMP" -> "MATCAT"
/*"LSMP" -> {"ARR2CAT"; "NNI"; "INT"; "BOOLEAN"; "PRIMARR"; "SINT"}*/
/*"LSMP" -> {"A1AGG"; "INS"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"LSMP" -> {"OAMON"; "OASGP"; "DIFRING"; "RETRACT"; "LINEXP"; "PATMAB"}*/
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/*"LSMP1" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"LSMP1" -> {"UFD"; "DIVRING"}*/
"LSMP1" -> "VECTCAT"
/*"LSMP1" -> {"A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"}*/
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/*"MAMA" -> {"ARR2CAT", "INT", "LIST", "ILIST", "NNI", "PI", "BOOLEAN"}*/
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/*"MAMA" -> {"SINT", "INS", "OINTDOM", "ORDRING", "OAGROUP", "OCAMON"}*/
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/*"ULSCAT" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"}*/
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/*"ULSCAT" -> {"OASGP"; "ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"}*/
/*"ULSCAT" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"}*/
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/*"U16MAT" -> {"ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"}*/
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/*"U16MAT" -> {"EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
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/*"U16MAT" -> {"KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"}*/
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/*"U32MAT" -> {"ELTAGG"; "ELTAB"; "CLAGG"; "INT"; "OM"; "FIELD"; "DIVRING"}*/
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1.4.12 Layer10

Depends on: IVECTOR PTCAT STRICAT LOCPOWC
Used by next layer: DIRPCAT FAXF PFECAT STRING

— **layer10** —

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  ${OUT}/ASSOCEQ.o  ${OUT}/CARTEN.o   ${OUT}/CLIF.o     ${OUT}/CLIP.o    \
  ${OUT}/COORDSYS.o ${OUT}/DBASE.o    ${OUT}/DHMATRIX.o ${OUT}/DIOSP.o   \
  ${OUT}/DIRPCAT.o  ${OUT}/DIRPCAT-.o ${OUT}/D02BBFA.o  ${OUT}/D02BHFA.o \
  ${OUT}/D02CJFA.o  ${OUT}/FAXF.o     ${OUT}/FAXF-.o    ${OUT}/FFPOLY2.o \
  ${OUT}/FNLA.o     ${OUT}/GRAY.o     ${OUT}/HB.o       ${OUT}/INBFF.o   \
  ${OUT}/IRSN.o     ${OUT}/LOP.o      \
  ${OUT}/MCALCFN.o  ${OUT}/MHROWRED.o ${OUT}/NUMODE.o  \
  ${OUT}/NUMQUAD.o  ${OUT}/ODESYS.o   ${OUT}/ODETOOLS.o ${OUT}/ORDFUNS.o \
  ${OUT}/PERMAN.o   ${OUT}/PFECAT.o   ${OUT}/PFECAT-.o  ${OUT}/POINT.o   \
  ${OUT}/PSEUDLIN.o ${OUT}/PTPACK.o   ${OUT}/REP2.o     ${OUT}/SETMN.o   \
  ${OUT}/SEX.o      ${OUT}/STRING.o   ${OUT}/SYMFUNC.o  ${OUT}/VECTOR2.o \
  layer10done
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———-

— **layerpic** —

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/* layer 10 */
/* depends on: IVECTOR PTCAT STRICAT */

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/*"CLIP" -> {"MODULE"; "ENTIRER"; "UFD"; "DIVRING"; "ORDRING"}*/
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/*"COORDSYS" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
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/*"COORDSYS" -> {"VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"}*/
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/*"DHMATRIX" -> {"FLAGG"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"}*/
/*"DHMATRIX" -> {"KONVERT"; "ORDSET"; "TRANFUN"; "TRIGCAT"; "ATRIG"}*/
/*"DHMATRIX" -> {"HYPCAT"; "AHYP"; "ELEMFUN"; "INT"; "VECTOR"}*/
"DHMATRIX" -> "IVECTOR"
/*"DHMATRIX" -> {"IARRAY1"; "VECTCAT-"; "A1AGG-"; "FLAGG-"; "LNAGG-"}*/

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/*"DIOSP" -> {"INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"}*/
/*"DIOSP" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"DIOSP" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"DIOSP" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"}*/
/*"DIOSP" -> {"PID"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"DIOSP" -> {"OASGP"; "ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"}*/
/*"DIOSP" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "NNI"}*/
/*"DIOSP" -> {"INT"; "LIST"; "ILIST"; "OAMONS"; "VECTOR"}*/
"DIOSP" -> "IVECTOR"
/*"DIOSP" -> {"IARRAY1"; "VECTCAT-"; "A1AGG-"; "FLAGG-"; "LNAGG-"; "IXAGG-"}*/
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/*"DIOSP" -> {"CLAGG-"; "HOAGG-"; "ORDSET-"; "AGG-"; "ELTAGG-"; "SETCAT-"}*/
/*"DIOSP" -> {"BASTYPE-"; "BOOLEAN"; "VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"}*/
/*"DIOSP" -> {"IXAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
/*"DIOSP" -> {"ELTAGG"; "ELTAB"; "CLAGG"; "SINT"; "OM"}*/

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/*"DIRPCAT" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
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/*"DIRPCAT" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"DIRPCAT" -> {"EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"DIRPCAT" -> {"OAMON"; "OASGP"; "ORDSET"; "DIFRING"; "KONVERT"}*/
/*"DIRPCAT" -> {"RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"}*/
/*"DIRPCAT" -> {"STEP"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"}*/
/*"DIRPCAT" -> {"IEVALAB"; "ELTAGG"; "ELTAB"; "FRETRCT"; "DIFEXT"; "PDRING"}*/
/*"DIRPCAT" -> {"FLINEXP"; "FINITE"; "OAMONS"; "VSPACE"; "FIELD"; "DIVRING"}*/
/*"DIRPCAT" -> {"VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"; "CLAGG"; "INT"}*/
/*"DIRPCAT" -> "VECTOR"*/
"DIRPCAT" -> "IVECTOR"
/*"DIRPCAT" -> {"IARRAY1"; "NNI"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"}*/
/*"DIRPCAT" -> {"ELAGG"; "OM"; "LIST"; "ILIST"; "LSAGG-"; "VECTCAT-"}*/
/*"DIRPCAT" -> {"A1AGG-"; "FLAGG-"; "LNAGG-"; "IXAGG-"; "CLAGG-"; "HOAGG-"}*/
/*"DIRPCAT" -> {"ORDSET-"; "AGG-"}*/

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/*"DIRPCAT-" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"DIRPCAT-" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"DIRPCAT-" -> {"EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"DIRPCAT-" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "DIFRING"}*/
/*"DIRPCAT-" -> {"KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"}*/
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/*"DIRPCAT-" -> {"TYPE"; "EVALAB"; "IEVALAB"; "ELTAGG"; "ELTAB"; "FRETRCT"}*/
/*"DIRPCAT-" -> {"DIFEXT"; "PDRING"; "FLINEXP"; "FINITE"; "OAMONS"; "VSPACE"}*/
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/*"DIRPCAT-" -> {"CLAGG"; "INT"; "VECTOR"}*/
"DIRPCAT-" -> "IVECTOR"
/*"DIRPCAT-" -> {"IARRAY1"; "NNI"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"}*/
/*"DIRPCAT-" -> {"ELAGG"; "OM"; "LIST"; "ILIST"; "LSAGG-"; "VECTCAT-"}*/
/*"DIRPCAT-" -> {"A1AGG-"; "FLAGG-"; "LNAGG-"; "IXAGG-"; "CLAGG-"; "HOAGG-"}*/
/*"DIRPCAT-" -> "ORDSET-"; "AGG-"}*/

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/*"D02BBFA" -> {"TYPE"; "EVALAB"; "IEVALAB"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
/*"D02BBFA" -> {"ELTAB"; "CLAGG"; "KONVERT"; "FLAGG"; "ORDSET"; "ELAGG"}*/
/*"D02BBFA" -> {"OM"; "LIST"; "ILIST"; "DFLOAT"; "FPS-"; "RNS-"}*/
/*"D02BBFA" -> {"FIELD-"; "EUCDOM-"; "UFD-"; "GCDDOM-"; "DIVRING-"}*/
/*"D02BBFA" -> {"INTDOM-"; "ALGEBRA-"; "DIFRING-"; "ORDRING-"; "FPS"; "RNS"}*/
/*"D02BBFA" -> {"FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"D02BBFA" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"D02BBFA" -> {"ABELSG"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
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/*"D02BBFA" -> {"DIVRING"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"D02BBFA" -> {"REAL"; "RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"; "VECTCAT"}*/
/*"D02BBFA" -> {"A1AGG"; "VECTOR"}*/
"D02BBFA" -> "IVECTOR"
/*"D02BBFA" -> {"IARRAY1"; "PI"}*/

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/*"D02BHFA" -> {"GCDDOM-"; "DIVRING-"; "INTDOM-"; "ALGEBRA-"; "DIFRING-"}*/
/*"D02BHFA" -> {"ORDRING-"; "FPS"; "RNS"; "FIELD"; "EUCDOM"; "PID"}*/
/*"D02BHFA" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"D02BHFA" -> {"CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"}*/
/*"D02BHFA" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"D02BHFA" -> {"ENTIRER"; "UFD"; "DIVRING"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"D02BHFA" -> {"OAMON"; "OASGP"; "ORDSET"; "REAL"; "KONVERT"; "RETRACT"}*/
/*"D02BHFA" -> {"RADCAT"; "PATMAB"; "CHARZ"; "VECTCAT"; "A1AGG"; "FLAGG"}*/
/*"D02BHFA" -> {"LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"}*/
/*"D02BHFA" -> {"IEVALAB"; "ELTAGG"; "ELTAB"; "CLAGG"; "VECTOR"}*/
"D02BHFA" -> "IVECTOR"
/*"D02BHFA" -> {"IARRAY1"; "PI"}*/

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/*"D02CJFA" -> {"ELAGG"; "OM"; "DFLOAT"; "FPS-"; "RNS-"; "FIELD-"}*/
/*"D02CJFA" -> {"EUCDOM-"; "UFD-"; "GCDDOM-"; "DIVRING-"; "INTDOM-"}*/
/*"D02CJFA" -> {"ALGEBRA-"; "DIFRING-"; "ORDRING-"; "FPS"; "RNS"; "FIELD"}*/
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/*"D02CJFA" -> {"OCAMON"; "OAMON"; "OASGP"; "REAL"; "RETRACT"; "RADCAT"}*/
/*"D02CJFA" -> {"PATMAB"; "CHARZ"; "VECTCAT"; "A1AGG"; "VECTOR"}*/
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/*"FAXF" -> {"FINITE"; "FFIELDC"; "STEP"; "DIFRING"; "SINT"; "PI"}*/
/*"FAXF" -> {"NNI"; "INT"; "VECTOR"}*/
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/*"FAXF" -> {"PATMAB"; "CFCAT"; "REAL"; "OM"; "BOOLEAN"; "VECTCAT-"}*/
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"FAXF-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=FAXF"]
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/*"FAXF-" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"FAXF-" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
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/*"FAXF-" -> {"FINITE"; "FFIELDC"; "STEP"; "DIFRING"; "SINT"; "PI"}*/
/*"FAXF-" -> {"NNI"; "INT"; "VECTOR"}*/
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/*"FAXF-" -> {"PATMAB"; "CFCAT"; "REAL"; "OM"; "BOOLEAN"; "VECTCAT-"}*/
/*"FAXF-" -> {"A1AGG-"; "FLAGG-"; "LNAGG-"; "IXAGG-"; "LIST"; "ILIST"}*/
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/*"FAXF-" -> {"SGROUP-"; "INS-"}*/

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/*"FFPOLY2" -> {"STEP"; "DIFRING"; "NNI"; "INT"; "PI"; "VECTOR"}*/
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/*"FNLA" -> {"HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "ELTAGG"}*/
/*"FNLA" -> {"ELTAB"; "CLAGG"; "KONVERT"; "ORDSET"; "INT"; "VECTOR"}*/
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/*"GRAY" -> {"LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"}*/
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/*"HB" -> {"HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"HB" -> {"EVALAB"; "IEVALAB"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
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/*"IRSN" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"IRSN" -> {"ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"IRSN" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "DIFRING"; "KONVERT"}*/
/*"IRSN" -> {"RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"}*/
/*"IRSN" -> {"STEP"; "SINT"; "PI"; "OM"; "ILIST"; "LSAGG"}*/
/*"IRSN" -> {"STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"}*/
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/*"IRSN" -> {"CLAGG"; "FLAGG"; "ELAGG"; "LSAGG-"; "STAGG-"; "BOOLEAN"}*/
/*"IRSN" -> "VECTOR"*/
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/*"LOP" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"LOP" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/
/*"LOP" -> {"PACPERC"; "INT"; "LIST"; "ILIST"; "VECTOR"}*/
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/*"LOP" -> {"CLAGG"; "KONVERT"; "FLAGG"; "ORDSET"; "ELAGG"; "OM"; "LSAGG-"}*/
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/*"MCALCFN" -> {"LMODULE"; "FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"}*/
/*"MCALCFN" -> {"TYPE"; "EVALAB"; "IEVALAB"; "ELTAGG"; "ELTAB"; "CLAGG"}*/
/*"MCALCFN" -> {"KONVERT"; "ORDSET"; "INT"; "VECTOR"; "LSAGG"; "STAGG"}*/
/*"MCALCFN" -> {"URAGG"; "RCAGG"; "ELAGG"; "OM"; "LIST"; "ILIST"}*/
/*"MCALCFN" -> {"INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"; "BMODULE"}*/
/*"MCALCFN" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"}*/
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/*"MCALCFN" -> {"OASGP"; "DIFRING"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"}*/
/*"MCALCFN" -> {"REAL"; "CHARZ"; "STEP"}*/
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/*"MHROWRED" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
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"MHROWRED" -> "IVECTOR"
/*"MHROWRED" -> {"IARRAY1"; "VECTCAT-"; "A1AGG-"; "BOOLEAN"; "INS"; "UFD"}*/
/*"MHROWRED" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"MHROWRED" -> {"DIFRING"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"}*/
/*"MHROWRED" -> {"CHARZ"; "STEP"; "OM"; "LSAGG"; "STAGG"; "URAGG"}*/
/*"MHROWRED" -> {"RCAGG"; "ELAGG"; "LIST"; "ILIST"; "SINT"; "NNI"}*/
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/*"POINT" -> {"RCAGG"; "ELAGG"; "OM"; "INT"; "LIST"; "ILIST"}*/
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/*"VECTOR2" -> {"EVALAB"; "IEVALAB"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
/*"VECTOR2" -> {"ORDSET"; "INT"; "VECTOR"}*/
"VECTOR2" -> "IVECTOR"
/*"VECTOR2" -> {"IARRAY1"; "VECTCAT-"; "A1AGG-"; "FLAGG-"; "LNAGG-"}*/
/*"VECTOR2" -> {"IXAGG-"; "LIST"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"}*/
/*"VECTOR2" -> {"ELAGG"; "OM"; "ILIST"}*/
```

———-

1.4.13 Layer11

Depends on: DIRPCAT FAXF PFECAT STRING LOP
Used by next layer: DIOPS DPOLCAT FINRALG FRAC RMATCAT RRCC UPXSCAT

— **layer11** —

```
LAYER11=\
  ${OUT}/ASP1.o     ${OUT}/ASP10.o    ${OUT}/ASP24.o    ${OUT}/ASP4.o     \
  ${OUT}/ASP50.o    ${OUT}/ASP6.o     ${OUT}/ASP73.o    ${OUT}/AXSERV.o   \
  ${OUT}/BALFACT.o  ${OUT}/BEZOUT.o   ${OUT}/BINARY.o   ${OUT}/BINFILE.o  \
  ${OUT}/BOUNDZRO.o ${OUT}/BPADICRT.o ${OUT}/BRILL.o    ${OUT}/CADU.o     \
  ${OUT}/CDEN.o     \
  ${OUT}/CHVAR.o    ${OUT}/COMMUPC.o  ${OUT}/CONTFRAC.o ${OUT}/CVMP.o     \
  ${OUT}/CYCLOTOM.o ${OUT}/CYCLES.o   ${OUT}/DDFACT.o   ${OUT}/DECIMAL.o  \
  ${OUT}/DIOPS.o    ${OUT}/DIOPS-.o   ${OUT}/DIRPROD.o  ${OUT}/DISPLAY.o  \
  ${OUT}/DMP.o      ${OUT}/DPMO.o     ${OUT}/DPOLCAT.o  ${OUT}/DPOLCAT-.o \
  ${OUT}/DSTREE.o   \
  ${OUT}/D01AJFA.o  ${OUT}/D01AKFA.o  ${OUT}/D01ALFA.o  ${OUT}/D01AMFA.o  \
  ${OUT}/D01APFA.o  ${OUT}/D01AQFA.o  ${OUT}/EMR.o      ${OUT}/EQ.o       \
  ${OUT}/ERROR.o    ${OUT}/EVALCYC.o  ${OUT}/EXP3D.o    \
  ${OUT}/E04DGFA.o  ${OUT}/E04FDFA.o  \
  ${OUT}/E04GCFA.o  ${OUT}/E04JAFA.o  ${OUT}/E04UCFA.o  ${OUT}/FACUTIL.o  \
  ${OUT}/FF.o       ${OUT}/FFFACTOR.o  \
```

```
${OUT}/FFCG.o     ${OUT}/FFCGX.o    ${OUT}/FFFG.o     \
${OUT}/FFFGF.o    ${OUT}/FFHOM.o    ${OUT}/FFNB.o     ${OUT}/FFNBX.o    \
${OUT}/FFPOLY.o   ${OUT}/FFSQFR.o  \
${OUT}/FFX.o      ${OUT}/FFSLPE.o   ${OUT}/FGLMICPK.o \
${OUT}/FILE.o     ${OUT}/FINAALG.o  ${OUT}/FINAALG-.o ${OUT}/FINRALG.o  \
${OUT}/FINRALG-.o ${OUT}/FFF.o      ${OUT}/FLOATRP.o  ${OUT}/FNAME.o    \
${OUT}/FOP.o      ${OUT}/FORMULA.o  ${OUT}/FORT.o     ${OUT}/FRAC.o     \
${OUT}/FTEM.o     ${OUT}/GENEEZ.o   ${OUT}/GENMFACT.o ${OUT}/GENPGCD.o  \
${OUT}/GALFACTU.o ${OUT}/GALPOLYU.o ${OUT}/GB.o       ${OUT}/GBEUCLID.o \
${OUT}/GBF.o      ${OUT}/GBINTERN.o ${OUT}/GHENSEL.o  ${OUT}/GMODPOL.o  \
${OUT}/GOSPER.o   ${OUT}/GRAPHVIZ.o \
${OUT}/GRIMAGE.o  ${OUT}/GROEBSOL.o ${OUT}/HDMP.o     \
${OUT}/HDP.o      ${OUT}/HEXADEC.o  ${OUT}/HEUGCD.o   ${OUT}/HTMLFORM.o \
${OUT}/IBPTOOLS.o \
${OUT}/IFF.o      ${OUT}/IBITS.o    ${OUT}/ICARD.o    ${OUT}/ICDEN.o    \
${OUT}/IDECOMP.o  ${OUT}/IIARRAY2.o ${OUT}/IMATLIN.o  ${OUT}/IMATQF.o   \
${OUT}/INMODGCD.o ${OUT}/INNMFACT.o ${OUT}/INPSIGN.o  ${OUT}/INTERGB.o  \
${OUT}/INTHERTR.o \
${OUT}/INTRAT.o   ${OUT}/INTRF.o    ${OUT}/INTSLPE.o  ${OUT}/INTTR.o    \
${OUT}/ISUMP.o    ${OUT}/LAUPOL.o   ${OUT}/LEADCDET.o ${OUT}/LGROBP.o   \
${OUT}/LIMITRF.o  ${OUT}/LINDEP.o   ${OUT}/LISYSER.o  \
${OUT}/LO.o       ${OUT}/LPEFRAC.o  \
${OUT}/LSPP.o     ${OUT}/MATLIN.o   ${OUT}/MCDEN.o    ${OUT}/MDDFACT.o  \
${OUT}/MFINFACT.o ${OUT}/MFLOAT.o   ${OUT}/MINT.o     ${OUT}/MLIFT.o    \
${OUT}/MMAP.o     ${OUT}/MODMON.o   ${OUT}/MONOTOOL.o ${OUT}/MPCPF.o    \
${OUT}/MPC2.o     ${OUT}/MPC3.o     ${OUT}/MPOLY.o    ${OUT}/MPRFF.o    \
${OUT}/MRATFAC.o  ${OUT}/MULTSQFR.o ${OUT}/NORMRETR.o ${OUT}/NPCOEF.o   \
${OUT}/NSUP.o     ${OUT}/NTPOLFN.o  ${OUT}/ODP.o      ${OUT}/ODEPRIM.o  \
${OUT}/ODEPRRIC.o ${OUT}/OMPKG.o    ${OUT}/OMSERVER.o ${OUT}/PACRATC.o  \
${OUT}/PADEPAC.o   \
${OUT}/PADICRAT.o ${OUT}/PADICRC.o  ${OUT}/PARAMP.o \
${OUT}/PCOMP.o    ${OUT}/PDECOMP.o  \
${OUT}/PF.o       ${OUT}/PFBR.o     ${OUT}/PFBRU.o    ${OUT}/PFORP.o    \
${OUT}/PFOTOOLS.o \
${OUT}/PFRPAC.o   ${OUT}/PGCD.o     ${OUT}/PINTERPA.o ${OUT}/PLEQN.o    \
${OUT}/PLPKCRV.o  \
${OUT}/PMPLCAT.o  ${OUT}/PMQFCAT.o  ${OUT}/PNTHEORY.o ${OUT}/POLUTIL.o  \
${OUT}/POLTOPOL.o ${OUT}/POLYCATQ.o ${OUT}/POLYLIFT.o ${OUT}/POLYROOT.o \
${OUT}/POLY2.o    ${OUT}/POLY2UP.o  ${OUT}/PRS.o      ${OUT}/PSQFR.o    \
${OUT}/PUSHVAR.o  ${OUT}/QALGSET.o  ${OUT}/QFCAT2.o   ${OUT}/RADIX.o    \
${OUT}/RATFACT.o  ${OUT}/RCFIELD.o  ${OUT}/RCFIELD-.o ${OUT}/RDETR.o    \
${OUT}/RDETRS.o   ${OUT}/REAL0.o    ${OUT}/REAL0Q.o   ${OUT}/REALSOLV.o \
${OUT}/RESRING.o  ${OUT}/RETSOL.o   ${OUT}/RF.o       ${OUT}/RFFACTOR.o \
${OUT}/RINTERP.o  ${OUT}/RMATCAT.o  ${OUT}/RMATCAT-.o ${OUT}/RRCC.o     \
${OUT}/RRCC-.o    ${OUT}/SCPKG.o    ${OUT}/SHDP.o     ${OUT}/SHP.o      \
${OUT}/SIGNRF.o   ${OUT}/SMITH.o    ${OUT}/SMP.o      ${OUT}/SMTS.o     \
${OUT}/SOLVEFOR.o ${OUT}/SPLTREE.o  ${OUT}/STINPROD.o ${OUT}/STTF.o     \
${OUT}/STTFNC.o   ${OUT}/SUBRESP.o  ${OUT}/SUBSPACE.o ${OUT}/SUMRF.o    \
${OUT}/SUP.o      ${OUT}/SUPEXPR.o  ${OUT}/SUPFRACF.o ${OUT}/TANEXP.o   \
${OUT}/TEMUTL.o   ${OUT}/TEX.o      ${OUT}/TEXTFILE.o ${OUT}/TREE.o     \
${OUT}/TWOFACT.o  ${OUT}/UNIFACT.o  ${OUT}/UP.o       ${OUT}/UPCDEN.o   \
${OUT}/UPDECOMP.o ${OUT}/UPDIVP.o   ${OUT}/UPMP.o     ${OUT}/UPOLYC2.o  \
${OUT}/UPXSCAT.o  ${OUT}/UPSQFREE.o ${OUT}/VIEWDEF.o  ${OUT}/VIEW2D.o   \
${OUT}/VOID.o     ${OUT}/WEIER.o    ${OUT}/WP.o \
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```
layer11done
```

———-

— layerpic —

```
/* layer 11 */
/* depends on: DIRPCAT FAXF PFECAT STRING */

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/*"ASP1" -> {"EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"}*/
/*"ASP1" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"ASP1" -> {"BASTYPE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"ASP1" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"; "ORDRING"}*/
/*"ASP1" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "REAL"}*/
/*"ASP1" -> {"KONVERT"; "RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"; "FMTC"}*/
/*"ASP1" -> {"INS"; "OINTDOM"; "DIFRING"; "LINEXP"; "CFCAT"; "STEP"}*/
/*"ASP1" -> {"POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARNZ"; "FRETRCT"}*/
/*"ASP1" -> {"EVALAB"; "IEVALAB"; "FLINEXP"}*/
"ASP1" -> "PFECAT"

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/*"ASP10" -> {"FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"ASP10" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"ASP10" -> {"SETCAT"; "BASTYPE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"ASP10" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/
/*"ASP10" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"ASP10" -> {"REAL"; "KONVERT"; "RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"}*/
/*"ASP10" -> {"FMTC"; "INS"; "OINTDOM"; "DIFRING"; "LINEXP"; "CFCAT"}*/
/*"ASP10" -> {"STEP"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARNZ"}*/
/*"ASP10" -> {"FRETRCT"; "EVALAB"; "IEVALAB"; "FLINEXP"}*/
"ASP10" -> "PFECAT"
/*"ASP10" -> {"VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"}*/
/*"ASP10" -> {"AGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "INT"; "VECTOR"; "IVECTOR"}*/
/*"ASP10" -> {"IARRAY1"; "NNI"; "PI"}*/

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/*"ASP24" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"ASP24" -> {"SETCAT"; "BASTYPE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"ASP24" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/
/*"ASP24" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"ASP24" -> {"REAL"; "KONVERT"; "RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"}*/
/*"ASP24" -> {"FMTC"; "INS"; "OINTDOM"; "DIFRING"; "LINEXP"; "CFCAT"}*/
/*"ASP24" -> {"STEP"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARNZ"}*/
/*"ASP24" -> {"FRETRCT"; "EVALAB"; "IEVALAB"; "FLINEXP"}*/
"ASP24" -> "PFECAT"

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/*"ASP4" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"ASP4" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"ASP4" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
/*"ASP4" -> {"DIVRING"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"ASP4" -> {"ORDSET"; "REAL"; "KONVERT"; "RETRACT"; "RADCAT"; "PATMAB"}*/
/*"ASP4" -> {"CHARZ"; "FMTC"; "INS"; "OINTDOM"; "DIFRING"; "LINEXP"}*/
/*"ASP4" -> {"CFCAT"; "STEP"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"}*/
/*"ASP4" -> {"CHARNZ"; "FRETRCT"; "EVALAB"; "IEVALAB"; "FLINEXP"}*/
"ASP4" -> "PFECAT"

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/*"ASP50" -> {"RNS"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"}*/
/*"ASP50" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"ASP50" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"ASP50" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"ASP50" -> {"UFD"; "DIVRING"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"ASP50" -> {"OASGP"; "ORDSET"; "REAL"; "KONVERT"; "RETRACT"; "RADCAT"}*/
/*"ASP50" -> {"PATMAB"; "CHARZ"; "FMTC"; "INS"; "OINTDOM"; "DIFRING"}*/
/*"ASP50" -> {"LINEXP"; "CFCAT"; "STEP"; "POLYCAT"; "PDRING"; "FAMR"}*/
/*"ASP50" -> {"AMR"; "CHARNZ"; "FRETRCT"; "EVALAB"; "IEVALAB"; "FLINEXP"}*/
"ASP50" -> "PFECAT"

"ASP6" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ASP6"]
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/*"ASP6" -> {"RNS"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"}*/
/*"ASP6" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"ASP6" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"ASP6" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
/*"ASP6" -> {"DIVRING"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"ASP6" -> {"ORDSET"; "REAL"; "KONVERT"; "RETRACT"; "RADCAT"; "PATMAB"}*/
/*"ASP6" -> {"CHARZ"; "FMTC"; "INS"; "OINTDOM"; "DIFRING"; "LINEXP"}*/
/*"ASP6" -> {"CFCAT"; "STEP"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"}*/
/*"ASP6" -> {"CHARNZ"; "FRETRCT"; "EVALAB"; "IEVALAB"; "FLINEXP"}*/
"ASP6" -> "PFECAT"

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/*"ASP73" -> {"FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"ASP73" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"ASP73" -> {"SETCAT"; "BASTYPE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"ASP73" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
/*"ASP73" -> {"DIVRING"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"ASP73" -> {"OASGP"; "ORDSET"; "REAL"; "KONVERT"; "RETRACT"; "RADCAT"}*/
/*"ASP73" -> {"PATMAB"; "CHARZ"; "INS"; "OINTDOM"; "DIFRING"; "LINEXP"}*/
/*"ASP73" -> {"CFCAT"; "STEP"; "OM"; "INT"; "VECTOR"; "IVECTOR"}*/
/*"ASP73" -> {"IARRAY1"; "PI"; "NNI"; "FMTC"; "POLYCAT"; "PDRING"}*/
/*"ASP73" -> {"FAMR"; "AMR"; "CHARNZ"; "FRETRCT"; "EVALAB"; "IEVALAB"}*/
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"AXSERV" [color="#FF4488",href="bookvol10.4.pdf#nameddest=AXSERV"]
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/*"AXSERV" -> {"CHAR"; "SINT"; "OUTFORM"; "LIST"; "INT"; "PRIMARR"}*/
/*"AXSERV" -> {"A1AGG-"; "ISTRING"; "BOOLEAN"; "LSAGG"; "STAGG"; "URAGG"}*/
/*"AXSERV" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"}*/
/*"AXSERV" -> {"KOERCE"; "EVALAB"; "IEVALAB"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
/*"AXSERV" -> {"ELTAB"; "CLAGG"; "KONVERT"; "FLAGG"; "ORDSET"; "ELAGG"}*/
/*"AXSERV" -> {"OM"; "ILIST"; "NNI"; "SRAGG-"; "LSAGG-"; "STAGG-"}*/
/*"AXSERV" -> {"ELAGG-"; "FLAGG-"; "URAGG-"; "PI"; "STRICAT"; "SRAGG"}*/
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/*"BALFACT" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "CHARZ"}*/
/*"BALFACT" -> {"UPOLYC"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARNZ"}*/
/*"BALFACT" -> {"FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"; "FLINEXP"}*/
/*"BALFACT" -> {"LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"}*/
"BALFACT" -> "PFECAT"
/*"BALFACT" -> {"UFD"; "ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "EUCDOM"}*/
/*"BALFACT" -> {"PID"; "FIELD"; "DIVRING"; "INT"; "LIST"; "ILIST"}*/
/*"BALFACT" -> {"LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"}*/
/*"BALFACT" -> {"TYPE"; "LNAGG"; "IXAGG"; "ELTAGG"; "CLAGG"; "FLAGG"}*/
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/*"BEZOUT" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"BEZOUT" -> {"UPOLYC"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"; "BMODULE"}*/
/*"BEZOUT" -> {"RMODULE"; "COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"}*/
/*"BEZOUT" -> {"INTDOM"; "ENTIRER"; "FRETRCT"; "RETRACT"; "EVALAB"}*/
/*"BEZOUT" -> {"IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"}*/
/*"BEZOUT" -> {"PATMAB"; "GCDDOM"}*/
"BEZOUT" -> "PFECAT"
/*"BEZOUT" -> {"UFD"; "ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "EUCDOM"}*/
/*"BEZOUT" -> {"PID"; "FIELD"; "DIVRING"; "MATCAT"; "ARR2CAT"; "HOAGG"}*/
/*"BEZOUT" -> {"AGG"; "TYPE"; "FLAGG"; "LNAGG"; "IXAGG"; "ELTAGG"; "CLAGG"}*/
/*"BEZOUT" -> {"NNI"; "INT"; "BOOLEAN"; "SINT"; "PI"}*/

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/*"BINARY" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"BINARY" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
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/*"BINARY" -> {"ENTIRER"; "UFD"; "DIVRING"; "RETRACT"; "FEVALAB"}*/
/*"BINARY" -> {"ELTAB"; "EVALAB"; "IEVALAB"; "DIFEXT"; "DIFRING"}*/
/*"BINARY" -> {"PDRING"; "FLINEXP"; "LINEXP"; "PATAB"; "KONVERT"}*/
/*"BINARY" -> {"FPATMAB"; "TYPE"; "PATMAB"; "STEP"; "ORDSET"; "OINTDOM"}*/
/*"BINARY" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "REAL"}*/
/*"BINARY" -> {"CHARZ"; "CHARNZ"}*/
"BINARY" -> "PFECAT"
/*"BINARY" -> {"INS"; "CFCAT"; "OM"; "FPS"; "RNS"; "RADCAT"; "UPOLYC"}*/
/*"BINARY" -> {"POLYCAT"; "FAMR"; "AMR"; "FRETRCT"}*/

"BINFILE" [color="#88FF44",href="bookvol10.3.pdf#nameddest=BINFILE"]
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/*"BINFILE" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"BINFILE" -> {"MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"}*/
/*"BINFILE" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"BINFILE" -> {"DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"}*/
/*"BINFILE" -> {"CFCAT"; "REAL"; "CHARZ"; "STEP"}*/
"BINFILE" -> "STRING"
/*"BINFILE" -> {"CHAR"; "SINT"; "OUTFORM"; "LIST"; "INT"; "PRIMARR"}*/
/*"BINFILE" -> {"A1AGG-"; "ISTRING"}*/

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/*"BOUNDZRO" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"BOUNDZRO" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"BOUNDZRO" -> {"ENTIRER"; "UFD"; "DIVRING"; "RETRACT"; "UPOLYC"}*/
/*"BOUNDZRO" -> {"POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARZ"; "CHARNZ"}*/
/*"BOUNDZRO" -> {"FRETRCT"; "EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"}*/
/*"BOUNDZRO" -> {"ORDSET"; "KONVERT"; "PATMAB"}*/
"BOUNDZRO" -> "PFECAT"
/*"BOUNDZRO" -> {"ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "INS"; "OINTDOM"}*/
/*"BOUNDZRO" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "CFCAT"}*/
/*"BOUNDZRO" -> {"REAL"; "QFCAT"; "FEVALAB"; "PATAB"; "FPATMAB"; "TYPE"}*/
/*"BOUNDZRO" -> {"INT"; "ES"; "OM"}*/

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/*"BPADICRT" -> {"CHARZ"; "CHARNZ"}*/
"BPADICRT" -> "PFECAT"
/*"BPADICRT" -> {"PADICCT"; "FPS"; "RNS"; "RADCAT"; "INS"; "CFCAT"}*/
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/*"DPMO" -> {"RETRACT"; "BMODULE"; "LMODULE"; "ABELGRP"; "CABMON"}*/
/*"DPMO" -> {"ABELMON"; "ABELSG"; "RMODULE"; "DIFEXT"; "RING"}*/
/*"DPMO" -> {"RNG"; "SGROUP"; "MONOID"; "DIFRING"; "PDRING"; "FLINEXP"}*/
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/*"DPMO" -> {"ORDSET"; "OAMONS"; "VSPACE"; "FIELD"; "EUCDOM"}*/
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/*"DPOLCAT" -> {"OAMON"; "OASGP"; "NNI"; "INT"; "LIST"}*/
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/*"HTMLFORM" -> {"SRAGG"; "A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"}*/
/*"HTMLFORM" -> {"TYPE"; "EVALAB"; "IEVALAB"; "ELTAGG"; "ELTAB"; "CLAGG"}*/
/*"HTMLFORM" -> {"KONVERT"; "ORDSET"; "OM"; "RCAGG"; "BOOLEAN"; "CHAR"}*/
/*"HTMLFORM" -> {"SINT"; "OUTFORM"; "LIST"; "PRIMARR"; "A1AGG-"; "ISTRING"}*/
/*"HTMLFORM" -> {"SRAGG-"; "ILIST"; "LSAGG"; "STAGG"; "URAGG"; "ELAGG"}*/
/*"HTMLFORM" -> {"LSAGG-"; "ORDFIN"; "FINITE"; "STAGG-"; "FLAGG-"; "LNAGG-"}*/
/*"HTMLFORM" -> {"IXAGG-"; "CLAGG-"; "HOAGG-"; "ORDSET-"; "AGG-"; "ELTAGG-"}*/
/*"HTMLFORM" -> {"SETCAT-"; "BASTYPE-"; "ELAGG-"; "URAGG-"; "INS-"; "PI"}*/
/*"HTMLFORM" -> {"EUCDOM-"; "UFD-"; "GCDDOM-"; "INTDOM-"; "ALGEBRA-"}*/
/*"HTMLFORM" -> {"DIFRING-"; "ORDRING-"; "MODULE-"; "RING-"; "ABELGRP-"}*/
/*"HTMLFORM" -> {"ABELMON-"; "MONOID-"; "ABELSG-"; "SGROUP-"; "RETRACT-"}*/

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/*"IBPTOOLS" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"IBPTOOLS" -> {"LMODULE"; "UPOLYC"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"}*/
/*"IBPTOOLS" -> {"BMODULE"; "RMODULE"; "COMRING"; "ALGEBRA"; "MODULE"}*/
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/*"IBPTOOLS" -> {"CHARZ"; "CHARNZ"; "INTDOM"; "ENTIRER"; "FRETRCT"}*/
/*"IBPTOOLS" -> {"RETRACT"; "EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"}*/
/*"IBPTOOLS" -> {"ORDSET"; "KONVERT"; "PATMAB"; "GCDDOM"}*/
"IBPTOOLS" -> "PFECAT"
/*"IBPTOOLS" -> {"UFD"; "ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "EUCDOM"}*/
/*"IBPTOOLS" -> {"PID"; "FIELD"; "DIVRING"; "BOOLEAN"; "SINT"; "NNI"; "INT"}*/

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/*"IBITS" -> {"A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"}*/
/*"IBITS" -> {"EVALAB"; "IEVALAB"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
/*"IBITS" -> "INT"*/
"IBITS" -> "STRING"
/*"IBITS" -> {"CHAR"; "SINT"; "OUTFORM"; "LIST"; "PRIMARR"; "A1AGG-"}*/
/*"IBITS" -> {"ISTRING"; "INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"IBITS" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"IBITS" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"IBITS" -> {"MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"}*/
/*"IBITS" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "DIFRING"; "RETRACT"}*/
/*"IBITS" -> {"LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "OM"}*/
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/*"ICARD" -> {"CHAR"; "SINT"; "OUTFORM"; "LIST"; "INT"; "PRIMARR"}*/
/*"ICARD" -> {"A1AGG-"; "ISTRING"; "PI"; "NNI"}*/

"ICDEN" [color="#FF4488",href="bookvol10.4.pdf#nameddest=ICDEN"]
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/*"ICDEN" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"ICDEN" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"ICDEN" -> {"ENTIRER"; "QFCAT"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"}*/
/*"ICDEN" -> {"UFD"; "DIVRING"; "RETRACT"; "FEVALAB"; "ELTAB"; "EVALAB"}*/
/*"ICDEN" -> {"IEVALAB"; "DIFEXT"; "DIFRING"; "PDRING"; "FLINEXP"; "LINEXP"}*/
/*"ICDEN" -> {"PATAB"; "KONVERT"; "FPATMAB"; "TYPE"; "PATMAB"; "STEP"}*/
/*"ICDEN" -> {"ORDSET"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"ICDEN" -> {"OASGP"; "REAL"; "CHARZ"; "CHARNZ"}*/
"ICDEN" -> "PFECAT"
/*"ICDEN" -> {"FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "ELTAGG"; "CLAGG"}*/

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/*"IDECOMP" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"IDECOMP" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"IDECOMP" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"IDECOMP" -> {"EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"IDECOMP" -> {"OAMON"; "OASGP"; "ORDSET"; "DIFRING"; "KONVERT"}*/
/*"IDECOMP" -> {"RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"}*/
/*"IDECOMP" -> {"STEP"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARNZ"}*/
/*"IDECOMP" -> {"FRETRCT"; "EVALAB"; "IEVALAB"; "FLINEXP"}*/
"IDECOMP" -> "PFECAT"
/*"IDECOMP" -> {"QFCAT"; "FIELD"; "DIVRING"; "FEVALAB"; "ELTAB"; "DIFEXT"}*/
/*"IDECOMP" -> {"PATAB"; "FPATMAB"; "TYPE"}*/
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"IDECOMP" -> "DIRPCAT"
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/*"IDECOMP" -> {"LNAGG"; "CLAGG"; "FLAGG"; "ELAGG"; "OM"; "INT"; "LIST"}*/
/*"IDECOMP" -> {"ILIST"; "NNI"; "BOOLEAN"; "LSAGG-"; "STAGG-"; "ELAGG-"}*/
/*"IDECOMP" -> {"FLAGG-"; "URAGG-"}*/

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/*"IFF" -> {"XF"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"IFF" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"IFF" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"IFF" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
/*"IFF" -> {"DIVRING"; "RETRACT"; "VSPACE"; "CHARZ"; "FPC"; "CHARNZ"}*/
/*"IFF" -> {"FINITE"; "FFIELDC"; "STEP"; "DIFRING"; "KONVERT"; "OAMONS"}*/
/*"IFF" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "INS"; "OINTDOM"}*/
/*"IFF" -> {"ORDRING"; "OAGROUP"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"}*/

"IIARRAY2" [color="#88FF44",href="bookvol10.3.pdf#nameddest=IIARRAY2"]
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/*"IIARRAY2" -> {"ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"; "ORDSET"; "INT"}*/
/*"IIARRAY2" -> {"PRIMARR"; "A1AGG-"; "FLAGG-"; "LNAGG-"; "IXAGG-"; "CLAGG-"}*/
/*"IIARRAY2" -> {"HOAGG-"; "ORDSET-"; "AGG-"; "NNI"; "INS"; "UFD"; "GCDDOM"}*/
/*"IIARRAY2" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"IIARRAY2" -> {"ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"IIARRAY2" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"IIARRAY2" -> {"EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"IIARRAY2" -> {"OAMON"; "OASGP"; "DIFRING"; "RETRACT"; "LINEXP"; "PATMAB"}*/
/*"IIARRAY2" -> {"CFCAT"; "REAL"; "CHARZ"; "STEP"; "OM"; "A1AGG"}*/
"IIARRAY2" -> "STRING"
/*"IIARRAY2" -> {"CHAR"; "SINT"; "OUTFORM"; "LIST"; "ISTRING"}*/

/* Note that ILIST has a circular self reference */
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/*"ILIST" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"; "FLAGG"}*/
/*"ILIST" -> {"ORDSET"; "ELAGG"; "SINT"; "NNI"; "INT"; "BOOLEAN"; "LIST"}*/
/*"ILIST" -> {"ILIST"; "OM"; "LSAGG-"; "STAGG-"; "ELAGG-"}*/
"ILIST" -> "STRING"
/*"ILIST" -> {"CHAR"; "OUTFORM"; "PRIMARR"; "A1AGG-"; "ISTRING"; "INS"}*/
/*"ILIST" -> {"UFD"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"}*/
/*"ILIST" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"}*/
/*"ILIST" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"ILIST" -> {"ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"ILIST" -> {"OCAMON"; "OAMON"; "OASGP"; "DIFRING"; "RETRACT"; "LINEXP"}*/
/*"ILIST" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"}*/

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/*"IMATLIN" -> {"FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"IMATLIN" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"IMATLIN" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
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/*"IMATLIN" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"IMATLIN" -> {"ENTIRER"; "UFD"; "DIVRING"; "FLAGG"; "LNAGG"; "IXAGG"}*/
/*"IMATLIN" -> {"HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "ELTAGG"}*/
/*"IMATLIN" -> {"ELTAB"; "CLAGG"; "KONVERT"; "ORDSET"; "MATCAT"; "ARR2CAT"}*/
/*"IMATLIN" -> {"BOOLEAN"; "INT"; "SINT"; "NNI"; "LIST"; "A1AGG"; "PI"}*/
/*"IMATLIN" -> {"UPOLYC"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARZ"}*/
/*"IMATLIN" -> {"CHARNZ"; "FRETRCT"; "RETRACT"; "FLINEXP"; "LINEXP"}*/
/*"IMATLIN" -> "PATMAB"*/
"IMATLIN" -> "PFECAT"
/*"IMATLIN" -> {"DIFRING"; "DIFEXT"; "STEP"; "QFCAT"; "FEVALAB"; "PATAB"}*/
/*"IMATLIN" -> {"FPATMAB"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"IMATLIN" -> {"OAMON"; "OASGP"; "REAL"; "VECTCAT"; "OM"}*/

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/*"IMATQF" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"IMATQF" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"IMATQF" -> {"MODULE"; "ENTIRER"; "FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"}*/
/*"IMATQF" -> {"AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "ELTAGG"; "ELTAB"}*/
/*"IMATQF" -> {"CLAGG"; "KONVERT"; "ORDSET"; "MATCAT"; "ARR2CAT"; "QFCAT"}*/
/*"IMATQF" -> {"FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "UFD"; "DIVRING"}*/
/*"IMATQF" -> {"RETRACT"; "FEVALAB"; "DIFEXT"; "DIFRING"; "PDRING"}*/
/*"IMATQF" -> {"FLINEXP"; "LINEXP"; "PATAB"; "FPATMAB"; "PATMAB"; "STEP"}*/
/*"IMATQF" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"IMATQF" -> {"OASGP"; "REAL"; "CHARZ"; "CHARNZ"}*/
"IMATQF" -> "PFECAT"

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/*"INMODGCD" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"INMODGCD" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"INMODGCD" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"INMODGCD" -> {"UPOLYC"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARZ"}*/
/*"INMODGCD" -> {"CHARNZ"; "FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"}*/
/*"INMODGCD" -> {"FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"}*/
"INMODGCD" -> "PFECAT"
/*"INMODGCD" -> {"UFD"; "ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "FIELD"}*/
/*"INMODGCD" -> {"DIVRING"; "INS"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"INMODGCD" -> {"OCAMON"; "OAMON"; "OASGP"; "CFCAT"; "REAL"; "INT"}*/
/*"INMODGCD" -> {"LIST"; "ILIST"; "BOOLEAN"; "NNI"; "LSAGG-"; "STAGG-"}*/
/*"INMODGCD" -> {"ELAGG-"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"}*/
/*"INMODGCD" -> {"AGG"; "TYPE"; "LNAGG"; "IXAGG"; "ELTAGG"; "CLAGG"}*/
/*"INMODGCD" -> {"FLAGG"; "ELAGG"; "OM"; "OAMONS"; "FLAGG-"; "PI"}*/
/*"INMODGCD" -> {"MONOID-"; "ABELMON-"}*/

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/*"INNMFACT" -> {"OCAMON"; "OAMON"; "OASGP"; "ABELMON"; "ABELSG"; "CABMON"}*/
/*"INNMFACT" -> {"EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"}*/
/*"INNMFACT" -> {"RNG"; "ABELGRP"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"INNMFACT" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "CHARZ"}*/
/*"INNMFACT" -> {"POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARNZ"; "FRETRCT"}*/
/*"INNMFACT" -> {"RETRACT"; "EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"}*/
/*"INNMFACT" -> {"KONVERT"; "PATMAB"}*/
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"INNMFACT" -> "PFECAT"
/*"INNMFACT" -> {"UFD"; "PI"; "NNI"; "INT"; "MONOID-"; "ABELSG-"}*/
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/*"INNMFACT" -> {"DIFEXT"; "STEP"; "FIELD"; "DIVRING"; "BOOLEAN"; "LSAGG-"}*/
/*"INNMFACT" -> {"STAGG-"; "ELAGG-"; "FLAGG-"; "SINT"; "LSAGG"; "STAGG"}*/
/*"INNMFACT" -> {"URAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"; "LNAGG"; "IXAGG"}*/
/*"INNMFACT" -> {"ELTAGG"; "CLAGG"; "FLAGG"; "ELAGG"; "OM"; "ABELMON-"}*/
/*"INNMFACT" -> {"URAGG-"; "LNAGG-"; "RCAGG-"; "IXAGG-"}*/

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/*"INPSIGN" -> {"LMODULE"; "UPOLYC"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"}*/
/*"INPSIGN" -> {"BMODULE"; "RMODULE"; "COMRING"; "ALGEBRA"; "MODULE"}*/
/*"INPSIGN" -> {"CHARZ"; "CHARNZ"; "INTDOM"; "ENTIRER"; "FRETRCT"}*/
/*"INPSIGN" -> {"RETRACT"; "EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"}*/
/*"INPSIGN" -> {"ORDSET"; "KONVERT"; "PATMAB"; "GCDDOM"}*/
"INPSIGN" -> "PFECAT"
/*"INPSIGN" -> {"UFD"; "ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "EUCDOM"}*/
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/*"INTERGB" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"INTERGB" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"INTERGB" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"INTERGB" -> {"ENTIRER"; "UFD"; "DIVRING"; "OAMONS"; "OCAMON"; "OAMON"}*/
/*"INTERGB" -> {"OASGP"; "ORDSET"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"}*/
/*"INTERGB" -> {"CHARZ"; "CHARNZ"; "FRETRCT"; "RETRACT"; "EVALAB"}*/
/*"INTERGB" -> {"IEVALAB"; "FLINEXP"; "LINEXP"; "KONVERT"; "PATMAB"}*/
"INTERGB" -> "PFECAT"
/*"INTERGB" -> {"FFIELDC"; "FPC"; "FINITE"; "STEP"; "DIFRING"; "NNI"; "INT"}*/

"INT" [color="#88FF44",href="bookvol10.3.pdf#nameddest=INT",
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/*"INT" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"INT" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"INT" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"}*/
/*"INT" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"INT" -> {"DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"}*/
/*"INT" -> {"REAL"; "CHARZ"; "STEP"; "OM"; "INT"; "NNI"; "DFLOAT"}*/
"INT" -> "STRING"
/*"INT" -> {"CHAR"; "SINT"; "OUTFORM"; "LIST"; "PRIMARR"; "A1AGG-"}*/
/*"INT" -> {"ISTRING"; "UPOLYC"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"}*/
/*"INT" -> {"CHARNZ"; "FRETRCT"; "EVALAB"; "IEVALAB"; "FLINEXP"}*/
"INT" -> "PFECAT"
/*"INT" -> {"ELTAB"; "DIFEXT"; "FIELD"; "DIVRING"; "INS-"}*/

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/*"INTHERTR" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"INTHERTR" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
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/*"INTHERTR" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"INTHERTR" -> {"ENTIRER"; "UFD"; "DIVRING"; "UPOLYC"; "POLYCAT"; "PDRING"}*/
/*"INTHERTR" -> {"FAMR"; "AMR"; "CHARZ"; "CHARNZ"; "FRETRCT"; "RETRACT"}*/
/*"INTHERTR" -> {"EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"}*/
/*"INTHERTR" -> {"KONVERT"; "PATMAB"}*/
"INTHERTR" -> "PFECAT"
/*"INTHERTR" -> {"ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "NNI"; "INT"}*/

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/*"INTRAT" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"INTRAT" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"INTRAT" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
/*"INTRAT" -> {"DIVRING"; "CHARZ"; "RETRACT"; "UPOLYC"; "POLYCAT"; "PDRING"}*/
/*"INTRAT" -> {"FAMR"; "AMR"; "CHARNZ"; "FRETRCT"; "EVALAB"; "IEVALAB"}*/
/*"INTRAT" -> {"FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"}*/
"INTRAT" -> "PFECAT"
/*"INTRAT" -> {"ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "QFCAT"; "FEVALAB"}*/
/*"INTRAT" -> {"PATAB"; "FPATMAB"; "TYPE"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"INTRAT" -> {"OCAMON"; "OAMON"; "OASGP"; "REAL"}*/

"INTRF" [color="#FF4488",href="bookvol10.4.pdf#nameddest=INTRF"]
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/*"INTRF" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"INTRF" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"INTRF" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "RETRACT"; "CHARZ"}*/
/*"INTRF" -> {"POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARNZ"; "FRETRCT"}*/
/*"INTRF" -> {"EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"}*/
/*"INTRF" -> {"PATMAB"; "GCDDOM"}*/
"INTRF" -> "PFECAT"
/*"INTRF" -> {"UFD"; "QFCAT"; "FIELD"; "EUCDOM"; "PID"; "DIVRING"}*/
/*"INTRF" -> {"FEVALAB"; "ELTAB"; "DIFEXT"; "DIFRING"; "PATAB"; "FPATMAB"}*/
/*"INTRF" -> {"TYPE"; "STEP"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"INTRF" -> {"OAMON"; "OASGP"; "REAL"; "UPOLYC"}*/

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/*"INTSLPE" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"INTSLPE" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"INTSLPE" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"INTSLPE" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"}*/
/*"INTSLPE" -> {"PID"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"INTSLPE" -> {"OASGP"; "ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"}*/
/*"INTSLPE" -> {"LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"}*/
/*"INTSLPE" -> {"UPOLYC"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARNZ"}*/
/*"INTSLPE" -> {"FRETRCT"; "EVALAB"; "IEVALAB"; "FLINEXP"}*/
"INTSLPE" -> "PFECAT"
/*"INTSLPE" -> {"ELTAB"; "DIFEXT"; "FIELD"; "DIVRING"; "LIST"; "ILIST"}*/
/*"INTSLPE" -> "NNI"*/

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/*"INTTR" -> {"CHARZ"; "CHARNZ"; "FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"}*/
/*"INTTR" -> {"FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"}*/
"INTTR" -> "PFECAT"
/*"INTTR" -> {"ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "QFCAT"; "FEVALAB"}*/
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/*"ISUMP" -> {"CHARNZ"; "FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"}*/
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/*"ISUMP" -> {"UFD"; "INS"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"}*/
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/*"ISUMP" -> {"FIELD"; "DIVRING"; "FEVALAB"; "ELTAB"; "DIFEXT"; "PATAB"}*/
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/*"LEADCDET" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "POLYCAT"}*/
/*"LEADCDET" -> {"PDRING"; "FAMR"; "AMR"; "CHARZ"; "CHARNZ"; "FRETRCT"}*/
/*"LEADCDET" -> {"RETRACT"; "EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"}*/
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/*"LPEFRAC" -> {"TYPE"; "PATMAB"; "STEP"; "ORDSET"; "OINTDOM"; "ORDRING"}*/
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/*"PLEQN" -> {"INT"; "INS"; "CFCAT"; "OM"; "LIST"; "VECTOR"; "IVECTOR"}*/
/*"PLEQN" -> {"IARRAY1"; "VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"}*/
/*"PLEQN" -> {"HOAGG"; "AGG"; "ELTAGG"; "CLAGG"; "SINT"; "ILIST"; "LSAGG-"}*/
/*"PLEQN" -> {"STAGG-"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "ELAGG"}*/
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/*"PLEQN" -> "PI"*/

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/*"PLPKCRV" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"PLPKCRV" -> {"MODULE"; "ENTIRER"; "UFD"; "DIVRING"; "FAMR"; "AMR"}*/
/*"PLPKCRV" -> {"CHARZ"; "CHARNZ"; "FRETRCT"; "RETRACT"}*/
"PLPKCRV" -> "DIRPCAT"
/*"PLPKCRV" -> {"IXAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
/*"PLPKCRV" -> {"ELTAGG"; "ELTAB"; "DIFEXT"; "DIFRING"; "PDRING"; "FLINEXP"}*/
/*"PLPKCRV" -> {"LINEXP"; "FINITE"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"PLPKCRV" -> {"OAMON"; "OASGP"; "ORDSET"; "OAMONS"; "VSPACE"; "BOOLEAN"}*/
/*"PLPKCRV" -> {"NNI"; "INT"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "LNAGG"}*/
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"PMPLCAT" -> "PFECAT"
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/*"PNTHEORY" -> {"DIVRING"; "FEVALAB"; "ELTAB"; "EVALAB"; "IEVALAB"}*/
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/*"PNTHEORY" -> {"BOOLEAN"; "OM"; "PI"; "SINT"; "INS-"; "EUCDOM-"}*/
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/*"PNTHEORY" -> {"ORDRING-"; "MODULE-"; "RING-"; "ABELGRP-"; "ABELMON-"}*/
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/*"POLUTIL" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
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"POLUTIL" -> "PFECAT"
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/*"POLYCAT" -> {"UPOLYC"; "DIFEXT"; "FIELD"; "DIVRING"; "FPS"; "RNS"}*/
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/*"POLYCAT-" -> {"ABELGRP";  "SGROUP";  "MONOID";  "LMODULE";  "FAMR"}*/
/*"POLYCAT-" -> {"AMR";  "BMODULE";  "RMODULE";  "COMRING";  "ALGEBRA"}*/
/*"POLYCAT-" -> {"MODULE";  "CHARZ";  "CHARNZ";  "INTDOM";  "ENTIRER"}*/
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/*"POLYCAT-" -> {"IVECTOR";  "IARRAY1";  "INS";  "EUCDOM";  "PID"}*/
/*"POLYCAT-" -> {"OINTDOM";  "ORDRING";  "OAGROUP";  "DIFRING";  "CFCAT"}*/
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/*"POLYCAT-" -> {"DIFEXT";  "FIELD";  "DIVRING";  "FPS";  "RNS";  "RADCAT"}*/
/*"POLYCAT-" -> "SEXCAT"*/

/* Note that this depends on POLYCAT in this layer but POLYCAT is */
/* part of the layer0 clique and thus guaranteed to be compiled. */
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/*"POLYLIFT" -> {"COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"}*/
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/*"POLY2UP" -> {"CHARNZ"; "INTDOM"; "ENTIRER"; "FRETRCT"; "RETRACT"}*/
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/*"PRS" -> {"CHARZ"; "CHARNZ"; "FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"}*/
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/*"PRS" -> {"FIELD"; "DIVRING"; "NNI"; "INT"; "VECTOR"; "IVECTOR"}*/
/*"PRS" -> {"IARRAY1"; "VECTCAT-"; "BOOLEAN"; "PI"; "MONOID-"; "ABELMON-"}*/
/*"PRS" -> {"VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"}*/
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/*"QALGSET" -> {"URAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"; "LNAGG"}*/
/*"QALGSET" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "FLAGG"; "ELAGG"}*/
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/*"QFCAT" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"QFCAT" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"QFCAT" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"QFCAT" -> {"MODULE"; "ENTIRER"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"}*/
/*"QFCAT" -> {"UFD"; "DIVRING"; "RETRACT"; "FEVALAB"; "ELTAB"; "EVALAB"}*/
/*"QFCAT" -> {"IEVALAB"; "DIFEXT"; "DIFRING"; "PDRING"; "FLINEXP"}*/
/*"QFCAT" -> {"LINEXP"; "PATAB"; "KONVERT"; "FPATMAB"; "TYPE"; "PATMAB"}*/
/*"QFCAT" -> {"STEP"; "ORDSET"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"QFCAT" -> {"OCAMON"; "OAMON"; "OASGP"; "REAL"; "CHARZ"; "CHARNZ"}*/
"QFCAT" -> "PFECAT"
/*"QFCAT" -> {"DFLOAT"; "INS"; "CFCAT"; "FPS"; "RNS"; "RADCAT"; "INT"}*/
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"QFCAT-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=QFCAT",
          shape=ellipse]
/*"QFCAT-" -> {"INTDOM";  "COMRING";  "RING";  "RNG";  "ABELGRP"}*/
/*"QFCAT-" -> {"CABMON";  "ABELMON";  "ABELSG";  "SETCAT";  "BASTYPE"}*/
/*"QFCAT-" -> {"KOERCE";  "SGROUP";  "MONOID";  "LMODULE";  "BMODULE"}*/
/*"QFCAT-" -> {"RMODULE";  "ALGEBRA";  "MODULE";  "ENTIRER";  "FIELD"}*/
/*"QFCAT-" -> {"EUCDOM";  "PID";  "GCDDOM";  "UFD";  "DIVRING";  "RETRACT"}*/
/*"QFCAT-" -> {"FEVALAB";  "ELTAB";  "EVALAB";  "IEVALAB";  "DIFEXT"}*/
/*"QFCAT-" -> {"DIFRING";  "PDRING";  "FLINEXP";  "LINEXP";  "PATAB"}*/
/*"QFCAT-" -> {"KONVERT";  "FPATMAB";  "TYPE";  "PATMAB";  "STEP"}*/
/*"QFCAT-" -> {"ORDSET";  "OINTDOM";  "ORDRING";  "OAGROUP";  "OCAMON"}*/
/*"QFCAT-" -> {"OAMON";  "OASGP";  "REAL";  "CHARZ";  "CHARNZ"}*/
"QFCAT-" -> "PFECAT"
/*"QFCAT-" -> {"DFLOAT";  "INS";  "CFCAT";  "FPS";  "RNS";  "RADCAT";  "INT"}*/

/* Note that QFCAT2 depends on QFCAT in the same layer but QFCAT is */
/* part of the bootstrap clique so it is guaranteed to be compiled */
"QFCAT2" [color="#FF4488",href="bookvol10.4.pdf#nameddest=QFCAT2"]
/*"QFCAT2" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
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/*"QFCAT2" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
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/*"QFCAT2" -> {"FEVALAB"; "ELTAB"; "EVALAB"; "IEVALAB"; "DIFEXT"; "DIFRING"}*/
/*"QFCAT2" -> {"PDRING"; "FLINEXP"; "LINEXP"; "PATAB"; "KONVERT"; "FPATMAB"}*/
/*"QFCAT2" -> {"TYPE"; "PATMAB"; "STEP"; "ORDSET"; "OINTDOM"; "ORDRING"}*/
/*"QFCAT2" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "REAL"; "CHARZ"}*/
/*"QFCAT2" -> "CHARNZ"*/
"QFCAT2" -> "PFECAT"

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/*"RADIX" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"RADIX" -> {"MODULE"; "ENTIRER"; "UFD"; "DIVRING"; "RETRACT"; "FEVALAB"}*/
/*"RADIX" -> {"ELTAB"; "EVALAB"; "IEVALAB"; "DIFEXT"; "DIFRING"; "PDRING"}*/
/*"RADIX" -> {"FLINEXP"; "LINEXP"; "PATAB"; "KONVERT"; "FPATMAB"; "TYPE"}*/
/*"RADIX" -> {"PATMAB"; "STEP"; "ORDSET"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"RADIX" -> {"OCAMON"; "OAMON"; "OASGP"; "REAL"; "CHARZ"; "CHARNZ"}*/
"RADIX" -> "PFECAT"
/*"RADIX" -> {"INS"; "CFCAT"; "INT"; "NNI"; "LIST"; "OM"; "ILIST"}*/
/*"RADIX" -> {"BOOLEAN"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"}*/
/*"RADIX" -> {"AGG"; "LNAGG"; "IXAGG"; "ELTAGG"; "CLAGG"; "FLAGG"; "ELAGG"}*/
/*"RADIX" -> "PI"*/
"RADIX" -> "STRING"
/*"RADIX" -> {"CHAR"; "SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"; "ISTRING"}*/
/*"RADIX" -> {"FPS"; "RNS"; "RADCAT"; "UPOLYC"; "POLYCAT"; "FAMR"; "AMR"}*/
/*"RADIX" -> "FRETRCT"*/

"RATFACT" [color="#FF4488",href="bookvol10.4.pdf#nameddest=RATFACT"]
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/*"RATFACT" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
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/*"RATFACT" -> {"BMODULE"; "RMODULE"; "COMRING"; "ALGEBRA"; "MODULE"}*/
/*"RATFACT" -> {"CHARZ"; "CHARNZ"; "INTDOM"; "ENTIRER"; "FRETRCT"}*/
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/*"RATFACT" -> {"ORDSET"; "KONVERT"; "PATMAB"; "GCDDOM"}*/
"RATFACT" -> "PFECAT"
/*"RATFACT" -> {"UFD"; "ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "EUCDOM"}*/
/*"RATFACT" -> {"PID"; "FIELD"; "DIVRING"; "INS"; "OINTDOM"; "ORDRING"}*/
/*"RATFACT" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "CFCAT"; "REAL"}*/
/*"RATFACT" -> {"INT"; "INS-"; "EUCDOM-"; "UFD-"; "GCDDOM-"; "QFCAT"}*/
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/*"RCFIELD" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"RCFIELD" -> {"EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"RCFIELD" -> {"OAMON"; "OASGP"; "ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"}*/
/*"RCFIELD" -> {"LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"}*/
/*"RCFIELD" -> {"QFCAT"; "FIELD"; "DIVRING"; "FEVALAB"; "ELTAB"; "EVALAB"}*/
/*"RCFIELD" -> {"IEVALAB"; "DIFEXT"; "PDRING"; "FLINEXP"; "PATAB"; "FPATMAB"}*/
/*"RCFIELD" -> {"TYPE"; "CHARNZ"}*/
"RCFIELD" -> "PFECAT"
/*"RCFIELD" -> {"FRETRCT"; "RADCAT"; "NNI"; "INT"; "LSAGG"; "STAGG"}*/
/*"RCFIELD" -> {"URAGG"; "RCAGG"; "HOAGG"; "AGG"; "LNAGG"; "IXAGG"}*/
/*"RCFIELD" -> {"ELTAGG"; "CLAGG"; "FLAGG"; "ELAGG"; "OM"; "LIST"}*/
/*"RCFIELD" -> {"ILIST"; "LSAGG-"; "STAGG-"; "PI"}*/

"RCFIELD-" [color="#4488FF",href="bookvol10.2.pdf#nameddest=RCFIELD"]
/*"RCFIELD-" -> {"INS";  "UFD";  "GCDDOM";  "INTDOM";  "COMRING";  "RING"}*/
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/*"RCFIELD-" -> {"SETCAT";  "BASTYPE";  "KOERCE";  "SGROUP";  "MONOID"}*/
/*"RCFIELD-" -> {"LMODULE";  "BMODULE";  "RMODULE";  "ALGEBRA";  "MODULE"}*/
/*"RCFIELD-" -> {"ENTIRER";  "EUCDOM";  "PID";  "OINTDOM";  "ORDRING"}*/
/*"RCFIELD-" -> {"OAGROUP";  "OCAMON";  "OAMON";  "OASGP";  "ORDSET"}*/
/*"RCFIELD-" -> {"DIFRING";  "KONVERT";  "RETRACT";  "LINEXP";  "PATMAB"}*/
/*"RCFIELD-" -> {"CFCAT";  "REAL";  "CHARZ";  "STEP";  "QFCAT";  "FIELD"}*/
/*"RCFIELD-" -> {"DIVRING";  "FEVALAB";  "ELTAB";  "EVALAB";  "IEVALAB"}*/
/*"RCFIELD-" -> {"DIFEXT";  "PDRING";  "FLINEXP";  "PATAB";  "FPATMAB"}*/
/*"RCFIELD-" -> {"TYPE";  "CHARNZ"}*/
"RCFIELD-" -> "PFECAT"
/*"RCFIELD-" -> {"FRETRCT";  "RADCAT";  "NNI";  "INT";  "LSAGG";  "STAGG"}*/
/*"RCFIELD-" -> {"URAGG";  "RCAGG";  "HOAGG";  "AGG";  "LNAGG";  "IXAGG"}*/
/*"RCFIELD-" -> {"ELTAGG";  "CLAGG";  "FLAGG";  "ELAGG";  "OM";  "LIST"}*/
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/*"RDETR" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"RDETR" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"RDETR" -> {"ENTIRER"; "UFD"; "DIVRING"; "CHARZ"; "RETRACT"; "UPOLYC"}*/
/*"RDETR" -> {"POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARNZ"; "FRETRCT"}*/
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/*"RDETR" -> {"EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"}*/
/*"RDETR" -> {"KONVERT"; "PATMAB"}*/
"RDETR" -> "PFECAT"
/*"RDETR" -> {"ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "BOOLEAN"; "NNI"}*/
/*"RDETR" -> {"INT"; "INS"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
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/*"RDETRS" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"RDETRS" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"RDETRS" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
/*"RDETRS" -> {"DIVRING"; "CHARZ"; "RETRACT"; "UPOLYC"; "POLYCAT"; "PDRING"}*/
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/*"RDETRS" -> {"FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"}*/
"RDETRS" -> "PFECAT"
/*"RDETRS" -> {"ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "INT"; "LIST"}*/
/*"RDETRS" -> {"ILIST"; "LSAGG-"; "STAGG-"; "ELAGG-"; "FLAGG-"; "URAGG-"}*/
/*"RDETRS" -> {"VECTOR"; "VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"}*/
/*"RDETRS" -> {"HOAGG"; "AGG"; "TYPE"; "ELTAGG"; "CLAGG"; "IVECTOR"}*/
/*"RDETRS" -> {"IARRAY1"; "PI"; "NNI"}*/

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/*"REAL0" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"REAL0" -> {"SGROUP"; "MONOID"; "LMODULE"; "FAMR"; "AMR"; "BMODULE"}*/
/*"REAL0" -> {"RMODULE"; "COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"}*/
/*"REAL0" -> {"INTDOM"; "ENTIRER"; "FRETRCT"; "RETRACT"; "EVALAB"}*/
/*"REAL0" -> {"IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"}*/
/*"REAL0" -> {"PATMAB"; "GCDDOM"}*/
"REAL0" -> "PFECAT"
/*"REAL0" -> {"UFD"; "ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "EUCDOM"}*/
/*"REAL0" -> {"PID"; "FIELD"; "DIVRING"; "INS"; "OINTDOM"; "ORDRING"}*/
/*"REAL0" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "CFCAT"; "REAL"}*/
/*"REAL0" -> {"INT"; "OM"; "NNI"; "LIST"; "ILIST"; "PI"; "BOOLEAN"}*/
/*"REAL0" -> {"INS-"; "EUCDOM-"; "UFD-"; "GCDDOM-"; "INTDOM-"; "ALGEBRA-"}*/
/*"REAL0" -> {"DIFRING-"; "ORDRING-"; "MODULE-"; "RING-"; "ABELGRP-"}*/
/*"REAL0" -> {"ABELMON-"; "SINT"; "VECTOR"; "IVECTOR"; "IARRAY1"; "VECTCAT"}*/
/*"REAL0" -> {"A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"}*/
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"REAL0Q" [color="#FF4488",href="bookvol10.4.pdf#nameddest=REAL0Q"]
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/*"REAL0Q" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"REAL0Q" -> {"SGROUP"; "MONOID"; "LMODULE"; "FAMR"; "AMR"; "BMODULE"}*/
/*"REAL0Q" -> {"RMODULE"; "COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"}*/
/*"REAL0Q" -> {"CHARNZ"; "INTDOM"; "ENTIRER"; "FRETRCT"; "RETRACT"}*/
/*"REAL0Q" -> {"EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"}*/
/*"REAL0Q" -> {"KONVERT"; "PATMAB"; "GCDDOM"}*/
"REAL0Q" -> "PFECAT"
/*"REAL0Q" -> {"UFD"; "ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "EUCDOM"}*/
/*"REAL0Q" -> {"PID"; "FIELD"; "DIVRING"; "INS"; "OINTDOM"; "ORDRING"}*/
/*"REAL0Q" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "CFCAT"; "REAL"}*/
/*"REAL0Q" -> {"INT"; "INS-"; "EUCDOM-"; "UFD-"; "GCDDOM-"; "QFCAT"}*/
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/*"REALSOLV" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"REALSOLV" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"REALSOLV" -> {"EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"REALSOLV" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "DIFRING"}*/
/*"REALSOLV" -> {"KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"}*/
/*"REALSOLV" -> {"REAL"; "CHARZ"; "STEP"; "POLYCAT"; "PDRING"; "FAMR"}*/
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/*"RESRING" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"RESRING" -> {"SGROUP"; "MONOID"; "LMODULE"; "FAMR"; "AMR"; "BMODULE"}*/
/*"RESRING" -> {"RMODULE"; "COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"}*/
/*"RESRING" -> {"CHARNZ"; "INTDOM"; "ENTIRER"; "FRETRCT"; "RETRACT"}*/
/*"RESRING" -> {"EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"}*/
/*"RESRING" -> {"KONVERT"; "PATMAB"; "GCDDOM"}*/
"RESRING" -> "PFECAT"
/*"RESRING" -> {"UFD"; "FIELD"; "EUCDOM"; "PID"; "DIVRING"; "OAMONS"}*/
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/*"RETSOL" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"RETSOL" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"RETSOL" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "RETRACT"; "POLYCAT"}*/
/*"RETSOL" -> {"PDRING"; "FAMR"; "AMR"; "CHARZ"; "CHARNZ"; "FRETRCT"}*/
/*"RETSOL" -> {"EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"}*/
/*"RETSOL" -> {"KONVERT"; "PATMAB"; "GCDDOM"}*/
"RETSOL" -> "PFECAT"
/*"RETSOL" -> {"UFD"; "INT"; "LIST"; "ILIST"; "BOOLEAN"}*/

"RF" [color="#FF4488",href="bookvol10.4.pdf#nameddest=RF"]
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/*"RF" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"RF" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"RF" -> {"ENTIRER"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARZ"; "CHARNZ"}*/
/*"RF" -> {"FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"}*/
/*"RF" -> {"ORDSET"; "KONVERT"; "PATMAB"; "GCDDOM"}*/
"RF" -> "PFECAT"
/*"RF" -> {"UFD"; "QFCAT"; "FIELD"; "EUCDOM"; "PID"; "DIVRING"; "FEVALAB"}*/
/*"RF" -> {"ELTAB"; "DIFEXT"; "DIFRING"; "PATAB"; "FPATMAB"; "TYPE"}*/
/*"RF" -> {"STEP"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"RF" -> {"OASGP"; "REAL"; "UPOLYC"}*/

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/*"RFFACTOR" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"RFFACTOR" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"RFFACTOR" -> {"INS"; "UFD"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"RFFACTOR" -> {"OAMON"; "OASGP"; "ORDSET"; "DIFRING"; "KONVERT"}*/
/*"RFFACTOR" -> {"RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"}*/
/*"RFFACTOR" -> {"STEP"; "QFCAT"; "FIELD"; "DIVRING"; "FEVALAB"; "ELTAB"}*/
/*"RFFACTOR" -> {"EVALAB"; "IEVALAB"; "DIFEXT"; "PDRING"; "FLINEXP"}*/
/*"RFFACTOR" -> {"PATAB"; "FPATMAB"; "TYPE"; "CHARNZ"}*/
"RFFACTOR" -> "PFECAT"
/*"RFFACTOR" -> {"POLYCAT"; "FAMR"; "AMR"; "FRETRCT"; "FFIELDC"; "FPC"}*/
/*"RFFACTOR" -> "FINITE"*/

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/*"RINTERP" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"RINTERP" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"RINTERP" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"RINTERP" -> {"ENTIRER"; "UFD"; "DIVRING"; "LSAGG"; "STAGG"; "URAGG"}*/
/*"RINTERP" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
/*"RINTERP" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
/*"RINTERP" -> {"FLAGG"; "ORDSET"; "ELAGG"; "OM"; "INT"; "LIST"; "ILIST"}*/
/*"RINTERP" -> {"NNI"; "SINT"; "LSAGG-"; "STAGG-"; "POLYCAT"; "PDRING"}*/
/*"RINTERP" -> {"FAMR"; "AMR"; "CHARZ"; "CHARNZ"; "FRETRCT"; "RETRACT"}*/
/*"RINTERP" -> {"FLINEXP"; "LINEXP"; "PATMAB"}*/
"RINTERP" -> "PFECAT"
/*"RINTERP" -> {"PI"; "MONOID-"; "ABELMON-"; "ORDSET-"; "SGROUP-"}*/
/*"RINTERP" -> {"ABELSG-"; "SETCAT-"; "BASTYPE-"; "VECTOR"; "IVECTOR"}*/
/*"RINTERP" -> "IARRAY1"*/

"RMATCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=RMATCAT"]
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/*"SUMRF" -> {"MODULE"; "ENTIRER"; "ORDSET"; "RETRACT"; "POLYCAT"}*/
/*"SUMRF" -> {"PDRING"; "FAMR"; "AMR"; "CHARZ"; "CHARNZ"; "FRETRCT"}*/
/*"SUMRF" -> {"EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"; "KONVERT"}*/
/*"SUMRF" -> {"PATMAB"; "GCDDOM"}*/
"SUMRF" -> "PFECAT"
/*"SUMRF" -> {"UFD"; "QFCAT"; "FIELD"; "EUCDOM"; "PID"; "DIVRING"}*/
/*"SUMRF" -> {"FEVALAB"; "ELTAB"; "DIFEXT"; "DIFRING"; "PATAB"; "FPATMAB"}*/
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/*"SUP" -> {"FPC"; "INT"; "LIST"; "NNI"; "PI"; "ILIST"; "BOOLEAN"}*/
/*"SUP" -> {"FFIELDC"; "FINITE"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"}*/
/*"SUP" -> {"HOAGG"; "AGG"; "TYPE"; "LNAGG"; "IXAGG"; "ELTAGG"; "CLAGG"}*/
/*"SUP" -> {"FLAGG"; "ELAGG"; "OM"; "LSAGG-"; "FPS"; "RNS"; "ORDRING"}*/
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/*"TANEXP" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "CFCAT"}*/
/*"TANEXP" -> {"REAL"; "OM"; "VECTOR"; "IVECTOR"; "IARRAY1"; "SINT"}*/
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/*"UPDECOMP" -> {"ORDSET"; "KONVERT"; "PATMAB"; "GCDDOM"}*/
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/*"UPDIVP" -> {"IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"}*/
/*"UPDIVP" -> "PATMAB"; "GCDDOM"}*/
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/*"UPMP" -> {"PATMAB"; "GCDDOM"}*/
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/*"UPOLYC2" -> {"ORDSET"; "KONVERT"; "PATMAB"; "GCDDOM"}*/
"UPOLYC2" -> "PFECAT"
/*"UPOLYC2" -> {"UFD"; "ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "EUCDOM"}*/
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/*"UPXSCAT" -> {"UPSCAT"; "PSCAT"; "AMR"; "RADCAT"; "TRANFUN"; "TRIGCAT"}*/
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/*"UPSQFREE" -> {"ORDSET"; "KONVERT"; "PATMAB"; "GCDDOM"}*/
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/*"UPSQFREE" -> {"UFD"; "ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "EUCDOM"}*/
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/*"UPSQFREE" -> {"ALGEBRA-"; "DIFRING-"; "ORDRING-"; "MODULE-"; "RING-"}*/
/*"UPSQFREE" -> {"ABELGRP-"; "NNI"; "BOOLEAN"; "LIST"; "PI"}*/

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/*"VECTOR" -> {"AGG"; "TYPE"; "SETCAT"; "BASTYPE"; "KOERCE"; "EVALAB"}*/
/*"VECTOR" -> {"IEVALAB"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"; "ORDSET"}*/
/*"VECTOR" -> {"INT"; "VECTOR"; "IVECTOR"; "IARRAY1"; "VECTCAT-"; "A1AGG-"}*/
/*"VECTOR" -> {"SYMBOL"; "REF"; "ALIST"; "LIST"}*/
"VECTOR" -> "STRING"
/*"VECTOR" -> {"CHAR"; "SINT"; "OUTFORM"; "PRIMARR"; "ISTRING"; "SRAGG-"}*/
/*"VECTOR" -> {"FLAGG-"; "LNAGG-"; "RADCAT"; "RING"; "RNG"; "ABELGRP"}*/
/*"VECTOR" -> {"CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"VECTOR" -> {"INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"; "BMODULE"}*/
/*"VECTOR" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"; "PID"}*/
/*"VECTOR" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"VECTOR" -> {"DIFRING"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"}*/
/*"VECTOR" -> {"CHARZ"; "STEP"; "OM"}*/

"VIEWDEF" [color="#FF4488",href="bookvol10.4.pdf#nameddest=VIEWDEF"]
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/*"VIEWDEF" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"}*/
/*"VIEWDEF" -> {"KOERCE"; "EVALAB"; "IEVALAB"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
/*"VIEWDEF" -> {"ELTAB"; "CLAGG"; "KONVERT"; "FLAGG"; "ORDSET"; "ELAGG"}*/
/*"VIEWDEF" -> {"OM"; "LIST"; "ILIST"; "LSAGG-"; "STAGG-"; "ELAGG-"}*/
/*"VIEWDEF" -> {"FLAGG-"; "URAGG-"; "LNAGG-"; "RCAGG-"; "IXAGG-"; "CLAGG-"}*/
/*"VIEWDEF" -> {"HOAGG-"; "ORDSET-"; "AGG-"; "ELTAGG-"; "SETCAT-"}*/
/*"VIEWDEF" -> "BASTYPE-"*/
"VIEWDEF" -> "STRING"
/*"VIEWDEF" -> {"CHAR"; "SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"; "ISTRING"}*/
/*"VIEWDEF" -> {"SRAGG-"; "STRICAT"; "SRAGG"; "A1AGG"}*/

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/*"VIEW2D" -> {"PI"; "NNI"; "VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"}*/
/*"VIEW2D" -> {"HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "ELTAGG"}*/
/*"VIEW2D" -> {"ELTAB"; "CLAGG"; "KONVERT"; "ORDSET"; "VECTOR"; "IVECTOR"}*/
/*"VIEW2D" -> {"IARRAY1"; "LIST"; "ILIST"; "LSAGG-"; "STAGG-"; "SINT"}*/
"VIEW2D" -> "STRING"
/*"VIEW2D" -> {"CHAR"; "OUTFORM"; "PRIMARR"; "A1AGG-"; "ISTRING"; "INS"}*/
/*"VIEW2D" -> {"UFD"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"}*/
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/*"VIEW2D" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"}*/
/*"VIEW2D" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"VIEW2D" -> {"ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"VIEW2D" -> {"OCAMON"; "OAMON"; "OASGP"; "DIFRING"; "RETRACT"; "LINEXP"}*/
/*"VIEW2D" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "OM"; "SRAGG-"}*/
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/*"WEIER" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"WEIER" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"WEIER" -> {"UFD"; "DIVRING"; "INT"; "LIST"; "ILIST"; "NNI"; "POLYCAT"}*/
/*"WEIER" -> {"PDRING"; "FAMR"; "AMR"; "CHARZ"; "CHARNZ"; "FRETRCT"}*/
/*"WEIER" -> {"RETRACT"; "EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"}*/
/*"WEIER" -> {"KONVERT"; "PATMAB"}*/
"WEIER" -> "PFECAT"
/*"WEIER" -> {"MTSCAT"; "PSCAT"; "RADCAT"; "TRANFUN"; "TRIGCAT"; "ATRIG"}*/
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/*"WP" -> {"OAMON"; "OASGP"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"; "COMRING"}*/
/*"WP" -> {"CHARZ"; "CHARNZ"; "INTDOM"; "ENTIRER"; "FRETRCT"; "RETRACT"}*/
/*"WP" -> {"EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"; "KONVERT"; "PATMAB"}*/
/*"WP" -> "GCDDOM"*/
"WP" -> "PFECAT"
/*"WP" -> {"UFD"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"}*/
/*"WP" -> {"TYPE"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "FLAGG"}*/
/*"WP" -> {"ELAGG"; "OM"; "INT"; "LIST"; "ILIST"; "LSAGG-"; "STAGG-"}*/
/*"WP" -> {"ELAGG-"; "FLAGG-"; "URAGG-"; "LNAGG-"; "RCAGG-"; "IXAGG-"}*/
/*"WP" -> {"CLAGG-"; "HOAGG-"; "ORDSET-"; "AGG-"; "ELTAGG-"; "SETCAT-"}*/
/*"WP" -> {"BASTYPE-"; "NNI"; "BOOLEAN"; "FIELD"; "EUCDOM"; "PID"; "DIVRING"}*/
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1.4.14 Layer12

Depends on: DIOPS DPOLCAT FINRALG FRAC RMATCAT RRCC UPXSCAT FFSQFR PACRATC PLPKCRV
Used by next layer: DIAGG FRAMALG MDAGG SMATCAT UPXSCCA

— **layer12** —

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LAYER12=\
```

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  ${OUT}/DIAGG.o   ${OUT}/DIAGG-.o   ${OUT}/DSMP.o     ${OUT}/EXPUPXS.o \
  ${OUT}/FACTRN.o  ${OUT}/FFFACTSE.o \
  ${OUT}/FRAMALG.o ${OUT}/FRAMALG-.o ${OUT}/INTFRSP.o  ${OUT}/LPARSPT.o  \
  ${OUT}/MDAGG.o   ${OUT}/NPOLYGON.o \
  ${OUT}/ODPOL.o   ${OUT}/PLOT.o     ${OUT}/RFP.o     \
  ${OUT}/RMCAT2.o  ${OUT}/ROIRC.o    ${OUT}/SDPOL.o   \
  ${OUT}/SMATCAT.o ${OUT}/SMATCAT-.o ${OUT}/TUBETOOL.o ${OUT}/UPXSCCA.o \
  ${OUT}/UPXSCCA-.o \
  layer12done
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———-

— **layerpic** —

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/* layer 12 */
/* depends on: DIOPS DPOLCAT FFSQFR FINRALG FRAC RMATCAT RRCC UPXSCAT */
/*             PLPKCRV */

"DFLOAT" [color="#88FF44",href="bookvol10.3.pdf#nameddest=DFLOAT",
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/*"DFLOAT" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
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/*"DFLOAT" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"DFLOAT" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/
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/*"DFLOAT" -> {"REAL"; "KONVERT"; "RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"}*/
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/*"DFLOAT" -> {"AHYP"; "ELEMFUN"; "SPFCAT"; "DFLOAT"; "INT"; "PI"; "NNI"}*/
/*"DFLOAT" -> {"FPS-"; "RNS-"; "FIELD-"; "EUCDOM-"; "UFD-"; "GCDDOM-"}*/
/*"DFLOAT" -> {"DIVRING-"; "INTDOM-"; "ALGEBRA-"; "DIFRING-"; "ORDRING-"}*/
/*"DFLOAT" -> "MODULE-"*/
"DFLOAT" -> "FRAC"
/*"DFLOAT" -> {"RING-"; "ABELGRP-"; "ABELMON-"; "INS"; "OINTDOM"; "LINEXP"}*/
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"DIAGG" -> "DIOPS"
/*"DIAGG" -> {"BGAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"}*/
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/*"DIAGG" -> {"BOOLEAN"; "NNI"; "INT"}*/

"DIAGG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=DIAGG"]
"DIAGG-" -> "DIOPS"
/*"DIAGG-" -> {"BGAGG";  "HOAGG";  "AGG";  "TYPE";  "SETCAT";  "BASTYPE"}*/
/*"DIAGG-" -> {"KOERCE";  "EVALAB";  "IEVALAB";  "CLAGG";  "KONVERT"}*/
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/*"DSMP" -> {"MONOID"; "LMODULE"; "FAMR"; "AMR"; "BMODULE"; "RMODULE"}*/
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/*"DSMP" -> {"COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"; "INTDOM"}*/
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/*"DSMP" -> {"LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"; "GCDDOM"; "PFECAT"}*/
/*"DSMP" -> {"UFD"; "DIFEXT"; "DIFRING"; "DVARCAT"; "NNI"; "INT"; "FPS"}*/
/*"DSMP" -> {"RNS"; "FIELD"; "EUCDOM"; "PID"; "DIVRING"; "ORDRING"}*/
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/*"DSMP" -> {"INS"; "OINTDOM"; "CFCAT"; "STEP"; "UPOLYC"; "ELTAB"}*/

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/*"EXPUPXS" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
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/*"EXPUPXS" -> {"INS"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "KONVERT"}*/
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/*"EXPUPXS" -> {"INT"; "LIST"; "ILIST"; "BOOLEAN"; "OM"; "QFCAT"; "FEVALAB"}*/
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/*"FACTRN" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
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/*"FACTRN" -> {"XF"; "VSPACE"; "FPC"; "CHARNZ"; "FINITE"; "UPOLYC"}*/
/*"FACTRN" -> {"POLYCAT"; "PDRING"; "FAMR"; "AMR"; "FRETRCT"; "EVALAB"}*/
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/*"FACTRN" -> {"PFECAT"}*/
/*"FACTRN" -> {"ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "LSAGG"; "STAGG"}*/
/*"FACTRN" -> {"URAGG" "RCAGG"; "HOAGG"; "AGG"; "TYPE"; "LNAGG"; "IXAGG"}*/
/*"FACTRN" -> {"ELTAGG" "CLAGG"; "FLAGG"; "ELAGG"; "OM"; "INT"; "LIST"} */
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/*"FACTRN" -> {"OCAMON" "OAMON"; "OASGP"; "CFCAT"; "REAL"; "QFCAT"}*/
/*"FACTRN" -> {"FEVALAB""PATAB"; "FPATMAB"}*/

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/*"FFFACTSE" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"FFFACTSE" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"FFFACTSE" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
/*"FFFACTSE" -> {"DIVRING"; "CHARNZ"; "FINITE"; "STEP"; "DIFRING"}*/
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/*"FFFACTSE" -> {"CHARZ"; "FRETRCT"; "RETRACT"; "EVALAB"}*/
/*"FFFACTSE" -> {"IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"}*/
/*"FFFACTSE" -> {"KONVERT"; "PATMAB"}*/
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"FFFACTSE" -> "PFECAT"
"FFFACTSE" -> "FFSQFR"
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/*"FFFACTSE" -> {"NNI"; "INT"; "PI"; "PRIMARR"; "A1AGG"; "FLAGG"}*/
/*"FFFACTSE" -> {"LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"}*/
/*"FFFACTSE" -> {"ELTAGG"; "CLAGG"; "BOOLEAN"; "SINT"; "LIST"}*/
/*"FFFACTSE" -> {"ILIST"; "LSAGG-"; "STAGG-"; "INS-"; "INS"}*/
/*"FFFACTSE" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
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/*"FRAMALG" -> {"INTDOM"; "ENTIRER"; "FRETRCT"; "RETRACT"; "EVALAB"}*/
/*"FRAMALG" -> {"IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"}*/
/*"FRAMALG" -> {"PATMAB"; "GCDDOM"; "PFECAT"; "UFD"; "ELTAB"; "DIFRING"}*/
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/*"FRAMALG-" -> {"SGROUP";  "MONOID";  "LMODULE";  "MODULE";  "BMODULE"}*/
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/*"FRAMALG-" -> {"FLINEXP";  "LINEXP";  "ORDSET";  "KONVERT";  "PATMAB"}*/
/*"FRAMALG-" -> {"GCDDOM";  "PFECAT";  "UFD";  "ELTAB";  "DIFRING"}*/
/*"FRAMALG-" -> {"DIFEXT";  "STEP";  "EUCDOM";  "PID";  "FIELD";  "DIVRING"}*/
/*"FRAMALG-" -> {"VECTCAT";  "A1AGG";  "FLAGG";  "LNAGG";  "IXAGG";  "HOAGG"}*/
/*"FRAMALG-" -> {"AGG";  "TYPE";  "ELTAGG";  "CLAGG";  "INT";  "VECTOR"}*/
/*"FRAMALG-" -> {"IVECTOR";  "IARRAY1";  "INS";  "OINTDOM";  "ORDRING"}*/
/*"FRAMALG-" -> {"OAGROUP";  "OCAMON";  "OAMON";  "OASGP";  "CFCAT";  "REAL"}*/
/*"FRAMALG-" -> {"OM";  "NNI";  "PI";  "SINT";  "LIST";  "ILIST"}*/

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"INTFRSP" -> "PFORP"
"INTFRSP" -> "PARAMP"
"INTFRSP" -> "LISYSER"
/*"INTFRSP" -> {"PRSPCAT"; "SETCATD"; "LOCPOWC"; "PLACESC"}*/
/*"INTFRSP" -> {"DIVCAT"; "LOP"; "FIELD"; "EUCDOM"; "PID"}*/
/*"INTFRSP" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"INTFRSP" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"INTFRSP" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"INTFRSP" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/
/*"INTFRSP" -> {"POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARZ"; "CHARNZ"}*/
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/*"INTFRSP" -> {"FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"; "FLINEXP"}*/
/*"INTFRSP" -> {"LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"; "PFECAT"}*/
/*"INTFRSP" -> {"DIRPCAT"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"; "ELTAGG"}*/
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/*"INTFRSP" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "OAMONS"}*/
/*"INTFRSP" -> {"VSPACE"; "UPSCAT"; "PSCAT"; "FAMONC"; "INT"; "LIST"}*/
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/*"INTFRSP" -> {"LNAGG"; "CLAGG"; "FLAGG"; "ELAGG"; "OM"; "VECTOR"}*/
/*"INTFRSP" -> {"IVECTOR"; "IARRAY1"; "VECTCAT-"; "A1AGG-"; "FLAGG-"}*/
/*"INTFRSP" -> {"LNAGG-"; "IXAGG-"; "LSAGG-"; "SINT"; "PI"; "STAGG-"}*/
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/*"LPARSPT" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"LPARSPT" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"LPARSPT" -> {"UFD"; "DIVRING"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"}*/
/*"LPARSPT" -> {"CHARZ"; "CHARNZ"; "FRETRCT"; "RETRACT"; "EVALAB"}*/
/*"LPARSPT" -> {"IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"}*/
/*"LPARSPT" -> {"PATMAB"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"; "ELTAGG"}*/
/*"LPARSPT" -> {"ELTAB"; "DIFEXT"; "DIFRING"; "FINITE"; "ORDRING"}*/
/*"LPARSPT" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "OAMONS"}*/
/*"LPARSPT" -> {"VSPACE"; "UPSCAT"; "PSCAT"; "SINT"; "INT"; "LSAGG"}*/
/*"LPARSPT" -> {"STAGG"; "URAGG"; "RCAGG"; "LNAGG"; "CLAGG"; "FLAGG"}*/
/*"LPARSPT" -> {"ELAGG"; "OM"; "LIST"; "ILIST"; "NNI"; "BOOLEAN"; "STEP"}*/
/*"LPARSPT" -> {"UPOLYC"; "PI"; "LSAGG-"; "STAGG-"; "OUTFORM"; "ELAGG-"}*/

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"MDAGG" -> "DIOPS"
/*"MDAGG" -> {"BGAGG"; "HOAGG"; "AGG"; "TYPE"; "SETCAT"; "BASTYPE"}*/
/*"MDAGG" -> {"KOERCE"; "EVALAB"; "IEVALAB"; "CLAGG"; "KONVERT"}*/

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/*"NPOLYGON" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"NPOLYGON" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"NPOLYGON" -> {"LMODULE"; "FAMR"; "AMR"; "BMODULE"; "RMODULE"; "COMRING"}*/
/*"NPOLYGON" -> {"ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"; "INTDOM"}*/
/*"NPOLYGON" -> {"ENTIRER"; "FRETRCT"; "RETRACT"}*/
"NPOLYGON" -> "DIRPCAT"
/*"NPOLYGON" -> {"IXAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
/*"NPOLYGON" -> {"ELTAGG"; "ELTAB"; "DIFEXT"; "DIFRING"; "PDRING"}*/
/*"NPOLYGON" -> {"FLINEXP"; "LINEXP"; "FINITE"; "ORDRING"; "OAGROUP"}*/
/*"NPOLYGON" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "OAMONS"; "VSPACE"}*/
/*"NPOLYGON" -> {"FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "UFD"; "DIVRING"; "INT"}*/
/*"NPOLYGON" -> {"PI"; "NNI"; "LIST"; "ILIST"; "LSAGG"; "STAGG"; "URAGG"}*/
/*"NPOLYGON" -> {"RCAGG"; "LNAGG"; "CLAGG"; "KONVERT"; "FLAGG"; "ELAGG"}*/
/*"NPOLYGON" -> {"OM"; "LSAGG-"; "STAGG-"; "ELAGG-"; "FLAGG-"; "URAGG-"}*/
/*"NPOLYGON" -> {"BOOLEAN"}*/

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/*"ODPOL" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"ODPOL" -> {"MONOID"; "LMODULE"; "FAMR"; "AMR"; "BMODULE"; "RMODULE"}*/
/*"ODPOL" -> {"COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"; "INTDOM"}*/
/*"ODPOL" -> {"ENTIRER"; "FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"}*/
/*"ODPOL" -> {"FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"; "GCDDOM"}*/
/*"ODPOL" -> {"PFECAT"; "UFD"; "DIFEXT"; "DIFRING"; "DVARCAT"; "FPS"; "RNS"}*/
/*"ODPOL" -> {"FIELD"; "EUCDOM"; "PID"; "DIVRING"; "ORDRING"; "OAGROUP"}*/
/*"ODPOL" -> {"OCAMON"; "OAMON"; "OASGP"; "REAL"; "RADCAT"; "INS"; "OINTDOM"}*/
/*"ODPOL" -> {"CFCAT"; "STEP"; "UPOLYC"; "ELTAB"}*/

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/*"PLOT" -> {"RNS-"; "FIELD-"; "EUCDOM-"; "UFD-"; "GCDDOM-"; "DIVRING-"}*/
/*"PLOT" -> {"INTDOM-"; "ALGEBRA-"; "DIFRING-"; "ORDRING-"; "MODULE-"}*/
/*"PLOT" -> {"RING-"; "ABELGRP-"; "ABELMON-"; "MONOID-"; "ORDSET-"}*/
/*"PLOT" -> {"ABELSG-"; "SGROUP-"; "TRANFUN-"; "SETCAT-"; "ELEMFUN-"}*/
/*"PLOT" -> {"HYPCAT-"; "ATRIG-"; "TRIGCAT-"; "RADCAT-"; "RETRACT-"}*/
/*"PLOT" -> {"BASTYPE-"; "FPS"; "RNS"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"}*/
/*"PLOT" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"PLOT" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "SGROUP"}*/
/*"PLOT" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
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/*"PLOT" -> {"RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"; "PTCAT"; "VECTCAT"}*/
/*"PLOT" -> {"A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"}*/
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/*"PLOT" -> {"NNI"; "PI"; "LSAGG-"; "STAGG-"; "ELAGG-"; "FLAGG-"; "URAGG-"}*/
/*"PLOT" -> {"SINT"; "INS"; "OINTDOM"; "DIFRING"; "LINEXP"; "CFCAT"}*/
/*"PLOT" -> {"STEP"; "TRANFUN"; "TRIGCAT"; "ATRIG"; "HYPCAT"; "AHYP"}*/
/*"PLOT" -> {"ELEMFUN"; "SPFCAT"}*/
"PLOT" -> "FRAC"

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/*"RFP" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/
/*"RFP" -> {"INT"; "LIST"; "ILIST"; "PACPERC"; "FFIELDC"; "FPC"; "CHARNZ"}*/
/*"RFP" -> {"FINITE"; "STEP"; "DIFRING"; "PACFFC"; "UPOLYC"; "POLYCAT"}*/
/*"RFP" -> {"PDRING"; "FAMR"; "AMR"; "CHARZ"; "FRETRCT"; "RETRACT"; "EVALAB"}*/
/*"RFP" -> {"IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"}*/
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/*"RFP" -> {"OM"; "LSAGG-"; "STAGG-"; "ELAGG-"; "QFCAT"; "FEVALAB"; "PATAB"}*/
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/*"RFP" -> {"OASGP"; "REAL"; "INS"; "CFCAT"}*/
"RFP" -> "PACRATC"
/*"RFP" -> {"XF"; "VSPACE"; "BOOLEAN"; "NNI"; "FLAGG-"; "URAGG-"}*/

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/*"RMCAT2" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"RMCAT2" -> {"DIRPCAT"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"}*/
/*"RMCAT2" -> {"IEVALAB"; "ELTAGG"; "ELTAB"; "FRETRCT"; "RETRACT"; "BMODULE"}*/
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/*"RMCAT2" -> {"FINITE"; "ALGEBRA"; "MODULE"; "COMRING"; "ORDRING"}*/
/*"RMCAT2" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "OAMONS"}*/
/*"RMCAT2" -> {"VSPACE"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"}*/
/*"RMCAT2" -> {"ENTIRER"; "UFD"; "DIVRING"}*/
"RMCAT2" -> "RMATCAT"
/*"RMCAT2" -> {"NNI"; "INT"}*/

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/*"ROIRC" -> {"OAMON"; "OASGP"; "ORDSET"; "ABELMON"; "ABELSG"; "CABMON"}*/
/*"ROIRC" -> {"ABELGRP"; "RING"; "RNG"; "SGROUP"; "MONOID"; "LMODULE"}*/
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/*"ROIRC" -> {"UFD"; "DIVRING"; "UPOLYC"; "POLYCAT"; "PDRING"; "FAMR"}*/
/*"ROIRC" -> {"AMR"; "CHARZ"; "CHARNZ"; "FRETRCT"; "RETRACT"; "EVALAB"}*/
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/*"ROIRC" -> {"ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "NNI"; "INT"; "LIST"}*/
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/*"SDPOL" -> {"MONOID"; "LMODULE"; "FAMR"; "AMR"; "BMODULE"; "RMODULE"}*/
/*"SDPOL" -> {"COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"; "INTDOM"}*/
/*"SDPOL" -> {"ENTIRER"; "FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"}*/
/*"SDPOL" -> {"FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"}*/
/*"SDPOL" -> {"GCDDOM"; "PFECAT"; "UFD"; "DIFEXT"; "DIFRING"; "DVARCAT"}*/
/*"SDPOL" -> {"FPS"; "RNS"; "FIELD"; "EUCDOM"; "PID"; "DIVRING"; "ORDRING"}*/
/*"SDPOL" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "REAL"; "RADCAT"}*/
/*"SDPOL" -> {"INS"; "OINTDOM"; "CFCAT"; "STEP"; "UPOLYC"; "ELTAB"}*/

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/*"SMATCAT" -> {"COMRING"; "FRETRCT"; "RETRACT"; "FLINEXP"; "LINEXP"}*/
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/*"SMATCAT" -> {"OAMONS"; "VSPACE"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"}*/
/*"SMATCAT" -> {"INTDOM"; "ENTIRER"; "UFD"; "DIVRING"; "NNI"; "INT"}*/
/*"SMATCAT" -> {"VECTOR"; "IVECTOR"; "IARRAY1"; "INS"; "OINTDOM"; "KONVERT"}*/
/*"SMATCAT" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "OM"; "VECTCAT"}*/
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/*"SMATCAT" -> {"VECTCAT-"; "A1AGG-"; "FLAGG-"; "LNAGG-"; "IXAGG-"; "CLAGG-"}*/
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/*"SMATCAT-" -> {"BMODULE";  "RMODULE"}*/
"SMATCAT-" -> "RMATCAT"
/*"SMATCAT-" -> {"HOAGG";  "AGG";  "TYPE";  "EVALAB";  "IEVALAB";  "MODULE"}*/
/*"SMATCAT-" -> {"COMRING";  "FRETRCT";  "RETRACT";  "FLINEXP";  "LINEXP"}*/
/*"SMATCAT-" -> {"ALGEBRA";  "DIRPCAT";  "IXAGG";  "ELTAGG";  "ELTAB"}*/
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/*"SMATCAT-" -> {"OASGP";  "ORDSET";  "OAMONS";  "VSPACE";  "FIELD"}*/
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/*"SMATCAT-" -> {"UFD";  "DIVRING";  "NNI";  "INT";  "VECTOR";  "IVECTOR"}*/
/*"SMATCAT-" -> {"IARRAY1";  "INS";  "OINTDOM";  "KONVERT";  "PATMAB"}*/
/*"SMATCAT-" -> {"CFCAT";  "REAL";  "CHARZ";  "STEP";  "OM";  "VECTCAT"}*/
/*"SMATCAT-" -> {"A1AGG";  "FLAGG";  "LNAGG";  "CLAGG";  "LSAGG";  "STAGG"}*/
/*"SMATCAT-" -> {"URAGG";  "RCAGG";  "ELAGG";  "LIST";  "ILIST";  "LSAGG-"}*/
/*"SMATCAT-" -> {"VECTCAT-";  "A1AGG-";  "FLAGG-";  "LNAGG-";  "IXAGG-"}*/
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/*"TUBETOOL" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"TUBETOOL" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/
/*"TUBETOOL" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"TUBETOOL" -> {"REAL"; "KONVERT"; "RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"}*/
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/*"TUBETOOL" -> {"ALGEBRA-"; "DIFRING-"; "ORDRING-"; "MODULE-"}*/
"TUBETOOL" -> "FRAC"
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/*"UPXSCCA" -> {"RMODULE"; "COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"}*/
/*"UPXSCCA" -> {"CHARNZ"; "INTDOM"; "ENTIRER"; "ELTAB"; "DIFRING"}*/
/*"UPXSCCA" -> {"PDRING"; "RADCAT"; "TRANFUN"; "TRIGCAT"; "ATRIG"}*/
/*"UPXSCCA" -> {"HYPCAT"; "AHYP"; "ELEMFUN"; "FIELD"; "EUCDOM"; "PID"}*/
/*"UPXSCCA" -> {"GCDDOM"; "UFD"; "DIVRING"; "RETRACT"; "ULSCAT"}*/

"UPXSCCA-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=UPXSCCA"]
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/*"UPXSCCA-" -> {"UPSCAT";  "PSCAT";  "AMR";  "RING";  "RNG";  "ABELGRP"}*/
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/*"UPXSCCA-" -> {"KOERCE";  "SGROUP";  "MONOID";  "LMODULE";  "BMODULE"}*/
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/*"UPXSCCA-" -> {"GCDDOM";  "UFD";  "DIVRING";  "RETRACT";  "ULSCAT"}*/
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———-

1.4.15 Layer13

Depends on: DIAGG FRAMALG MDAGG SMATCAT UPXSCCA RFP
Used by next layer: FSAGG KDAGG MSETAGG MONOGEN

— **layer13** —

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  ${OUT}/AFALGGRO.o ${OUT}/AFALGRES.o \
  ${OUT}/DPMM.o     ${OUT}/EFUPXS.o  ${OUT}/FFINTBAS.o ${OUT}/FRIDEAL.o  \
  ${OUT}/FRIDEAL2.o ${OUT}/FRMOD.o   ${OUT}/FSAGG.o    ${OUT}/FSAGG-.o   \
  ${OUT}/IBATOOL.o  ${OUT}/INTFACT.o ${OUT}/KDAGG.o    ${OUT}/KDAGG-.o   \
  ${OUT}/MSETAGG.o  ${OUT}/MONOGEN.o ${OUT}/MONOGEN-.o ${OUT}/NFINTBAS.o \
  layer13done
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———-

— **layerpic** —

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/* layer 13 */
/* depends on: DIAGG FRAMALG MDAGG SMATCAT UPXSCCA RFP*/

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"AFALGGRO" -> "PFECAT"
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/*"AFALGGRO" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"AFALGGRO" -> {"UFD"; "DIVRING"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"}*/
/*"AFALGGRO" -> {"CHARZ"; "CHARNZ"; "FRETRCT"; "RETRACT"; "EVALAB"}*/
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/*"AFALGGRO" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "OAMONS"; "VSPACE"}*/
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/*"AFALGGRO" -> {"MONOID-"; "ABELMON-"; "ORDSET-"; "SGROUP-"; "ORDFIN"}*/
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/*"AFALGRES" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"AFALGRES" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"AFALGRES" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"AFALGRES" -> {"UFD"; "DIVRING"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"}*/
/*"AFALGRES" -> {"CHARNZ"; "FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"}*/
/*"AFALGRES" -> {"LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"; "PFECAT"}*/
/*"AFALGRES" -> {"IXAGG"; "HOAGG"; "AGG"; "TYPE"; "ELTAGG"; "ELTAB"}*/
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/*"AFALGRES" -> {"OASGP"; "OAMONS"; "VSPACE"; "UPOLYC"; "STEP"; "NNI"; "INT"}*/
/*"AFALGRES" -> {"LIST"; "ILIST"; "LSAGG-"; "STAGG-"; "FFIELDC"; "FPC"; "PI"}*/
/*"AFALGRES" -> {"VECTOR"; "OUTFORM"; "MONOID-"; "ABELMON-"; "ORDSET-"}*/
/*"AFALGRES" -> {"SGROUP-"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "LNAGG"}*/
/*"AFALGRES" -> {"CLAGG"; "FLAGG"; "ELAGG"; "OM"; "ELAGG-"; "FLAGG-"}*/
/*"AFALGRES" -> {"INS-"; "EUCDOM-"; "UFD-"; "GCDDOM-"; "ENTIRER"; "FLINEXP"}*/
/*"AFALGRES" -> {"URAGG-"; "DIRPCAT"; "DIFEXT"; "OAMON"}*/

"DPMM" [color="#88FF44",href="bookvol10.3.pdf#nameddest=DPMM"]
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/*"DPMM" -> {"BASTYPE"; "KOERCE"; "EVALAB"; "IEVALAB"; "ELTAGG"; "ELTAB"}*/
/*"DPMM" -> {"FRETRCT"; "RETRACT"; "BMODULE"; "LMODULE"; "ABELGRP"}*/
/*"DPMM" -> {"CABMON"; "ABELMON"; "ABELSG"; "RMODULE"; "DIFEXT"; "RING"}*/
/*"DPMM" -> {"RNG"; "SGROUP"; "MONOID"; "DIFRING"; "PDRING"; "FLINEXP"}*/
/*"DPMM" -> {"LINEXP"; "FINITE"; "ALGEBRA"; "MODULE"; "COMRING"; "ORDRING"}*/
/*"DPMM" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "OAMONS"}*/
/*"DPMM" -> {"VSPACE"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"}*/
/*"DPMM" -> {"ENTIRER"; "UFD"; "DIVRING"}*/
"DPMM" -> "SMATCAT"
/*"DPMM" -> {"RMATCAT"; "SINT"; "PI"; "NNI"; "INT"; "INS"; "OINTDOM"}*/
/*"DPMM" -> {"KONVERT"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "OM"}*/

"EFUPXS" [color="#FF4488",href="bookvol10.4.pdf#nameddest=EFUPXS"]
/*"EFUPXS" -> "PTRANFN"*/
"EFUPXS" -> "UPXSCCA"
/*"EFUPXS" -> {"UPXSCAT"; "UPSCAT"; "PSCAT"; "AMR"; "RING"; "RNG"; "ABELGRP"}*/
/*"EFUPXS" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"EFUPXS" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"EFUPXS" -> {"COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"; "INTDOM"}*/
/*"EFUPXS" -> {"ENTIRER"; "ELTAB"; "DIFRING"; "PDRING"; "RADCAT"; "TRANFUN"}*/
/*"EFUPXS" -> {"TRIGCAT"; "ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "FIELD"}*/
/*"EFUPXS" -> {"EUCDOM"; "PID"; "GCDDOM"; "UFD"; "DIVRING"; "RETRACT"}*/
/*"EFUPXS" -> {"ULSCAT"; "NNI"; "INT"; "INS"; "OINTDOM"; "ORDRING"}*/
/*"EFUPXS" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "KONVERT"}*/
/*"EFUPXS" -> {"LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "STEP"; "OM"; "PI"}*/
/*"EFUPXS" -> {"STRING"; "CHAR"; "SINT"; "OUTFORM"; "LIST"; "PRIMARR"}*/
/*"EFUPXS" -> {"A1AGG-"; "ISTRING"}*/

"FFINTBAS" [color="#FF4488",href="bookvol10.4.pdf#nameddest=FFINTBAS"]
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/*"FFINTBAS" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"FFINTBAS" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"FFINTBAS" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"FFINTBAS" -> {"UPOLYC"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARZ"}*/
/*"FFINTBAS" -> {"CHARNZ"; "FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"}*/
/*"FFINTBAS" -> {"FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"}*/
/*"FFINTBAS" -> {"PFECAT"; "UFD"; "ELTAB"; "DIFRING"; "DIFEXT"; "STEP"}*/
/*"FFINTBAS" -> {"FIELD"; "DIVRING"}*/
"FFINTBAS" -> "FRAMALG"
/*"FFINTBAS" -> {"FINRALG"; "INT"; "VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"}*/
/*"FFINTBAS" -> {"IXAGG"; "HOAGG"; "AGG"; "TYPE"; "ELTAGG"; "CLAGG"; "NNI"}*/

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/*"FRIDEAL" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"FRIDEAL" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"FRIDEAL" -> {"ENTIRER"; "QFCAT"; "FIELD"; "UFD"; "DIVRING"; "RETRACT"}*/
/*"FRIDEAL" -> {"FEVALAB"; "ELTAB"; "EVALAB"; "IEVALAB"; "DIFEXT"}*/
/*"FRIDEAL" -> {"DIFRING"; "PDRING"; "FLINEXP"; "LINEXP"; "PATAB"}*/
/*"FRIDEAL" -> {"KONVERT"; "FPATMAB"; "TYPE"; "PATMAB"; "STEP"; "ORDSET"}*/
/*"FRIDEAL" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"FRIDEAL" -> {"REAL"; "CHARZ"; "CHARNZ"; "PFECAT"; "UPOLYC"; "POLYCAT"}*/
/*"FRIDEAL" -> {"FAMR"; "AMR"; "FRETRCT"}*/
"FRIDEAL" -> "FRAMALG"
/*"FRIDEAL" -> {"FINRALG"; "VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"}*/
/*"FRIDEAL" -> {"HOAGG"; "AGG"; "ELTAGG"; "CLAGG"; "INT"; "VECTOR"}*/
/*"FRIDEAL" -> {"IVECTOR"; "IARRAY1"; "VECTCAT-"; "A1AGG-"; "BOOLEAN"}*/
/*"FRIDEAL" -> {"LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "ELAGG"; "OM"; "LIST"}*/
/*"FRIDEAL" -> {"ILIST"; "LSAGG-"; "SINT"; "NNI"; "MONOID-"; "ABELMON-"}*/
/*"FRIDEAL" -> {"INS"; "CFCAT"; "STAGG-"; "ELAGG-"; "FLAGG-"; "LNAGG-"}*/
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/*"FRIDEAL2" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"FRIDEAL2" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
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/*"FRIDEAL2" -> {"ELTAB"; "EVALAB"; "IEVALAB"; "DIFEXT"; "DIFRING"}*/
/*"FRIDEAL2" -> {"PDRING"; "FLINEXP"; "LINEXP"; "PATAB"; "KONVERT"}*/
/*"FRIDEAL2" -> {"FPATMAB"; "TYPE"; "PATMAB"; "STEP"; "ORDSET"; "OINTDOM"}*/
/*"FRIDEAL2" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "REAL"}*/
/*"FRIDEAL2" -> {"CHARZ"; "CHARNZ"; "PFECAT"; "UPOLYC"; "POLYCAT"; "FAMR"}*/
/*"FRIDEAL2" -> {"AMR"; "FRETRCT"}*/
"FRIDEAL2" -> "FRAMALG"
/*"FRIDEAL2" -> {"FINRALG"; "INS"; "CFCAT"; "OM"; "INT"; "VECTOR"; "IVECTOR"}*/
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/*"FRMOD" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
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/*"FRMOD" -> {"CHARNZ"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"FRMOD" -> {"ENTIRER"; "QFCAT"; "FIELD"; "UFD"; "DIVRING"; "RETRACT"}*/
/*"FRMOD" -> {"FEVALAB"; "ELTAB"; "EVALAB"; "IEVALAB"; "DIFEXT"; "DIFRING"}*/
/*"FRMOD" -> {"PDRING"; "FLINEXP"; "LINEXP"; "PATAB"; "KONVERT"; "FPATMAB"}*/
/*"FRMOD" -> {"TYPE"; "PATMAB"; "STEP"; "ORDSET"; "OINTDOM"; "ORDRING"}*/
/*"FRMOD" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "REAL"; "PFECAT"}*/
/*"FRMOD" -> {"UPOLYC"; "POLYCAT"; "FAMR"; "AMR"; "FRETRCT"; "BOOLEAN"}*/
/*"FRMOD" -> {"VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"}*/
/*"FRMOD" -> {"AGG"; "ELTAGG"; "CLAGG"; "INT"; "VECTOR"; "IVECTOR"}*/
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"FSAGG-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=FSAGG"]
"FSAGG-" -> "DIAGG"
/*"FSAGG-" -> {"DIOPS";  "BGAGG";  "HOAGG";  "AGG";  "TYPE";  "SETCAT"}*/
/*"FSAGG-" -> {"BASTYPE";  "KOERCE";  "EVALAB";  "IEVALAB";  "CLAGG"}*/
/*"FSAGG-" -> {"KONVERT";  "SETAGG";  "FINITE";  "NNI";  "INT";  "BOOLEAN"}*/
/*"FSAGG-" -> {"SINT";  "PI";  "INS-";  "ORDSET";  "LIST";  "ILIST"}*/
/*"FSAGG-" -> {"LSAGG";  "STAGG";  "URAGG";  "RCAGG";  "LNAGG";  "IXAGG"}*/
/*"FSAGG-" -> {"ELTAGG";  "ELTAB";  "FLAGG";  "ELAGG";  "OM";  "LSAGG-"}*/

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/*"IBATOOL" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"IBATOOL" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"IBATOOL" -> {"UPOLYC"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARZ"}*/
/*"IBATOOL" -> {"CHARNZ"; "FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"}*/
/*"IBATOOL" -> {"FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"; "PFECAT"}*/
/*"IBATOOL" -> {"UFD"; "ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "FIELD"}*/
/*"IBATOOL" -> "DIVRING"*/
"IBATOOL" -> "FRAMALG"
/*"IBATOOL" -> {"FINRALG"; "SINT"; "NNI"; "INT"; "PI"; "INS"; "OINTDOM"}*/
/*"IBATOOL" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "CFCAT"}*/
/*"IBATOOL" -> {"REAL"; "OM"; "VECTOR"; "IVECTOR"; "IARRAY1"; "VECTCAT"}*/
/*"IBATOOL" -> {"A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"}*/
/*"IBATOOL" -> {"TYPE"; "ELTAGG"; "CLAGG"}*/

"INTFACT" [color="#FF4488",href="bookvol10.4.pdf#nameddest=INTFACT"]
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/*"INTFACT" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"INTFACT" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"INTFACT" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"INTFACT" -> {"EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
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/*"INTFACT" -> {"LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "INT"}*/
/*"INTFACT" -> {"INS-"; "EUCDOM-"; "UFD-"; "GCDDOM-"; "INTDOM-"; "ALGEBRA-"}*/
/*"INTFACT" -> {"DIFRING-"; "ORDRING-"; "MODULE-"; "RING-"; "ABELGRP-"}*/
/*"INTFACT" -> {"ABELMON-"; "LIST"; "ILIST"; "LSAGG-"; "STAGG-"; "ELAGG-"}*/
/*"INTFACT" -> {"PI"; "NNI"; "SINT"; "BOOLEAN"}*/
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/*"KDAGG-" -> {"DIOPS";  "BGAGG";  "HOAGG";  "AGG";  "TYPE";  "SETCAT"}*/
/*"KDAGG-" -> {"BASTYPE";  "KOERCE";  "EVALAB";  "IEVALAB";  "CLAGG"}*/
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/*"MONOGEN" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
"MONOGEN" -> "FRAMALG"
/*"MONOGEN" -> {"FINRALG"; "ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"}*/
/*"MONOGEN" -> {"KONVERT"; "FRETRCT"; "RETRACT"; "FLINEXP"; "LINEXP"}*/
/*"MONOGEN" -> {"FINITE"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"}*/
/*"MONOGEN" -> {"ENTIRER"; "UFD"; "DIVRING"; "DIFEXT"; "DIFRING"; "PDRING"}*/
/*"MONOGEN" -> {"FFIELDC"; "FPC"; "STEP"; "UPOLYC"; "POLYCAT"; "FAMR"}*/
/*"MONOGEN" -> {"AMR"; "EVALAB"; "IEVALAB"; "ORDSET"; "PATMAB"; "PFECAT"}*/
/*"MONOGEN" -> {"ELTAB"; "NNI"; "INT"; "SINT"; "MONOID-"; "ABELMON-"}*/
/*"MONOGEN" -> {"ORDSET-"; "SGROUP-"; "PI"; "VECTOR"; "IVECTOR"; "IARRAY1"}*/
/*"MONOGEN" -> {"INS"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"MONOGEN" -> {"OASGP"; "CFCAT"; "REAL"}*/

"MONOGEN-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=MONOGEN"]
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/*"MONOGEN-" -> {"ABELMON";  "ABELSG";  "SETCAT";  "BASTYPE";  "KOERCE"}*/
/*"MONOGEN-" -> {"SGROUP";  "MONOID";  "LMODULE";  "BMODULE";  "RMODULE"}*/
"MONOGEN-" -> "FRAMALG"
/*"MONOGEN-" -> {"FINRALG";  "ALGEBRA";  "MODULE";  "CHARZ";  "CHARNZ"}*/
/*"MONOGEN-" -> {"KONVERT";  "FRETRCT";  "RETRACT";  "FLINEXP";  "LINEXP"}*/
/*"MONOGEN-" -> {"FINITE";  "FIELD";  "EUCDOM";  "PID";  "GCDDOM";  "INTDOM"}*/
/*"MONOGEN-" -> {"ENTIRER";  "UFD";  "DIVRING";  "DIFEXT";  "DIFRING"}*/
/*"MONOGEN-" -> {"PDRING";  "FFIELDC";  "FPC";  "STEP";  "UPOLYC"}*/
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/*"MONOGEN-" -> {"ORDSET"; "PATMAB"; "PFECAT"; "ELTAB"; "NNI"; "INT"}*/
/*"MONOGEN-" -> {"SINT"; "MONOID-"; "ABELMON-"; "ORDSET-"; "SGROUP-"}*/
/*"MONOGEN-" -> {"PI"; "VECTOR"; "IVECTOR"; "IARRAY1"; "INS"; "OINTDOM"}*/
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/*"MONOGEN-" -> {"CFCAT"; "REAL"}*/

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/*"NFINTBAS" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"NFINTBAS" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "FAMR"; "AMR"}*/
/*"NFINTBAS" -> {"BMODULE"; "RMODULE"; "COMRING"; "ALGEBRA"; "MODULE"}*/
/*"NFINTBAS" -> {"CHARZ"; "CHARNZ"; "INTDOM"; "ENTIRER"; "FRETRCT"}*/
/*"NFINTBAS" -> {"RETRACT"; "EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"}*/
/*"NFINTBAS" -> {"ORDSET"; "KONVERT"; "PATMAB"; "GCDDOM"; "PFECAT"; "UFD"}*/
/*"NFINTBAS" -> {"ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "EUCDOM"; "PID"}*/
/*"NFINTBAS" -> {"FIELD"; "DIVRING"}*/
"NFINTBAS" -> "FRAMALG"
/*"NFINTBAS" -> {"FINRALG"; "INT"; "VECTOR"; "IVECTOR"; "IARRAY1"; "INS"}*/
/*"NFINTBAS" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"NFINTBAS" -> {"OASGP"; "CFCAT"; "REAL"; "OM"; "VECTCAT"; "A1AGG"; "FLAGG"}*/
/*"NFINTBAS" -> {"LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"; "ELTAGG"}*/
/*"NFINTBAS" -> {"CLAGG"; "LIST"; "ILIST"; "PI"; "NNI"; "INS-"; "EUCDOM-"}*/
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———-

1.4.16 Layer14

Depends on: FSAGG KDAGG MSETAGG MONOGEN
Used by next layer: TBAGG

— **layer14** —

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  ${OUT}/CCLASS.o   ${OUT}/CPIMA.o   ${OUT}/FSAGG2.o   ${OUT}/GALFACT.o  \
  ${OUT}/IALGFACT.o ${OUT}/IBACHIN.o  ${OUT}/MMLFORM.o ${OUT}/NORMMA.o   \
  ${OUT}/ODERED.o   ${OUT}/OMSAGG.o   ${OUT}/PERM.o    ${OUT}/PERMGRP.o  \
  ${OUT}/PRIMES.o   ${OUT}/PRJALGPK.o \
  ${OUT}/PWFFINTB.o ${OUT}/RDIST.o   ${OUT}/SAE.o      \
  ${OUT}/SAEFACT.o  ${OUT}/SAERFFC.o  ${OUT}/SGCF.o    ${OUT}/SPACE3.o   \
  ${OUT}/TBAGG.o    ${OUT}/TBAGG-.o   ${OUT}/VIEW3D.o  ${OUT}/WFFINTBS.o \
  layer14done
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———-

— **layerpic** —

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/* depends on: FSAGG KDAGG MSETAGG MONOGEN */

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"BSD" -> "FSAGG"

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/*"CHAR" -> {"SINT"; "INT"; "NNI"; "PRIMARR"; "A1AGG-"; "INS"; "UFD"}*/
/*"CHAR" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"CHAR" -> {"CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"CHAR" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"}*/
/*"CHAR" -> {"PID"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"CHAR" -> {"OASGP"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"}*/
/*"CHAR" -> {"CFCAT"; "REAL"; "CHARZ"; "STEP"; "OM"; "PI"}*/
"CHAR" -> "FSAGG"
/*"CHAR" -> {"DIAGG"; "DIOPS"; "BGAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"}*/
/*"CHAR" -> {"IEVALAB"; "CLAGG"; "SETAGG"; "STRING"; "CHAR"; "OUTFORM"}*/
/*"CHAR" -> {"LIST"; "ISTRING"; "STRICAT"; "SRAGG"; "A1AGG"; "FLAGG"}*/
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"CCLASS" -> "FSAGG"
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/*"CCLASS" -> {"A1AGG-"; "ISTRING"; "SRAGG-"; "NNI"; "BOOLEAN"; "INS"; "UFD"}*/
/*"CCLASS" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
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/*"RDIST" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"RDIST" -> {"ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"RDIST" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"; "PID"}*/
/*"RDIST" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"RDIST" -> {"ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"}*/
/*"RDIST" -> {"CFCAT"; "REAL"; "CHARZ"; "STEP"; "LSAGG"; "STAGG"; "URAGG"}*/
/*"RDIST" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "LNAGG"}*/
/*"RDIST" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "FLAGG"; "ELAGG"; "OM"}*/
/*"RDIST" -> {"VECTCAT"; "A1AGG"}*/
"RDIST" -> "FSAGG"
/*"RDIST" -> {"DIAGG"; "DIOPS"; "BGAGG"; "SETAGG"; "FINITE"}*/

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/*"SAE" -> {"UPOLYC"; "POLYCAT"; "PDRING"; "RING"; "RNG"; "ABELGRP"}*/
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/*"SAE" -> {"RMODULE"; "COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"}*/
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/*"SAE" -> {"FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"; "GCDDOM"}*/
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/*"SAE" -> {"PID"; "FIELD"; "DIVRING"}*/
"SAE" -> "MONOGEN"
/*"SAE" -> {"FRAMALG"; "FINRALG"; "FINITE"; "FFIELDC"; "FPC"; "NNI"; "INT"}*/
/*"SAE" -> {"BOOLEAN"; "SINT"; "VECTOR"; "IVECTOR"; "IARRAY1"; "VECTCAT-"}*/
/*"SAE" -> {"A1AGG-"; "FLAGG-"; "LNAGG-"; "IXAGG-"; "CLAGG-"; "HOAGG-"}*/
/*"SAE" -> {"ORDSET-"; "AGG-"; "ELTAGG-"; "SETCAT-"; "BASTYPE-"; "VECTCAT"}*/
/*"SAE" -> {"A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"}*/
/*"SAE" -> {"ELTAGG"; "CLAGG"; "QFCAT"; "FEVALAB"; "PATAB"; "FPATMAB"}*/
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/*"SAEFACT" -> {"FIELD"; "DIVRING"}*/
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/*"SAEFACT" -> {"FRAMALG"; "FINRALG"; "FINITE"; "FFIELDC"; "FPC"; "INS"}*/
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/*"SAERFFC" -> {"FRAMALG"; "FINRALG"; "FINITE"; "FFIELDC"; "FPC"; "INS"}*/
/*"SAERFFC" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
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/*"SGCF" -> {"ELTAB"; "CLAGG"; "KONVERT"; "ORDSET"; "VECTCAT-"; "A1AGG-"}*/
/*"SGCF" -> {"FLAGG-"; "LNAGG-"; "IXAGG-"; "LSAGG"; "STAGG"; "URAGG"}*/
/*"SGCF" -> {"RCAGG"; "ELAGG"; "OM"; "INS"; "UFD"; "GCDDOM"; "INTDOM"}*/
/*"SGCF" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"SGCF" -> {"ABELSG"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"SGCF" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"}*/
/*"SGCF" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "DIFRING"}*/
/*"SGCF" -> {"RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"}*/
/*"SGCF" -> {"STEP"; "ELAGG-"; "URAGG-"}*/
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/*"SPACE3" -> {"CLAGG"; "KONVERT"; "FLAGG"; "ORDSET"; "ELAGG"; "OM"}*/
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/*"TBAGG-" -> {"CLAGG";  "KONVERT";  "IXAGG";  "ELTAGG";  "ELTAB"}*/
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/*"VIEW3D" -> {"ORDRING-"; "MODULE-"; "FRAC"; "RING-"; "ABELGRP-"}*/
/*"VIEW3D" -> {"ABELMON-"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "LIST"}*/
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/*"VIEW3D" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "REAL"}*/
/*"VIEW3D" -> {"KONVERT"; "RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"; "DIFRING"}*/
/*"VIEW3D" -> "OM"*/
"VIEW3D" -> "FSAGG"
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/*"VIEW3D" -> {"URAGG"; "RCAGG"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"}*/
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/*"WFFINTBS" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
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/*"WFFINTBS" -> {"FINITE"; "STEP"; "DIFRING"; "UPOLYC"; "POLYCAT"; "PDRING"}*/
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/*"WFFINTBS" -> {"IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"}*/
/*"WFFINTBS" -> {"PATMAB"; "PFECAT"; "ELTAB"; "DIFEXT"; "FRAMALG"}*/
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/*"WFFINTBS" -> {"VECTOR"; "IVECTOR"; "IARRAY1"; "VECTCAT"; "A1AGG"}*/
/*"WFFINTBS" -> {"FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"; "TYPE"}*/
/*"WFFINTBS" -> {"ELTAGG"; "CLAGG"}*/
"WFFINTBS" -> "MONOGEN"
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1.4.17 Layer15

Depends on: TBAGG
Used by next layer: ALIST

— layer15 —

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LAYER15=\
  ${OUT}/ALIST.o   ${OUT}/EQTBL.o   ${OUT}/GSTBL.o   ${OUT}/HASHTBL.o \
  ${OUT}/INTABL.o  ${OUT}/INTFTBL.o ${OUT}/INTPACK.o ${OUT}/IPF.o     \
  ${OUT}/KAFILE.o  ${OUT}/PATRES.o  ${OUT}/PDEPACK.o ${OUT}/STBL.o    \
  ${OUT}/STRTBL.o  ${OUT}/TABLE.o   ${OUT}/TBCMPPK.o  \
  layer15done
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— layerpic —

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/* layer 15 */
/* depends on: TBAGG */

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/*"ALAGG" -> {"KONVERT"; "IXAGG"; "ELTAGG"; "ELTAB"; "LSAGG"; "STAGG"}*/
/*"ALAGG" -> {"URAGG"; "RCAGG"; "LNAGG"; "FLAGG"; "ORDSET"; "ELAGG"}*/

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/*"ALIST" -> {"INT"; "LIST"; "ILIST"; "OM"; "INS"; "UFD"; "GCDDOM"}*/
/*"ALIST" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"ALIST" -> {"ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"ALIST" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"; "PID"}*/
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/*"ALIST" -> {"URAGG-"; "LNAGG-"; "BOOLEAN"; "STRING"; "CHAR"; "SINT"}*/
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"FFIELDC" -> "TBAGG"
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/*"FFIELDC-" -> {"ORDSET";  "VECTOR";  "IVECTOR";  "IARRAY1";  "VECTCAT-"}*/
/*"FFIELDC-" -> {"A1AGG-";  "BOOLEAN";  "SINT";  "OAMONS";  "OCAMON"}*/
/*"FFIELDC-" -> {"OAMON";  "OASGP"}*/
"FFIELDC-" -> "TBAGG"
/*"FFIELDC-" -> {"KDAGG";  "DIAGG";  "DIOPS";  "BGAGG";  "INS-";  "INS"}*/
/*"FFIELDC-" -> {"OINTDOM";  "ORDRING";  "OAGROUP";  "RETRACT";  "LINEXP"}*/
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/*"INTPACK" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
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/*"INTPACK" -> {"OAMON"; "OASGP"; "ORDSET"; "REAL"; "KONVERT"; "RETRACT"}*/
/*"INTPACK" -> {"RADCAT"; "PATMAB"; "CHARZ"; "DIFRING"; "OM"; "TRANFUN"}*/
/*"INTPACK" -> {"TRIGCAT"; "ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "LSAGG"}*/
/*"INTPACK" -> {"STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"}*/
/*"INTPACK" -> {"IEVALAB"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"}*/
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/*"INTPACK" -> {"FLAGG-"; "LNAGG-"; "BOOLEAN"; "STAGG-"}*/
"INTPACK" -> "TBAGG"
/*"INTPACK" -> {"KDAGG"; "DIAGG"; "DIOPS"; "BGAGG"; "NNI"; "INS-"; "PI"}*/
/*"INTPACK" -> {"MONOID-"; "ABELMON-"; "ORDSET-"; "SGROUP-"; "ABELSG-"}*/
/*"INTPACK" -> {"SETCAT-"; "BASTYPE-"; "STRICAT"; "SRAGG"; "A1AGG"}*/
/*"INTPACK" -> "SPFCAT"*/

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/*"IPF" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"IPF" -> {"ENTIRER"; "UFD"; "DIVRING"; "CHARNZ"; "FINITE"; "STEP"}*/
/*"IPF" -> {"DIFRING"; "FAXF"; "XF"; "RETRACT"; "VSPACE"; "CHARZ"; "KONVERT"}*/
/*"IPF" -> {"PI"; "NNI"; "INT"; "LIST"; "BOOLEAN"; "OAMONS"; "OCAMON"}*/
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/*"IPF" -> {"INS-"; "ILIST"; "INS"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"IPF" -> {"LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "VECTOR"; "IVECTOR"}*/
/*"IPF" -> {"IARRAY1"; "VECTCAT-"; "A1AGG-"; "FLAGG-"; "LNAGG-"; "IXAGG-"}*/
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/*"KAFILE" -> {"ELTAB"; "FNCAT"; "STRING"; "CHAR"; "SINT"; "OUTFORM"}*/
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/*"PDEPACK" -> {"KONVERT"; "IXAGG"; "ELTAGG"; "ELTAB"; "NNI"; "SYMBOL"}*/
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/*"PDEPACK" -> {"ABELSG"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"PDEPACK" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/
/*"PDEPACK" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"PDEPACK" -> {"REAL"; "RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"; "DIFRING"}*/
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/*"TBCMPPK" -> "ELTAB"*/
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———-

1.4.18 Layer16

Depends on: ALIST
Used by next layer: ACF COMPCAT FFCAT FRNAALG FS OC QUATCAT RPOLCAT UTSCAT

— **layer16** —

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LAYER16=\
  ${OUT}/ACF.o      ${OUT}/ACF-.o     ${OUT}/ACPLOT.o   ${OUT}/ANTISYM.o  \
  ${OUT}/ANY.o      ${OUT}/ASP12.o    ${OUT}/ASP27.o    ${OUT}/ASP28.o    \
  ${OUT}/ASP30.o    ${OUT}/ASP33.o    ${OUT}/ASP49.o    ${OUT}/ASP55.o    \
  ${OUT}/ASP7.o     ${OUT}/ASP78.o    ${OUT}/ASP8.o     ${OUT}/ASP9.o     \
  ${OUT}/ATTRBUT.o  ${OUT}/BLUPPACK.o \
  ${OUT}/BOP.o      ${OUT}/BOP1.o     ${OUT}/COMMONOP.o \
  ${OUT}/COMPCAT.o  ${OUT}/COMPCAT-.o ${OUT}/DRAW.o     ${OUT}/DRAWCFUN.o \
  ${OUT}/DROPT.o    ${OUT}/DROPT0.o   ${OUT}/D01ANFA.o  ${OUT}/D01ASFA.o  \
  ${OUT}/D03AGNT.o  ${OUT}/EP.o       ${OUT}/E04AGNT.o  ${OUT}/FCPAK1.o   \
  ${OUT}/FEXPR.o    ${OUT}/FFCAT.o    ${OUT}/FFCAT-.o   ${OUT}/FFCGP.o    \
  ${OUT}/FFNBP.o    ${OUT}/FFP.o      ${OUT}/FLOAT.o    ${OUT}/FPARFRAC.o \
  ${OUT}/FR.o       ${OUT}/FRNAALG.o  ${OUT}/FRNAALG-.o ${OUT}/FS.o       \
  ${OUT}/FS-.o      ${OUT}/FST.o      ${OUT}/FUNCTION.o ${OUT}/GDMP.o     \
  ${OUT}/GOPT.o     ${OUT}/GOPT0.o    ${OUT}/HACKPI.o   ${OUT}/IDEAL.o    \
  ${OUT}/INFCLCT.o  \
  ${OUT}/INFORM.o   ${OUT}/INFORM1.o  ${OUT}/IPRNTPK.o  ${OUT}/IR.o       \
  ${OUT}/ISUPS.o    ${OUT}/KERNEL.o   ${OUT}/LIB.o      ${OUT}/LMDICT.o   \
  ${OUT}/LODO.o     ${OUT}/LODOOPS.o  ${OUT}/MATRIX.o   ${OUT}/MKFLCFN.o  \
  ${OUT}/MSET.o     ${OUT}/M3D.o      ${OUT}/NAGC02.o   ${OUT}/NAGC05.o   \
  ${OUT}/NAGC06.o   ${OUT}/NAGD01.o   ${OUT}/NAGD02.o   ${OUT}/NAGD03.o   \
  ${OUT}/NAGE01.o   ${OUT}/NAGE02.o   ${OUT}/NAGE04.o   ${OUT}/NAGF07.o   \
  ${OUT}/NAGS.o     ${OUT}/NAGSP.o    ${OUT}/NREP.o     ${OUT}/NSDPS.o    \
  ${OUT}/NUMFMT.o   \
  ${OUT}/OC.o       ${OUT}/OC-.o      ${OUT}/ODEPACK.o  ${OUT}/ODERAT.o   \
  ${OUT}/OMERR.o    ${OUT}/OMERRK.o   ${OUT}/OPTPACK.o  ${OUT}/OSI.o      \
  ${OUT}/OVAR.o     ${OUT}/PACOFF.o   ${OUT}/PACRAT.o  \
  ${OUT}/PATTERN.o  ${OUT}/PLCS.o     ${OUT}/PMKERNEL.o ${OUT}/PMSYM.o    \
  ${OUT}/POLY.o     ${OUT}/PRIMELT.o  ${OUT}/QALGSET2.o ${OUT}/QEQUAT.o   \
  ${OUT}/QUATCAT.o  ${OUT}/QUATCAT-.o ${OUT}/RECLOS.o   ${OUT}/REP1.o     \
  ${OUT}/RESULT.o   ${OUT}/RFFACT.o   ${OUT}/RMATRIX.o  ${OUT}/ROMAN.o    \
  ${OUT}/ROUTINE.o  ${OUT}/RPOLCAT.o  ${OUT}/RPOLCAT-.o ${OUT}/RULECOLD.o \
  ${OUT}/SAOS.o     ${OUT}/SCELL.o  \
  ${OUT}/SEGBIND.o  ${OUT}/SEM.o      ${OUT}/SET.o      ${OUT}/SPECOUT.o  \
  ${OUT}/SQMATRIX.o ${OUT}/SWITCH.o   ${OUT}/SYMS.o     ${OUT}/SYMTAB.o   \
  ${OUT}/SYSSOLP.o  ${OUT}/UTSCAT.o   ${OUT}/UTSCAT-.o  ${OUT}/VARIABLE.o \
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layer16done
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———-

— layerpic —

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/* layer 16 */
/* depends on: ALIST */

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/*"ACF" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
/*"ACF" -> {"DIVRING"; "RADCAT"; "SYMBOL"; "INT"; "REF"}*/
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/*"ACF-" -> {"AMR";  "CHARZ";  "CHARNZ";  "FRETRCT";  "RETRACT";  "EVALAB"}*/
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/*"ASP12" -> {"MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"}*/
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"ASP27" -> "ALIST"
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/*"ASP28" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/
/*"ASP28" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
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/*"ASP30" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/
/*"ASP30" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"ASP30" -> {"REAL"; "KONVERT"; "RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"}*/
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/*"ASP49" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
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/*"ASP49" -> {"ORDSET"; "REAL"; "KONVERT"; "RETRACT"; "RADCAT"; "PATMAB"}*/
/*"ASP49" -> {"CHARZ"; "ES"; "IEVALAB"; "EVALAB"; "VECTCAT"; "A1AGG"}*/
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/*"ASP49" -> {"ELAGG"; "FMTC"; "INS"; "OINTDOM"; "DIFRING"; "LINEXP"}*/
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/*"ASP78" -> {"ORDSET"; "REAL"; "KONVERT"; "RETRACT"; "RADCAT"; "PATMAB"}*/
/*"ASP78" -> {"CHARZ"; "FMTC"; "INS"; "OINTDOM"; "DIFRING"; "LINEXP"}*/
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/*"ASP9" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
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/*"DROPT" -> {"FLAGG"; "ORDSET"; "ELAGG"; "OM"; "INT"; "LIST"; "ILIST"}*/
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/*"DROPT" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"}*/
/*"DROPT" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"DROPT" -> {"ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"DROPT" -> {"OCAMON"; "OAMON"; "OASGP"; "DIFRING"; "RETRACT"; "LINEXP"}*/
/*"DROPT" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "SYMBOL"; "REF"}*/
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/*"DROPT" -> {"STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"}*/
/*"DROPT" -> {"ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"; "NNI"; "FPS"}*/
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/*"DROPT0" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"DROPT0" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"DROPT0" -> {"ENTIRER"; "UFD"; "DIVRING"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
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/*"D01ANFA" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
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/*"D01ANFA" -> {"ORDSET"; "REAL"; "KONVERT"; "RETRACT"; "RADCAT"; "PATMAB"}*/
/*"D01ANFA" -> {"CHARZ"; "DIFRING"; "OM"; "TRANFUN"; "TRIGCAT"; "ATRIG"}*/
/*"D01ANFA" -> {"HYPCAT"; "AHYP"; "ELEMFUN"; "SPFCAT"; "PI"; "INS-"}*/
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/*"D01ASFA" -> {"REAL"; "KONVERT"; "RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"}*/
/*"D01ASFA" -> {"DIFRING"; "OM"; "TRANFUN"; "TRIGCAT"; "ATRIG"; "HYPCAT"}*/
/*"D01ASFA" -> {"AHYP"; "ELEMFUN"; "SPFCAT"; "PI"; "INS-"; "EUCDOM-"; "UFD-"}*/
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/*"D03AGNT" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
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/*"EP" -> {"REAL"; "NNI"; "INT"; "BOOLEAN"; "LSAGG"; "STAGG"; "URAGG"}*/
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/* Note that ES has a circular self reference */
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/*"ES-" -> {"LIST";  "STRING";  "CHAR";  "SINT";  "OUTFORM";  "PRIMARR"}*/
/*"ES-" -> {"A1AGG";  "ISTRING";  "SRAGG";  "FLAGG";  "LNAGG";  "BOOLEAN"}*/
/*"ES-" -> {"FSAGG";  "DIAGG";  "DIOPS";  "BGAGG";  "HOAGG";  "AGG";  "TYPE"}*/
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/*"ES-" -> {"FLAGG";  "ELAGG";  "OM";  "PATAB";  "ILIST";  "LSAGG"}*/
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/*"E04AGNT" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"E04AGNT" -> {"ENTIRER"; "UFD"; "DIVRING"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"E04AGNT" -> {"OAMON"; "OASGP"; "ORDSET"; "REAL"; "KONVERT"; "RETRACT"}*/
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/*"E04AGNT" -> {"DIFEXT"; "PDRING"; "FLINEXP"; "PATAB"; "FPATMAB"}*/
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/*"FCPAK1" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
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/*"FCPAK1" -> {"OAMON"; "OASGP"; "ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"}*/
/*"FCPAK1" -> {"LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "OM"}*/
/*"FCPAK1" -> {"SYMBOL"; "INT"; "REF"}*/
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/*"FFCAT-" -> {"FLINEXP";  "LINEXP";  "ORDSET";  "KONVERT";  "PATMAB"}*/
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/*"FFCAT-" -> {"FFIELDC";  "FPC";  "INT";  "BOOLEAN";  "NNI";  "VECTCAT"}*/
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/*"FFCAT-" -> {"ELTAGG";  "CLAGG";  "SINT";  "VECTOR";  "IVECTOR"}*/
/*"FFCAT-" -> {"IARRAY1";  "SYMBOL";  "REF"}*/
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/*"FFCAT-" -> {"LIST";  "STRING";  "CHAR";  "OUTFORM";  "PRIMARR";  "A1AGG-"}*/
/*"FFCAT-" -> {"ISTRING";  "SRAGG-";  "FLAGG-";  "LNAGG-";  "ILIST"}*/
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/*"FFCGP" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"FFCGP" -> {"ENTIRER"; "UFD"; "DIVRING"; "RETRACT"; "VSPACE"; "CHARZ"}*/
/*"FFCGP" -> {"FPC"; "CHARNZ"; "FINITE"; "FFIELDC"; "STEP"; "DIFRING"}*/
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/*"FFCGP" -> {"PI"; "SINT"; "PRIMARR"; "SYMBOL"; "REF"}*/
"FFCGP" -> "ALIST"
/*"FFCGP" -> {"LIST"; "STRING"; "CHAR"; "OUTFORM"; "A1AGG-"; "ISTRING"}*/
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/*"FFCGP" -> {"OAMON"; "OASGP"; "ORDSET"; "VECTOR"; "IVECTOR"; "IARRAY1"}*/
/*"FFCGP" -> {"INS-"; "EUCDOM-"; "UFD-"; "GCDDOM-"; "INTDOM-"; "ALGEBRA-"}*/
/*"FFCGP" -> {"DIFRING-"; "ORDRING-"; "MODULE-"; "RING-"; "ABELGRP-"}*/
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/*"IDEAL" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "FIELD"; "EUCDOM"; "PID"}*/
/*"IDEAL" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"IDEAL" -> {"CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"IDEAL" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
/*"IDEAL" -> {"DIVRING"; "OAMONS"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"IDEAL" -> {"POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARZ"; "CHARNZ"}*/
/*"IDEAL" -> {"FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"; "FLINEXP"}*/
/*"IDEAL" -> {"LINEXP"; "KONVERT"; "PATMAB"; "PFECAT"; "NNI"; "INT"; "LIST"}*/
/*"IDEAL" -> {"ILIST"; "BOOLEAN"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"}*/
/*"IDEAL" -> {"HOAGG"; "AGG"; "TYPE"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"}*/
/*"IDEAL" -> {"CLAGG"; "FLAGG"; "ELAGG"; "OM"; "LSAGG-"; "STAGG-"; "ELAGG-"}*/
/*"IDEAL" -> {"FLAGG-"; "SINT"; "SYMBOL"; "REF"}*/
"IDEAL" -> "ALIST"
/*"IDEAL" -> {"STRING"; "CHAR"; "OUTFORM"; "PRIMARR"; "A1AGG-"; "ISTRING"}*/
/*"IDEAL" -> {"SRAGG-"; "LNAGG-"; "DIRPCAT"; "DIFEXT"; "DIFRING"; "FINITE"}*/
/*"IDEAL" -> {"ORDRING"; "OAGROUP"; "VSPACE"; "ORDFIN"; "VECTOR"; "IVECTOR"}*/
/*"IDEAL" -> {"IARRAY1"; "VECTCAT-"; "IXAGG-"; "CLAGG-"; "HOAGG-"; "ORDSET-"}*/
/*"IDEAL" -> {"AGG-"; "ELTAGG-"; "SETCAT-"; "BASTYPE-"; "VECTCAT"; "A1AGG"}*/

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/*"INFCLCT" -> {SETCATD"; SETCAT"; BASTYPE"; KOERCE"; NNI"; INT"; "OUTFORM"}*/
/*"INFCLCT" -> {LIST"; SYMBOL"; "REF"}*/
"INFCLCT" -> "ALIST"
/*"INFCLCT" -> {STRING"; CHAR"; SINT"; PRIMARR"; A1AGG-"; "ISTRING"}*/
/*"INFCLCT" -> {SRAGG-"; FLAGG-"; LNAGG-"; ILIST"; LSAGG-"; "STAGG-"}*/
/*"INFCLCT" -> {ELAGG-"; "URAGG-"}*?

"INFORM" [color="#88FF44",href="bookvol10.3.pdf#nameddest=INFORM"]
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/*"INFORM" -> {"INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"}*/
/*"INFORM" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"}*/
/*"INFORM" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"INFORM" -> {"ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"INFORM" -> {"OCAMON"; "OAMON"; "OASGP"; "DIFRING"; "RETRACT"; "LINEXP"}*/
/*"INFORM" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "FPS"; "RNS"}*/
/*"INFORM" -> {"FIELD"; "DIVRING"; "RADCAT"; "INT"; "SYMBOL"; "REF"}*/
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/*"INFORM" -> {"LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
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/*"INFORM" -> {"LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"}*/
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/*"INFORM" -> {"CLAGG"; "FLAGG"; "ELAGG"; "OM"; "ILIST"; "LSAGG-"; "STAGG-"}*/
/*"INFORM" -> {"ELAGG-"; "URAGG-"; "RCAGG-"; "IXAGG-"; "CLAGG-"; "HOAGG-"}*/
/*"INFORM" -> {"ORDSET-"; "AGG-"; "ELTAGG-"; "SETCAT-"; "BASTYPE-"; "NNI"}*/
/*"INFORM" -> {"STRICAT"; "SRAGG"; "A1AGG"}*/

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/*"IR" -> {"SGROUP"; "MONOID"; "ALGEBRA"; "ENTIRER"; "EUCDOM"; "PID"}*/
/*"IR" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"IR" -> {"ORDSET"; "DIFRING"; "KONVERT"; "LINEXP"; "PATMAB"; "CFCAT"}*/
/*"IR" -> {"REAL"; "CHARZ"; "STEP"; "QFCAT"; "FIELD"; "DIVRING"}*/
/*"IR" -> {"FEVALAB"; "ELTAB"; "EVALAB"; "IEVALAB"; "DIFEXT"; "PDRING"}*/
/*"IR" -> {"FLINEXP"; "PATAB"; "FPATMAB"; "TYPE"; "CHARNZ"; "PFECAT"}*/
/*"IR" -> {"SYMBOL"; "INT"; "REF"}*/
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/*"IR" -> {"LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
/*"IR" -> {"A1AGG-"; "ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"; "ILIST"}*/
/*"IR" -> {"NNI"; "BOOLEAN"; "LFCAT"; "PRIMCAT"; "TRANFUN"; "TRIGCAT"}*/
/*"IR" -> {"ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "LSAGG-"; "STAGG-"}*/
/*"IR" -> {"ELAGG-"; "URAGG-"; "RCAGG-"; "IXAGG-"; "PI"; "LSAGG"; "STAGG"}*/
/*"IR" -> {"URAGG"; "RCAGG"; "HOAGG"; "AGG"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
/*"IR" -> {"CLAGG"; "FLAGG"; "ELAGG"; "OM"}*/

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/*"ISUPS" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"ISUPS" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "COMRING"}*/
/*"ISUPS" -> {"ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"; "INTDOM"; "ENTIRER"}*/
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/*"ISUPS" -> {"ELTAB"; "DIFRING"; "PDRING"; "INS"; "UFD"; "GCDDOM"; "EUCDOM"}*/
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/*"ISUPS" -> {"OASGP"; "ORDSET"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"}*/
/*"ISUPS" -> {"CFCAT"; "REAL"; "STEP"; "BOOLEAN"; "INT"; "OM"; "SINT"}*/
/*"ISUPS" -> {"NNI"; "PI"; "LIST"; "ILIST"; "LSAGG-"; "STAGG-"; "ELAGG-"}*/
/*"ISUPS" -> {"FLAGG-"; "URAGG-"; "TRANFUN"; "TRIGCAT"; "ATRIG"; "HYPCAT"}*/
/*"ISUPS" -> {"AHYP"; "ELEMFUN"; "STRING"; "CHAR"; "OUTFORM"; "PRIMARR"}*/
/*"ISUPS" -> {"A1AGG-"; "ISTRING"; "SYMBOL"; "REF"}*/
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/*"KERNEL" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
/*"KERNEL" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "FLAGG"}*/
/*"KERNEL" -> {"ELAGG"; "OM"; "ILIST"; "SYMBOL"; "REF"}*/
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/*"KERNEL" -> {"ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"; "INS"; "UFD"}*/
/*"KERNEL" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"KERNEL" -> {"CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"}*/
/*"KERNEL" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"KERNEL" -> {"ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"KERNEL" -> {"OCAMON"; "OAMON"; "OASGP"; "DIFRING"; "RETRACT"; "LINEXP"}*/
/*"KERNEL" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "FPS"; "RNS"}*/
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/*"LIB" -> {"INT"; "REF"}*/
"LIB" -> "ALIST"
/*"LIB" -> {"LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
/*"LIB" -> {"A1AGG-"; "ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"; "STRICAT"}*/
/*"LIB" -> {"SRAGG"; "A1AGG"; "FLAGG"; "LNAGG"; "ORDSET"; "OM"; "ORDFIN"}*/
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/*"LIST" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"; "FLAGG"}*/
/*"LIST" -> {"ORDSET"; "ELAGG"; "OM"; "INT"; "LIST"; "BOOLEAN"; "ILIST"}*/
/*"LIST" -> {"LSAGG-"; "STAGG-"; "ELAGG-"; "SYMBOL"; "REF"}*/
"LIST" -> "ALIST"
/*"LIST" -> {"STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"}*/
/*"LIST" -> {"ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"; "INS"; "UFD"}*/
/*"LIST" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"LIST" -> {"CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"}*/
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/*"LMDICT" -> {"LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "LNAGG"; "IXAGG"}*/
/*"LMDICT" -> {"ELTAGG"; "ELTAB"; "FLAGG"; "ORDSET"; "ELAGG"; "OM"; "INT"}*/
/*"LMDICT" -> {"LIST"; "ILIST"; "SYMBOL"; "REF"}*/
"LMDICT" -> "ALIST"
/*"LMDICT" -> {"STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"}*/
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/*"LODO" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "FRETRCT"; "RETRACT"}*/
/*"LODO" -> {"ALGEBRA"; "MODULE"; "ELTAB"; "SYMBOL"; "INT"; "REF"}*/
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/*"LODO" -> {"LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
/*"LODO" -> {"A1AGG-"; "ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"; "FIELD"}*/
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/*"LODO" -> {"UFD"; "DIVRING"; "INS"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"LODO" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "DIFRING"; "KONVERT"}*/
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/*"LODOOPS" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"LODOOPS" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
/*"LODOOPS" -> {"DIVRING"; "LODOCAT"; "OREPCAT"; "FRETRCT"; "RETRACT"}*/
/*"LODOOPS" -> {"ELTAB"; "SYMBOL"; "INT"; "REF"}*/
"LODOOPS" -> "ALIST"
/*"LODOOPS" -> {"LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
/*"LODOOPS" -> {"A1AGG-"; "ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"}*/
/*"LODOOPS" -> {"VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"}*/
/*"LODOOPS" -> {"AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "ELTAGG"; "CLAGG"}*/
/*"LODOOPS" -> {"KONVERT"; "ORDSET"; "VECTOR"; "IVECTOR"; "IARRAY1"}*/
/*"LODOOPS" -> {"VECTCAT-"; "NNI"; "PI"; "INS-"; "DPOLCAT"; "POLYCAT"}*/
/*"LODOOPS" -> {"PDRING"; "FAMR"; "AMR"; "CHARZ"; "CHARNZ"; "FLINEXP"}*/
/*"LODOOPS" -> {"LINEXP"; "PATMAB"; "PFECAT"; "DIFEXT"; "DIFRING"}*/
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/*"MATRIX" -> {"VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
/*"MATRIX" -> {"ELTAB"; "CLAGG"; "ORDSET"; "RING"; "RNG"; "ABELGRP"}*/
/*"MATRIX" -> {"CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"MATRIX" -> {"INT"; "PRIMARR"; "NNI"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"}*/
/*"MATRIX" -> {"COMRING"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
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/*"MATRIX" -> {"OCAMON"; "OAMON"; "OASGP"; "DIFRING"; "RETRACT"; "LINEXP"}*/
/*"MATRIX" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "OM"; "SYMBOL"}*/
/*"MATRIX" -> "REF"*/
"MATRIX" -> "ALIST"
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/*"MKFLCFN" -> {"LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"}*/
/*"MKFLCFN" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "EVALAB"; "IEVALAB"; "LNAGG"}*/
/*"MKFLCFN" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "FLAGG"; "ORDSET"}*/
/*"MKFLCFN" -> {"ELAGG"; "OM"; "STRICAT"; "SRAGG"; "A1AGG"; "LSAGG-"}*/
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/*"MSET" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"MSET" -> {"ABELSG"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"MSET" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"}*/
/*"MSET" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"MSET" -> {"DIFRING"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"}*/
/*"MSET" -> {"CHARZ"; "STEP"; "INT"; "SYMBOL"; "REF"}*/
"MSET" -> "ALIST"
/*"MSET" -> {"LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
/*"MSET" -> {"A1AGG-"; "ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"; "ILIST"}*/
/*"MSET" -> {"LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
/*"MSET" -> {"ELTAB"; "FLAGG"; "ELAGG"; "OM"; "NNI"; "BOOLEAN"}*/

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"M3D" -> "ALIST"
/*"M3D" -> {"LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
/*"M3D" -> {"A1AGG-"; "ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"; "NNI"}*/
/*"M3D" -> {"VECTOR"; "IVECTOR"; "IARRAY1"; "PI"; "A1AGG"; "FLAGG"}*/
/*"M3D" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
/*"M3D" -> {"ORDSET"; "VECTCAT-"; "IXAGG-"; "CLAGG-"; "HOAGG-"; "ORDSET-"}*/
/*"M3D" -> {"AGG-"; "ELTAGG-"; "SETCAT-"; "BASTYPE-"; "VECTCAT"; "RING"}*/
/*"M3D" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"}*/
/*"M3D" -> {"MONOID"; "LMODULE"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"}*/
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/*"NAGC02" -> {"RNS"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"}*/
/*"NAGC02" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"NAGC02" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"NAGC02" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"NAGC02" -> {"ENTIRER"; "UFD"; "DIVRING"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"NAGC02" -> {"OAMON"; "OASGP"; "ORDSET"; "REAL"; "KONVERT"; "RETRACT"}*/
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"NAGC05" -> "ALIST"
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/*"ODERAT" -> {"IXAGG"; "ELTAGG"; "CLAGG"; "FLAGG"; "ELAGG"; "OM"; "ILIST"}*/
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/*"OMERR" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"; "FLAGG"}*/
/*"OMERR" -> {"ORDSET"; "ELAGG"; "OM"; "INT"; "LIST"; "ILIST"; "NNI"}*/
/*"OMERR" -> {"SYMBOL"; "REF"}*/
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/*"OMERR" -> {"STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"}*/
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/*"OMERR" -> {"STAGG-"; "PI"}*/

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/*"OPTPACK" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"OPTPACK" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"OPTPACK" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"OPTPACK" -> {"ENTIRER"; "UFD"; "DIVRING"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"OPTPACK" -> {"OAMON"; "OASGP"; "ORDSET"; "REAL"; "KONVERT"; "RETRACT"}*/
/*"OPTPACK" -> {"RADCAT"; "PATMAB"; "CHARZ"; "STRING"; "CHAR"; "SINT"}*/
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/*"OPTPACK" -> {"SRAGG-"; "ILIST"; "TBAGG"; "KDAGG"; "DIAGG"; "DIOPS"}*/
/*"OPTPACK" -> {"BGAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
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/*"OPTPACK" -> {"FLAGG-"; "LNAGG-"; "LSAGG-"; "STAGG-"; "ELAGG-"; "INS-"}*/
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/*"OPTPACK" -> {"FLAGG"; "ELAGG"; "OM"; "DIFRING"; "TRANFUN"; "TRIGCAT"}*/
/*"OPTPACK" -> {"ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "SPFCAT"; "EUCDOM-"}*/
/*"OPTPACK" -> {"UFD-"; "GCDDOM-"; "INTDOM-"; "ALGEBRA-"; "DIFRING-"}*/
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/*"OVAR" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "REAL"}*/
/*"OVAR" -> {"RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"; "INS"; "OINTDOM"}*/
/*"OVAR" -> {"DIFRING"; "LINEXP"; "CFCAT"; "STEP"; "LSAGG"; "STAGG"}*/
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/*"PACOFF" -> {"VSPACE"; "CHARZ"; "ORDSET"; "NNI"; "INT"; "PI"; "VECTOR"}*/
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/*"PACOFF" -> {"FRETRCT"; "FLINEXP"; "LINEXP"; "PATMAB"; "PFECAT"; "DIFEXT"}*/
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/*"PACRAT" -> {"IXAGG-"; "CLAGG-"; "HOAGG-"; "ORDSET-"; "AGG-"; "ELTAGG-"}*/
/*"PACRAT" -> {"SETCAT-"; "BASTYPE-"; "VECTOR"; "IVECTOR"; "IARRAY1"}*/
/*"PACRAT" -> {"VECTCAT-"; "A1AGG-"; "UPOLYC"; "POLYCAT"; "PDRING"; "FAMR"}*/
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/*"PATTERN" -> {"A1AGG-"; "ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"; "BOOLEAN"}*/
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/*"PLCS" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "LNAGG"}*/
/*"PLCS" -> {"IXAGG"; "ELTAGG"; "CLAGG"; "KONVERT"; "FLAGG"; "ORDSET"}*/
/*"PLCS" -> {"ELAGG"; "OM"; "ILIST"; "LSAGG-"; "STAGG-"; "ELAGG-"; "URAGG-"}*/
/*"PLCS" -> {"RCAGG-"; "IXAGG-"; "CLAGG-"; "HOAGG-"; "ORDSET-"; "AGG-"}*/
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/*"PMKERNEL" -> {"HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "LNAGG"}*/
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/*"PMKERNEL" -> {"OM"; "INT"; "LIST"; "ILIST"; "NNI"; "SYMBOL"; "REF"}*/
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/*"POLY" -> {"MONOID"; "LMODULE"; "FAMR"; "AMR"; "BMODULE"; "RMODULE"}*/
/*"POLY" -> {"COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"; "INTDOM"}*/
/*"POLY" -> {"ENTIRER"; "FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"}*/
/*"POLY" -> {"FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"; "GCDDOM"}*/
/*"POLY" -> {"PFECAT"; "UFD"; "SYMBOL"; "INT"; "REF"}*/
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/*"POLY" -> {"LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
/*"POLY" -> {"A1AGG-"; "ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"; "FPS"}*/
/*"POLY" -> {"RNS"; "FIELD"; "EUCDOM"; "PID"; "DIVRING"; "ORDRING"}*/
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/*"PRIMELT" -> {"CLAGG"; "KONVERT"; "FLAGG"; "ORDSET"; "ELAGG"; "OM"}*/
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/*"PRIMELT" -> {"CLAGG-"; "SYMBOL"; "REF"}*/
"PRIMELT" -> "ALIST"
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/*"QUATCAT" -> {"FRETRCT"; "RETRACT"; "DIFEXT"; "DIFRING"; "PDRING"}*/
/*"QUATCAT" -> {"FEVALAB"; "ELTAB"; "EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"}*/
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/*"QUATCAT" -> {"FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "UFD"}*/
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/*"QUATCAT-" -> {"DIFRING";  "PDRING";  "FEVALAB";  "ELTAB";  "EVALAB"}*/
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/*"QUATCAT-" -> {"DIVRING";  "KONVERT";  "CHARZ";  "CHARNZ";  "FIELD"}*/
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"QUATCAT-" -> "ALIST"
/*"QUATCAT-" -> {"LIST";  "STRING";  "CHAR";  "SINT";  "OUTFORM";  "PRIMARR"}*/
/*"QUATCAT-" -> {"A1AGG-";  "ISTRING";  "SRAGG-";  "FLAGG-";  "LNAGG-"}*/
/*"QUATCAT-" -> {"RNS";  "ORDRING";  "OAGROUP";  "OCAMON";  "OAMON"}*/
/*"QUATCAT-" -> {"OASGP";  "REAL";  "RADCAT";  "PATMAB";  "INS";  "OINTDOM"}*/
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/*"RECLOS" -> {"OASGP"; "ORDSET"; "COMRING"; "BMODULE"; "RMODULE"; "FIELD"}*/
/*"RECLOS" -> {"EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "ALGEBRA"; "MODULE"}*/
/*"RECLOS" -> {"ENTIRER"; "UFD"; "DIVRING"; "FRETRCT"; "RETRACT"; "RADCAT"}*/
/*"RECLOS" -> {"REAL"; "KONVERT"; "PI"; "NNI"; "INT"; "SYMBOL"; "REF"}*/
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/*"RECLOS" -> {"LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
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/*"RECLOS" -> {"OINTDOM"; "DIFRING"; "LINEXP"; "PATMAB"; "CFCAT"; "STEP"}*/
/*"RECLOS" -> {"ILIST"; "LSAGG-"; "STAGG-"; "ELAGG-"; "URAGG-"; "RCAGG-"}*/
/*"RECLOS" -> {"IXAGG-"; "CLAGG-"; "HOAGG-"; "ORDSET-"; "AGG-"; "ELTAGG-"}*/
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/*"RECLOS" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "FLAGG"; "ELAGG"}*/
/*"RECLOS" -> {"OM"; "BOOLEAN"; "QFCAT"; "FEVALAB"; "DIFEXT"; "PDRING"}*/
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/*"REP1" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"}*/
/*"REP1" -> {"PID"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"REP1" -> {"OASGP"; "ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"}*/
/*"REP1" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "OM"; "LIST"}*/
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/*"REP1" -> {"LNAGG-"; "NNI"; "VECTOR"; "IVECTOR"; "IARRAY1"; "VECTCAT-"}*/
/*"REP1" -> {"A1AGG-"; "IXAGG-"; "VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"}*/
/*"REP1" -> {"IXAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "ELTAGG"}*/
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/*"REP1" -> {"RCAGG"; "ELAGG"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARNZ"}*/
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/*"RESULT" -> {"ELAGG"; "OM"; "ILIST"}*/

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/*"RFFACT" -> {"SGROUP"; "MONOID"; "LMODULE"; "FAMR"; "AMR"; "BMODULE"}*/
/*"RFFACT" -> {"RMODULE"; "COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"}*/
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/*"RFFACT" -> {"IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"}*/
/*"RFFACT" -> {"PATMAB"; "GCDDOM"; "PFECAT"; "UFD"; "ELTAB"; "DIFRING"}*/
/*"RFFACT" -> {"DIFEXT"; "STEP"; "EUCDOM"; "PID"; "FIELD"; "DIVRING"}*/
/*"RFFACT" -> {"SYMBOL"; "INT"; "REF"}*/
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/*"ROMAN" -> {"DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"}*/
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/*"ROMAN" -> {"LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
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/*"RPOLCAT" -> {"RMODULE"; "COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"}*/
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/*"RPOLCAT" -> {"IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"}*/
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/*"RPOLCAT" -> {"STEP"; "QFCAT"; "FEVALAB"; "ELTAB"; "DIFEXT"; "PATAB"}*/
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/*"RPOLCAT" -> {"HOAGG"; "AGG"; "LNAGG"; "IXAGG"; "ELTAGG"; "CLAGG"}*/
/*"RPOLCAT" -> {"FLAGG"; "ELAGG"; "STRING"; "CHAR"; "OUTFORM"; "PRIMARR"}*/
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/*"RPOLCAT-" -> {"SRAGG-";  "LNAGG-";  "STRICAT";  "SRAGG";  "A1AGG"}*/
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"SEGBIND" -> "ALIST"
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/*"SET" -> {"CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"}*/
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/*"SET" -> {"PID"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"SET" -> {"OASGP"; "DIFRING"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"}*/
/*"SET" -> {"REAL"; "CHARZ"; "STEP"; "OM"; "SYMBOL"; "INT"; "REF"}*/
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/*"SET" -> {"LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
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"SPECOUT" -> "ALIST"
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/*"SPECOUT" -> {"LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
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/*"SQMATRIX" -> {"SGROUP"; "MONOID"; "LMODULE"; "DIFRING"; "PDRING"}*/
/*"SQMATRIX" -> {"BMODULE"; "RMODULE"; "RMATCAT"; "HOAGG"; "AGG"; "TYPE"}*/
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/*"SQMATRIX" -> {"NNI"; "INT"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"}*/
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/*"SQMATRIX" -> {"ORDSET"; "ELAGG"; "OM"; "LIST"; "ILIST"; "EUCDOM"}*/
/*"SQMATRIX" -> {"PID"; "GCDDOM"; "INTDOM"; "ENTIRER"; "FIELD"; "UFD"}*/
/*"SQMATRIX" -> {"DIVRING"; "SYMBOL"; "REF"}*/
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/*"SQMATRIX" -> {"ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"; "INS"; "OINTDOM"}*/
/*"SQMATRIX" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "PATMAB"}*/
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/*"SWITCH" -> {"EVALAB"; "IEVALAB"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"}*/
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/*"SWITCH" -> {"UFD"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"}*/
/*"SWITCH" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"}*/
/*"SWITCH" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"SWITCH" -> {"ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"SWITCH" -> {"OCAMON"; "OAMON"; "OASGP"; "DIFRING"; "RETRACT"; "LINEXP"}*/
/*"SWITCH" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "NNI"}*/
/*"SWITCH" -> {"SYMBOL"; "REF"}*/
"SWITCH" -> "ALIST"
/*"SWITCH" -> {"STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"}*/
/*"SWITCH" -> {"ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"}*/

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/*"SYMS" -> {"LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
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/*"SYMTAB" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"SYMTAB" -> {"CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"SYMTAB" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"SYMTAB" -> {"EUCDOM"; "PID"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
/*"SYMTAB" -> {"OAMON"; "OASGP"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"}*/
/*"SYMTAB" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "INT"; "LIST"}*/
/*"SYMTAB" -> {"ILIST"; "OM"; "SYMBOL"; "REF"}*/
"SYMTAB" -> "ALIST"
/*"SYMTAB" -> {"STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"}*/
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/*"SYMTAB" -> {"ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"; "LSAGG-"; "STAGG-"}*/
/*"SYMTAB" -> {"ELAGG-"; "URAGG-"; "RCAGG-"; "IXAGG-"; "CLAGG-"; "HOAGG-"}*/
/*"SYMTAB" -> {"ORDSET-"; "AGG-"; "ELTAGG-"; "SETCAT-"; "BASTYPE-"}*/

"SYSSOLP" [color="#FF4488",href="bookvol10.4.pdf#nameddest=SYSSOLP"]
/*"SYSSOLP" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"SYSSOLP" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"SYSSOLP" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"SYSSOLP" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "POLYCAT"; "PDRING"}*/
/*"SYSSOLP" -> {"FAMR"; "AMR"; "CHARZ"; "CHARNZ"; "FRETRCT"; "RETRACT"}*/
/*"SYSSOLP" -> {"EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"}*/
/*"SYSSOLP" -> {"KONVERT"; "PATMAB"; "GCDDOM"; "PFECAT"; "UFD"; "QFCAT"}*/
/*"SYSSOLP" -> {"FIELD"; "EUCDOM"; "PID"; "DIVRING"; "FEVALAB"; "ELTAB"}*/
/*"SYSSOLP" -> {"DIFEXT"; "DIFRING"; "PATAB"; "FPATMAB"; "TYPE"; "STEP"}*/
/*"SYSSOLP" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"SYSSOLP" -> {"OASGP"; "REAL"; "OM"; "INT"; "LIST"; "ILIST"; "LSAGG-"}*/
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/*"SYSSOLP" -> {"URAGG"; "RCAGG"; "HOAGG"; "AGG"; "LNAGG"; "IXAGG"}*/
/*"SYSSOLP" -> {"ELTAGG"; "CLAGG"; "FLAGG"; "ELAGG"; "NNI"; "SYMBOL"; "REF"}*/
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/*"SYSSOLP" -> {"STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"}*/
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/*"SYSSOLP" -> {"FINITE"; "OAMONS"; "VSPACE"; "ORDFIN"; "VECTOR"; "IVECTOR"}*/
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/*"UTSCAT" -> {"BASTYPE"; "KOERCE"; "ABELMON"; "ABELSG"; "CABMON"}*/
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/*"UTSCAT" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "COMRING"}*/
/*"UTSCAT" -> {"ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"; "INTDOM"; "ENTIRER"}*/
/*"UTSCAT" -> {"ELTAB"; "DIFRING"; "PDRING"; "RADCAT"; "TRANFUN"; "TRIGCAT"}*/
/*"UTSCAT" -> {"ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "BOOLEAN"; "INT"}*/
/*"UTSCAT" -> {"SYMBOL"; "REF"}*/
"UTSCAT" -> "ALIST"
/*"UTSCAT" -> {"LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
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/*"UTSCAT" -> {"NNI"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"}*/
/*"UTSCAT" -> {"TYPE"; "EVALAB"; "IEVALAB"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
/*"UTSCAT" -> {"CLAGG"; "KONVERT"; "FLAGG"; "ELAGG"; "OM"; "LSAGG-"}*/
/*"UTSCAT" -> {"FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "UFD"; "DIVRING"}*/
/*"UTSCAT" -> {"INS"; "OINTDOM"; "ORDRING"; "OAGROUP"; "RETRACT"; "LINEXP"}*/
/*"UTSCAT" -> {"PATMAB"; "CFCAT"; "REAL"; "STEP"}*/

"UTSCAT-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=UTSCAT"]
/*"UTSCAT-" -> {"OAMONS";  "OCAMON";  "OAMON";  "OASGP";  "ORDSET"}*/
/*"UTSCAT-" -> {"SETCAT";  "BASTYPE";  "KOERCE";  "ABELMON";  "ABELSG"}*/
/*"UTSCAT-" -> {"CABMON";  "UPSCAT";  "PSCAT";  "AMR";  "RING";  "RNG"}*/
/*"UTSCAT-" -> {"ABELGRP";  "SGROUP";  "MONOID";  "LMODULE";  "BMODULE"}*/
/*"UTSCAT-" -> {"RMODULE";  "COMRING";  "ALGEBRA";  "MODULE";  "CHARZ"}*/
/*"UTSCAT-" -> {"CHARNZ";  "INTDOM";  "ENTIRER";  "ELTAB";  "DIFRING"}*/
/*"UTSCAT-" -> {"PDRING";  "RADCAT";  "TRANFUN";  "TRIGCAT";  "ATRIG"}*/
/*"UTSCAT-" -> {"HYPCAT";  "AHYP";  "ELEMFUN";  "BOOLEAN";  "INT"}*/
/*"UTSCAT-" -> {"SYMBOL";  "REF"}*/
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"UTSCAT-" -> "ALIST"
/*"UTSCAT-" -> {"LIST";  "STRING";  "CHAR";  "SINT";  "OUTFORM"}*/
/*"UTSCAT-" -> {"PRIMARR";  "A1AGG-";  "ISTRING";  "SRAGG-";  "FLAGG-"}*/
/*"UTSCAT-" -> {"LNAGG-";  "ILIST";  "NNI";  "LSAGG";  "STAGG";  "URAGG"}*/
/*"UTSCAT-" -> {"RCAGG";  "HOAGG";  "AGG";  "TYPE";  "EVALAB";  "IEVALAB"}*/
/*"UTSCAT-" -> {"LNAGG";  "IXAGG";  "ELTAGG";  "CLAGG";  "KONVERT";  "FLAGG"}*/
/*"UTSCAT-" -> {"ELAGG";  "OM";  "LSAGG-";  "FIELD";  "EUCDOM";  "PID"}*/
/*"UTSCAT-" -> {"GCDDOM";  "UFD";  "DIVRING";  "INS";  "OINTDOM";  "ORDRING"}*/
/*"UTSCAT-" -> {"OAGROUP";  "RETRACT";  "LINEXP";  "PATMAB";  "CFCAT"}*/
/*"UTSCAT-" -> {"REAL";  "STEP"}*/

"VARIABLE" [color="#88FF44",href="bookvol10.3.pdf#nameddest=VARIABLE"]
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"VARIABLE" -> "ALIST"
/*"VARIABLE" -> {"LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
/*"VARIABLE" -> {"A1AGG-"; "ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"}*/
/*"VARIABLE" -> "BOOLEAN"*/
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1.4.19 Layer17

Depends on: ACF COMPCAT FFCAT FRNAALG FS OC QUATCAT RPOLCAT UTSCAT NSDPS
Used by next layer: ACFS EXPRSOL FDIVCAT UFPS ULSCCAT UTSSOL

The clique1.spad file is used because "MYEXPR" and "MYUP" are mutually dependent. Rather than add one to the bootstrap we let the compiler resolve them in one step. This same technique might be useful for other cliques in bootstrap. This needs to be investigated.

— **layer17** —

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LAYER17=\
  ${OUT}/ACFS.o     ${OUT}/ACFS-.o    ${OUT}/AF.o       ${OUT}/AFFPLPS.o  \
  ${OUT}/ALGFACT.o  \
  ${OUT}/ALGFF.o    ${OUT}/ALGMANIP.o ${OUT}/ALGMFACT.o ${OUT}/ALGPKG.o   \
  ${OUT}/ALGSC.o    ${OUT}/AN.o       ${OUT}/APPRULE.o  ${OUT}/ASP19.o    \
  ${OUT}/ASP20.o    ${OUT}/ASP31.o    ${OUT}/ASP35.o    ${OUT}/ASP41.o    \
  ${OUT}/ASP42.o    ${OUT}/ASP74.o    ${OUT}/ASP77.o    ${OUT}/ASP80.o    \
  ${OUT}/CDFMAT.o   ${OUT}/CDFVEC.o   ${OUT}/CELL.o \
  ${OUT}/CINTSLPE.o ${OUT}/COMBF.o    ${OUT}/COMPFACT.o ${OUT}/COMPLEX.o  \
  ${OUT}/COMPLPAT.o ${OUT}/CMPLXRT.o  ${OUT}/CPMATCH.o  ${OUT}/CRFP.o     \
  ${OUT}/CTRIGMNP.o ${OUT}/D01WGTS.o  ${OUT}/D02AGNT.o  ${OUT}/D03EEFA.o  \
  ${OUT}/DBLRESP.o  ${OUT}/D01AGNT.o  ${OUT}/DERHAM.o   ${OUT}/DFSFUN.o   \
  ${OUT}/DRAWCURV.o ${OUT}/DTP.o      \
  ${OUT}/D01TRNS.o  ${OUT}/E04NAFA.o  ${OUT}/EF.o       \
  ${OUT}/EFSTRUC.o  ${OUT}/ELFUTS.o   ${OUT}/ESTOOLS.o  ${OUT}/EXPEXPAN.o \
  ${OUT}/EXPRODE.o  ${OUT}/EXPRTUBE.o ${OUT}/EXPR2.o    ${OUT}/FC.o       \
  ${OUT}/FDIVCAT.o  ${OUT}/FDIVCAT-.o ${OUT}/FDIV2.o    ${OUT}/FFCAT2.o   \
  ${OUT}/FLOATCP.o  ${OUT}/FORDER.o   ${OUT}/FORTRAN.o  ${OUT}/FRNAAF2.o  \
  ${OUT}/FSPRMELT.o ${OUT}/FSRED.o    ${OUT}/FSUPFACT.o ${OUT}/FSPECF.o   \
  ${OUT}/FS2.o      ${OUT}/FS2UPS.o   ${OUT}/GAUSSFAC.o ${OUT}/GCNAALG.o  \
  ${OUT}/GDRAW.o    \
```

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  ${OUT}/GENUFACT.o ${OUT}/GENUPS.o   ${OUT}/GTSET.o    ${OUT}/GPOLSET.o  \
  ${OUT}/IAN.o      ${OUT}/INEP.o     ${OUT}/INFPROD0.o ${OUT}/INFSP.o    \
  ${OUT}/INPRODFF.o ${OUT}/INPRODPF.o ${OUT}/INTAF.o    ${OUT}/INTALG.o   \
  ${OUT}/INTEF.o    ${OUT}/INTG0.o    ${OUT}/INTHERAL.o ${OUT}/INTPAF.o   \
  ${OUT}/INTPM.o    ${OUT}/INTTOOLS.o ${OUT}/ITRIGMNP.o ${OUT}/JORDAN.o   \
  ${OUT}/KOVACIC.o  ${OUT}/LF.o       ${OUT}/LIE.o      ${OUT}/LODOF.o    \
  ${OUT}/LSQM.o     ${OUT}/MCMPLX.o   ${OUT}/MULTFACT.o \
  ${MID}/clique1.spad \
  ${OUT}/NAGF01.o   ${OUT}/NAGF02.o   ${OUT}/NAGF04.o   ${OUT}/NCEP.o     \
  ${OUT}/NLINSOL.o  ${OUT}/NSMP.o     ${OUT}/NUMERIC.o  ${OUT}/OCT.o      \
  ${OUT}/OCTCT2.o   ${OUT}/ODEPAL.o   ${OUT}/ODERTRIC.o ${OUT}/OMEXPR.o   \
  ${OUT}/PACEXTC.o  ${OUT}/PADE.o     \
  ${OUT}/PAN2EXPR.o ${OUT}/PFO.o      ${OUT}/PFOQ.o     ${OUT}/PICOERCE.o \
  ${OUT}/PLACES.o   ${OUT}/PLACESPS.o \
  ${OUT}/PMASSFS.o  ${OUT}/PMFS.o     ${OUT}/PMPREDFS.o ${OUT}/PROJPLPS.o \
  ${OUT}/PSETPK.o   \
  ${OUT}/QUAT.o     ${OUT}/QUATCT2.o  ${OUT}/RADFF.o    ${OUT}/RDEEF.o    \
  ${OUT}/RDEEFS.o   ${OUT}/RDIV.o     ${OUT}/RSETCAT.o  ${OUT}/RSETCAT-.o \
  ${OUT}/RSETGCD.o  ${OUT}/RULE.o     ${OUT}/RULESET.o  ${OUT}/SD.o       \
  ${OUT}/SIGNEF.o   ${OUT}/SIMPAN.o   ${OUT}/SFORT.o    ${OUT}/SOLVESER.o \
  ${OUT}/SOLVETRA.o ${OUT}/SUMFS.o    ${OUT}/SUTS.o     ${OUT}/TOOLSIGN.o \
  ${OUT}/TRIGMNIP.o ${OUT}/TRMANIP.o  ${OUT}/UFPS.o     ${OUT}/ULSCCAT.o  \
  ${OUT}/ULSCCAT-.o ${OUT}/UPXSSING.o ${OUT}/UTSODE.o   ${OUT}/UTSODETL.o \
  ${OUT}/UTSSOL.o   ${OUT}/UTS2.o     ${OUT}/WUTSET.o  \
  layer17done
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———-

— layerpic —

```
/* layer 17 */
/* depends on: ACF COMPCAT FFCAT FRNAALG FS OC QUATCAT RPOLCAT UTSCAT */

"ACFS" [color="#4488FF",href="bookvol10.2.pdf#nameddest=ACFS"]
"ACFS" -> "ACF"
/*"ACFS" -> {"FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"ACFS" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"ACFS" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"ACFS" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"ACFS" -> {"UFD"; "DIVRING"; "RADCAT"}*/
"ACFS" -> "FS"
/*"ACFS" -> {"ES"; "ORDSET"; "RETRACT"; "IEVALAB"; "EVALAB"; "PATAB"}*/
/*"ACFS" -> {"KONVERT"; "FPATMAB"; "TYPE"; "PATMAB"; "FRETRCT"; "GROUP"}*/
/*"ACFS" -> {"PDRING"; "FLINEXP"; "LINEXP"; "CHARZ"; "CHARNZ"; "INT"}*/
/*"ACFS" -> {"LIST"; "ILIST"; "UPOLYC"; "POLYCAT"; "FAMR"; "AMR"}*/
/*"ACFS" -> {"PFECAT"; "ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "NNI"}*/

"ACFS-" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ACFS"]
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/*"ACFS-" -> {"RING";  "RNG";  "ABELGRP";  "CABMON";  "ABELMON";  "ABELSG"}*/
/*"ACFS-" -> {"SETCAT";  "BASTYPE";  "KOERCE";  "SGROUP";  "MONOID"}*/
/*"ACFS-" -> {"LMODULE";  "BMODULE";  "RMODULE";  "ALGEBRA";  "MODULE"}*/
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/*"ACFS-" -> {"ENTIRER";  "UFD";  "DIVRING";  "RADCAT"}*/
"ACFS-" -> "FS"
/*"ACFS-" -> {"ES";  "ORDSET";  "RETRACT";  "IEVALAB";  "EVALAB";  "PATAB"}*/
/*"ACFS-" -> {"KONVERT";  "FPATMAB";  "TYPE";  "PATMAB";  "FRETRCT"}*/
/*"ACFS-" -> {"GROUP";  "PDRING";  "FLINEXP";  "LINEXP";  "CHARZ";  "CHARNZ"}*/
/*"ACFS-" -> {"INT";  "LIST";  "ILIST";  "UPOLYC";  "POLYCAT";  "FAMR"}*/
/*"ACFS-" -> {"AMR";  "PFECAT";  "ELTAB";  "DIFRING";  "DIFEXT";  "STEP"}*/
/*"ACFS-" -> "NNI"*/

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/*"AF" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"AF" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"AF" -> {"MODULE"; "ENTIRER"}*/
"AF" -> "FS"
/*"AF" -> {"ES"; "RETRACT"; "IEVALAB"; "EVALAB"; "PATAB"; "KONVERT"}*/
/*"AF" -> {"FPATMAB"; "TYPE"; "PATMAB"; "FRETRCT"; "GROUP"; "PDRING"}*/
/*"AF" -> {"FLINEXP"; "LINEXP"; "CHARZ"; "CHARNZ"; "FIELD"; "EUCDOM"}*/
/*"AF" -> {"PID"; "GCDDOM"; "UFD"; "DIVRING"; "SYMBOL"; "INT"; "REF"}*/
/*"AF" -> {"ALIST"; "LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
/*"AF" -> {"A1AGG-"; "ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"; "ILIST"}*/
/*"AF" -> {"LSAGG-"; "STAGG-"; "ELAGG-"; "URAGG-"; "UPOLYC"; "POLYCAT"}*/
/*"AF" -> {"FAMR"; "AMR"; "PFECAT"; "ELTAB"; "DIFRING"; "DIFEXT"}*/
/*"AF" -> {"STEP"; "NNI"}*/
"AF" -> "ACF"
/*"AF" -> {"RADCAT"; "BOOLEAN"; "CACHSET"; "INS"; "OINTDOM"; "ORDRING"}*/
/*"AF" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "CFCAT"; "REAL"; "INS-"}*/

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"AFFPLPS" -> "PACFFC"
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/*"AFFPLPS" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"AFFPLPS" -> {"ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"AFFPLPS" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"AFFPLPS" -> {"UFD"; "DIVRING"; "CHARNZ"; "FINITE"; "STEP"; "DIFRING"}*/
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/*"ALGFACT" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"ALGFACT" -> {"SGROUP"; "MONOID"; "LMODULE"; "FAMR"; "AMR"; "BMODULE"}*/
/*"ALGFACT" -> {"RMODULE"; "COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"}*/
/*"ALGFACT" -> {"INTDOM"; "ENTIRER"; "FRETRCT"; "RETRACT"; "EVALAB"}*/
/*"ALGFACT" -> {"IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"}*/
/*"ALGFACT" -> {"PATMAB"; "GCDDOM"; "PFECAT"; "UFD"; "ELTAB"; "DIFRING"}*/
/*"ALGFACT" -> {"DIFEXT"; "STEP"; "EUCDOM"; "PID"; "FIELD"; "DIVRING"}*/
/*"ALGFACT" -> {"INT"; "LIST"; "ILIST"; "LSAGG-"; "STAGG-"; "ES"; "LSAGG"}*/
/*"ALGFACT" -> {"STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"; "LNAGG"}*/
/*"ALGFACT" -> {"IXAGG"; "ELTAGG"; "CLAGG"; "FLAGG"; "ELAGG"; "OM"}*/
/*"ALGFACT" -> {"CACHSET"; "PATAB"; "ELAGG-"; "INS"; "OINTDOM"; "ORDRING"}*/
/*"ALGFACT" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "CFCAT"; "REAL"}*/
/*"ALGFACT" -> {"QFCAT"; "FEVALAB"; "FPATMAB"}*/
"ALGFACT" -> "ACF"
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/*"ALGFACT" -> {"RADCAT"; "NNI"; "BOOLEAN"; "MONOGEN"; "FRAMALG"; "FINRALG"}*/
/*"ALGFACT" -> {"FINITE"; "FFIELDC"; "FPC"}*/

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/*"ALGFF" -> {"SGROUP"; "MONOID"; "LMODULE"; "FAMR"; "AMR"; "BMODULE"}*/
/*"ALGFF" -> {"RMODULE"; "COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"}*/
/*"ALGFF" -> {"INTDOM"; "ENTIRER"; "FRETRCT"; "RETRACT"; "EVALAB"}*/
/*"ALGFF" -> {"IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"}*/
/*"ALGFF" -> {"PATMAB"; "GCDDOM"; "PFECAT"; "UFD"; "ELTAB"; "DIFRING"}*/
/*"ALGFF" -> {"DIFEXT"; "STEP"; "EUCDOM"; "PID"; "FIELD"; "DIVRING"}*/
"ALGFF" -> "FFCAT"
/*"ALGFF" -> {"MONOGEN"; "FRAMALG"; "FINRALG"; "FINITE"; "FFIELDC"; "FPC"}*/
/*"ALGFF" -> {"QFCAT"; "FEVALAB"; "PATAB"; "FPATMAB"; "TYPE"; "OINTDOM"}*/
/*"ALGFF" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "REAL"}*/
/*"ALGFF" -> {"BOOLEAN"; "NNI"; "INT"; "VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"}*/
/*"ALGFF" -> {"IXAGG"; "HOAGG"; "AGG"; "ELTAGG"; "CLAGG"; "SINT"; "INS"}*/
/*"ALGFF" -> {"CFCAT"; "OM"; "VECTOR"; "IVECTOR"; "IARRAY1"; "VECTCAT-"}*/
/*"ALGFF" -> {"A1AGG-"; "FLAGG-"; "LNAGG-"; "IXAGG-"; "CLAGG-"; "HOAGG-"}*/
/*"ALGFF" -> {"ORDSET-"; "AGG-"; "ELTAGG-"; "SETCAT-"; "BASTYPE-"; "OAMONS"}*/

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/*"ALGMANIP" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"ALGMANIP" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"ALGMANIP" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "FIELD"; "EUCDOM"}*/
/*"ALGMANIP" -> {"PID"; "GCDDOM"; "UFD"; "DIVRING"; "ES"; "ORDSET"}*/
/*"ALGMANIP" -> {"RETRACT"; "IEVALAB"; "EVALAB"; "SYMBOL"; "INT"; "REF"}*/
/*"ALGMANIP" -> {"ALIST"; "LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"}*/
/*"ALGMANIP" -> {"PRIMARR"; "A1AGG-"; "ISTRING"; "SRAGG-"; "FLAGG-"}*/
/*"ALGMANIP" -> {"LNAGG-"; "ILIST"; "LSAGG-"; "CACHSET"; "UPOLYC"}*/
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/*"ALGMANIP" -> {"FPATMAB"; "GROUP"; "RADCAT"; "INS-"; "EUCDOM-"; "UFD-"}*/
/*"ALGMANIP" -> {"GCDDOM-"; "NNI"; "INTDOM-"; "ALGEBRA-"; "DIFRING-"}*/
/*"ALGMANIP" -> {"ORDRING-"; "MODULE-"; "RING-"; "ABELGRP-"; "INS"}*/
/*"ALGMANIP" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
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/*"ALGPKG" -> {"MODULE"; "ENTIRER"}*/
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/*"ASP31" -> {"ELTAB"; "CLAGG"; "NNI"; "ILIST"; "VECTOR"; "IVECTOR"}*/
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/*"ASP35" -> {"RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"}*/
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/*"ASP35" -> {"GROUP"; "PDRING"; "FLINEXP"; "LINEXP"; "CHARNZ"; "VECTCAT"}*/
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/*"D01WGTS" -> {"TRIGCAT"; "ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "SPFCAT"}*/
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/*"ELFUTS" -> {"ENTIRER"; "UFD"; "DIVRING"}*/
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/*"FSRED" -> {"LINEXP"; "CHARZ"; "CHARNZ"; "FIELD"; "EUCDOM"; "PID"}*/
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/*"JORDAN" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "MONAD"; "MODULE"}*/
/*"JORDAN" -> {"BMODULE"; "LMODULE"; "RMODULE"}*/
"JORDAN" -> "FRNAALG"
/*"JORDAN" -> {"FINAALG"; "COMRING"; "RING"; "RNG"; "SGROUP"; "MONOID"}*/
/*"JORDAN" -> {"FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "ALGEBRA"}*/
/*"JORDAN" -> {"ENTIRER"; "UFD"; "DIVRING"; "POLYCAT"; "PDRING"; "FAMR"}*/
/*"JORDAN" -> {"AMR"; "CHARZ"; "CHARNZ"; "FRETRCT"; "RETRACT"; "EVALAB"}*/
/*"JORDAN" -> {"IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"}*/
/*"JORDAN" -> {"PATMAB"; "PFECAT"}*/

"KOVACIC" [color="#FF4488",href="bookvol10.4.pdf#nameddest=KOVACIC"]
/*"KOVACIC" -> {"CHARZ"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"KOVACIC" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"KOVACIC" -> {"MONOID"; "LMODULE"}*/
"KOVACIC" -> "ACF"
/*"KOVACIC" -> {"FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"KOVACIC" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"KOVACIC" -> {"UFD"; "DIVRING"; "RADCAT"; "RETRACT"; "UPOLYC"}*/
/*"KOVACIC" -> {"POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARNZ"; "FRETRCT"}*/
/*"KOVACIC" -> {"EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"}*/
/*"KOVACIC" -> {"KONVERT"; "PATMAB"; "PFECAT"; "ELTAB"; "DIFRING"}*/
/*"KOVACIC" -> {"DIFEXT"; "STEP"; "QFCAT"; "FEVALAB"; "PATAB"; "FPATMAB"}*/
/*"KOVACIC" -> {"TYPE"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"KOVACIC" -> {"OASGP"; "REAL"; "PI"; "NNI"; "INT"; "LIST"; "ILIST"}*/
/*"KOVACIC" -> "BOOLEAN"*/
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"LF" [color="#FF4488",href="bookvol10.4.pdf#nameddest=LF"]
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/*"LF" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"LF" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"LF" -> {"MODULE"; "ENTIRER"}*/
"LF" -> "FS"
/*"LF" -> {"ES"; "RETRACT"; "IEVALAB"; "EVALAB"; "PATAB"; "KONVERT"}*/
/*"LF" -> {"FPATMAB"; "TYPE"; "PATMAB"; "FRETRCT"; "GROUP"; "PDRING"}*/
/*"LF" -> {"FLINEXP"; "LINEXP"; "CHARZ"; "CHARNZ"; "FIELD"; "EUCDOM"}*/
/*"LF" -> {"PID"; "GCDDOM"; "UFD"; "DIVRING"; "RADCAT"; "TRANFUN"}*/
/*"LF" -> {"TRIGCAT"; "ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "SYMBOL"}*/
/*"LF" -> {"INT"; "REF"; "ALIST"; "LIST"; "STRING"; "CHAR"; "SINT"}*/
/*"LF" -> {"OUTFORM"; "PRIMARR"; "A1AGG-"; "ISTRING"; "SRAGG-"; "FLAGG-"}*/
/*"LF" -> {"LNAGG-"; "ILIST"; "LSAGG-"; "STAGG-"; "ELAGG-"; "URAGG-"}*/
/*"LF" -> {"PI"; "NNI"; "BOOLEAN"}*/

"LIE" [color="#88FF44",href="bookvol10.3.pdf#nameddest=LIE"]
/*"LIE" -> {"NAALG"; "NARNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"LIE" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "MONAD"; "MODULE"; "BMODULE"}*/
/*"LIE" -> {"LMODULE"; "RMODULE"}*/
"LIE" -> "FRNAALG"
/*"LIE" -> {"FINAALG"; "COMRING"; "RING"; "RNG"; "SGROUP"; "MONOID"}*/
/*"LIE" -> {"PI"; "NNI"; "INT"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"}*/
/*"LIE" -> {"INTDOM"; "ALGEBRA"; "ENTIRER"; "UFD"; "DIVRING"; "POLYCAT"}*/
/*"LIE" -> {"PDRING"; "FAMR"; "AMR"; "CHARZ"; "CHARNZ"; "FRETRCT"}*/
/*"LIE" -> {"RETRACT"; "EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"}*/
/*"LIE" -> {"ORDSET"; "KONVERT"; "PATMAB"; "PFECAT"}*/

"LODOF" [color="#FF4488",href="bookvol10.4.pdf#nameddest=LODOF"]
/*"LODOF" -> {"FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"LODOF" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"LODOF" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"LODOF" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"LODOF" -> {"ENTIRER"; "UFD"; "DIVRING"; "CHARZ"; "RETRACT"; "UPOLYC"}*/
/*"LODOF" -> {"POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARNZ"; "FRETRCT"}*/
/*"LODOF" -> {"EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"}*/
/*"LODOF" -> {"KONVERT"; "PATMAB"; "PFECAT"; "ELTAB"; "DIFRING"; "DIFEXT"}*/
/*"LODOF" -> {"STEP"; "QFCAT"; "FEVALAB"; "PATAB"; "FPATMAB"; "TYPE"}*/
/*"LODOF" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"LODOF" -> {"OASGP"; "REAL"; "BOOLEAN"; "INT"; "LIST"; "ILIST"; "LSAGG-"}*/
/*"LODOF" -> {"STAGG-"; "SINT"; "NNI"; "OM"; "LSAGG"; "STAGG"; "URAGG"}*/
/*"LODOF" -> {"RCAGG"; "HOAGG"; "AGG"; "LNAGG"; "IXAGG"; "ELTAGG"; "CLAGG"}*/
/*"LODOF" -> {"FLAGG"; "ELAGG"; "PI"; "ELAGG-"; "MONOID-"; "ABELMON-"}*/
"LODOF" -> "ACF"
/*"LODOF" -> {"RADCAT"; "ES"}*/

"LSQM" [color="#88FF44",href="bookvol10.3.pdf#nameddest=LSQM"]
/*"LSQM" -> {"SMATCAT"; "DIFEXT"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"LSQM" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"LSQM" -> {"MONOID"; "LMODULE"; "DIFRING"; "PDRING"; "BMODULE"; "RMODULE"}*/
/*"LSQM" -> {"RMATCAT"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
/*"LSQM" -> {"MODULE"; "COMRING"; "FRETRCT"; "RETRACT"; "FLINEXP"; "LINEXP"}*/
/*"LSQM" -> "ALGEBRA"*/
"LSQM" -> "FRNAALG"
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/*"LSQM" -> {"FINAALG"; "NAALG"; "NARNG"; "MONAD"; "INTDOM"; "ENTIRER"}*/
/*"LSQM" -> {"PI"; "NNI"; "INT"; "SINT"; "VECTOR"; "IVECTOR"; "IARRAY1"}*/
/*"LSQM" -> {"VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
/*"LSQM" -> {"ELTAB"; "CLAGG"; "KONVERT"; "ORDSET"; "VECTCAT-"; "A1AGG-"}*/
/*"LSQM" -> {"FLAGG-"; "LNAGG-"; "IXAGG-"; "CLAGG-"; "HOAGG-"; "ORDSET-"}*/
/*"LSQM" -> {"AGG-"; "ELTAGG-"; "SETCAT-"; "BASTYPE-"; "EUCDOM"; "PID"}*/
/*"LSQM" -> {"GCDDOM"; "FIELD"; "UFD"; "DIVRING"; "POLYCAT"; "FAMR"; "AMR"}*/
/*"LSQM" -> {"CHARZ"; "CHARNZ"; "PATMAB"; "PFECAT"; "INS"; "OINTDOM"}*/
/*"LSQM" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "CFCAT"}*/
/*"LSQM" -> {"REAL"; "STEP"}*/

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/*"OMEXPR" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"}*/
/*"OMEXPR" -> {"MONOID"; "LMODULE"; "BOOLEAN"; "LSAGG"; "STAGG"; "URAGG"}*/
/*"OMEXPR" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
/*"OMEXPR" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
/*"OMEXPR" -> {"FLAGG"; "ELAGG"; "INT"; "LIST"; "ILIST"; "NNI"; "LSAGG-"}*/
/*"OMEXPR" -> {"STAGG-"; "PI"; "SYMBOL"; "REF"; "ALIST"; "STRING"; "CHAR"}*/
/*"OMEXPR" -> {"SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"; "ISTRING"; "SRAGG-"}*/
/*"OMEXPR" -> {"FLAGG-"; "LNAGG-"}*/
"OMEXPR" -> "FS"
/*"OMEXPR" -> {"ES"; "RETRACT"; "PATAB"; "FPATMAB"; "PATMAB"; "FRETRCT"}*/
/*"OMEXPR" -> {"GROUP"; "PDRING"; "FLINEXP"; "LINEXP"; "CHARZ"; "CHARNZ"}*/
/*"OMEXPR" -> {"ALGEBRA"; "MODULE"; "BMODULE"; "RMODULE"; "FIELD"; "EUCDOM"}*/
/*"OMEXPR" -> {"PID"; "GCDDOM"; "INTDOM"; "COMRING"; "ENTIRER"; "UFD"}*/
/*"OMEXPR" -> "DIVRING"*/

"MCMPLX" [color="#88FF44",href="bookvol10.3.pdf#nameddest=MCMPLX"]
/*"MCMPLX" -> {"FMTC"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"MCMPLX" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"MCMPLX" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"MCMPLX" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "ORDSET"; "RETRACT"}*/
"MCMPLX" -> "COMPCAT"
/*"MCMPLX" -> {"MONOGEN"; "FRAMALG"; "FINRALG"; "CHARZ"; "CHARNZ"}*/
/*"MCMPLX" -> {"KONVERT"; "FRETRCT"; "FLINEXP"; "LINEXP"; "FINITE"}*/
/*"MCMPLX" -> {"FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "UFD"; "DIVRING"}*/
/*"MCMPLX" -> {"DIFEXT"; "DIFRING"; "PDRING"; "FFIELDC"; "FPC"; "STEP"}*/
/*"MCMPLX" -> {"FEVALAB"; "ELTAB"; "EVALAB"; "IEVALAB"; "FPATMAB"; "TYPE"}*/
/*"MCMPLX" -> {"PATMAB"; "PATAB"; "TRANFUN"; "TRIGCAT"; "ATRIG"; "HYPCAT"}*/
/*"MCMPLX" -> {"AHYP"; "ELEMFUN"; "RADCAT"; "PFECAT"; "FPS"; "RNS"}*/
/*"MCMPLX" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "REAL"}*/
/*"MCMPLX" -> {"INS"; "OINTDOM"; "CFCAT"; "UPOLYC"; "POLYCAT"; "FAMR"}*/
/*"MCMPLX" -> {"AMR"; "OAMONS"}*/

"MULTFACT" [color="#FF4488",href="bookvol10.4.pdf#nameddest=MULTFACT"]
/*"MULTFACT" -> {"ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"; "OAMONS"; "OCAMON"}*/
/*"MULTFACT" -> {"OAMON"; "OASGP"; "ABELMON"; "ABELSG"; "CABMON"; "EUCDOM"}*/
/*"MULTFACT" -> {"PID"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"}*/
/*"MULTFACT" -> {"ABELGRP"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"MULTFACT" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "CHARZ"}*/
/*"MULTFACT" -> {"POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARNZ"; "FRETRCT"}*/
/*"MULTFACT" -> {"RETRACT"; "EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"}*/
/*"MULTFACT" -> {"KONVERT"; "PATMAB"; "PFECAT"; "UFD"; "INS"; "OINTDOM"}*/
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/*"MULTFACT" -> {"ORDRING"; "OAGROUP"; "DIFRING"; "CFCAT"; "REAL"; "STEP"}*/
"MULTFACT" -> "COMPCAT"
/*"MULTFACT" -> {"MONOGEN"; "FRAMALG"; "FINRALG"; "FINITE"; "FIELD"}*/
/*"MULTFACT" -> {"DIVRING"; "DIFEXT"; "FFIELDC"; "FPC"; "FEVALAB"; "ELTAB"}*/
/*"MULTFACT" -> {"FPATMAB"; "TYPE"; "PATAB"; "TRANFUN"; "TRIGCAT"; "ATRIG"}*/
/*"MULTFACT" -> {"HYPCAT"; "AHYP"; "ELEMFUN"; "RADCAT"; "UPOLYC"}*/

/* MYEXPR and MYUP are mutually dependent */
/* We remove them and create a new node */
"MYEXPR/MYUP" [color="blue",href="bookvol10.3.pdf#nameddest=MYEXPR"]
"MYEXPR/MYUP" -> "FS"

/*"MYEXPR" [color="#88FF44",href="bookvol10.3.pdf#nameddest=MYEXPR"]*/
/*"MYEXPR" -> "MYUP"*/ /* clique1.spad */
/*"MYEXPR" -> {"FS"; "ES"; "ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"MYEXPR" -> {"RETRACT"; "IEVALAB"; "EVALAB"; "PATAB"; "KONVERT"; "FPATMAB"}*/
/*"MYEXPR" -> {"TYPE"; "PATMAB"; "FRETRCT"; "MONOID"; "SGROUP"; "GROUP"}*/
/*"MYEXPR" -> {"ABELMON"; "ABELSG"; "ABELGRP"; "CABMON"; "RING"; "RNG"}*/
/*"MYEXPR" -> {"LMODULE"; "PDRING"; "FLINEXP"; "LINEXP"; "CHARZ"; "CHARNZ"}*/
/*"MYEXPR" -> {"ALGEBRA"; "MODULE"; "BMODULE"; "RMODULE"; "FIELD"; "EUCDOM"}*/
/*"MYEXPR" -> {"PID"; "GCDDOM"; "INTDOM"; "COMRING"; "ENTIRER"; "UFD"}*/
/*"MYEXPR" -> {"DIVRING"; "COMBOPC"; "CFCAT"; "POLYCAT"; "FAMR"; "AMR"}*/
/*"MYEXPR" -> {"PFECAT"; "UPOLYC"; "ELTAB"; "DIFRING"; "DIFEXT"; "STEP"}*/
/*"MYEXPR" -> {"INS"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"MYEXPR" -> {"OASGP"; "REAL"; "FPS"; "RNS"; "RADCAT"; "QFCAT"}*/
/*"MYEXPR" -> {"FEVALAB"; "CACHSET"}*/

/*"MYUP" [color="#88FF44",href="bookvol10.3.pdf#nameddest=MYUP"]*/
/*"MYUP" -> "MYEXPR"*/ /* clique1.spad */
/*"MYUP" -> {"UPOLYC"; "POLYCAT"; "PDRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"MYUP" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"MYUP" -> {"SGROUP"; "MONOID"; "LMODULE"; "FAMR"; "AMR"; "BMODULE"}*/
/*"MYUP" -> {"RMODULE"; "COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"}*/
/*"MYUP" -> {"INTDOM"; "ENTIRER"; "FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"}*/
/*"MYUP" -> {"FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"; "GCDDOM"}*/
/*"MYUP" -> {"PFECAT"; "UFD"; "ELTAB"; "DIFRING"; "DIFEXT"; "STEP"}*/
/*"MYUP" -> {"EUCDOM"; "PID"; "FIELD"; "DIVRING"; "NNI"; "INT"; "FPS"}*/
/*"MYUP" -> {"RNS"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"MYUP" -> {"REAL"; "RADCAT"; "INS"; "OINTDOM"; "CFCAT"}*/

"NAGF01" [color="#FF4488",href="bookvol10.4.pdf#nameddest=NAGF01"]
/*"NAGF01" -> {"SYMBOL"; "INT"; "REF"; "ALIST"; "LIST"; "STRING"}*/
/*"NAGF01" -> {"CHAR"; "SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"; "ISTRING"}*/
/*"NAGF01" -> {"SRAGG-"; "FLAGG-"; "LNAGG-"; "FPS"; "RNS"; "FIELD"}*/
/*"NAGF01" -> {"EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"}*/
/*"NAGF01" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"NAGF01" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"NAGF01" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"}*/
/*"NAGF01" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"NAGF01" -> {"REAL"; "KONVERT"; "RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"}*/
/*"NAGF01" -> {"INS"; "OINTDOM"; "DIFRING"; "LINEXP"; "CFCAT"; "STEP"}*/
"NAGF01" -> "COMPCAT"
/*"NAGF01" -> {"MONOGEN"; "FRAMALG"; "FINRALG"; "CHARNZ"; "FRETRCT"}*/
/*"NAGF01" -> {"FLINEXP"; "FINITE"; "DIFEXT"; "PDRING"; "FFIELDC"; "FPC"}*/
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/*"NAGF01" -> {"FEVALAB"; "ELTAB"; "EVALAB"; "IEVALAB"; "FPATMAB"; "TYPE"}*/
/*"NAGF01" -> {"PATAB"; "TRANFUN"; "TRIGCAT"; "ATRIG"; "HYPCAT"; "AHYP"}*/
/*"NAGF01" -> {"ELEMFUN"; "PFECAT"}*/

"NAGF02" [color="#FF4488",href="bookvol10.4.pdf#nameddest=NAGF02"]
/*"NAGF02" -> {"SYMBOL"; "INT"; "REF"; "ALIST"; "LIST"; "STRING"; "CHAR"}*/
/*"NAGF02" -> {"SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"; "ISTRING"; "SRAGG-"}*/
/*"NAGF02" -> {"FLAGG-"; "LNAGG-"; "FPS"; "RNS"; "FIELD"; "EUCDOM"; "PID"}*/
/*"NAGF02" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"NAGF02" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"NAGF02" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"NAGF02" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"; "ORDRING"}*/
/*"NAGF02" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "REAL"}*/
/*"NAGF02" -> {"KONVERT"; "RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"; "INS-"}*/
/*"NAGF02" -> {"EUCDOM-"; "UFD-"; "GCDDOM-"; "INTDOM-"; "ALGEBRA-"}*/
/*"NAGF02" -> {"DIFRING-"; "ORDRING-"; "MODULE-"; "RING-"; "ABELGRP-"}*/
/*"NAGF02" -> {"ABELMON-"; "MONOID-"; "ORDSET-"; "ABELSG-"; "SGROUP-"}*/
/*"NAGF02" -> {"DFLOAT"; "PI"; "NNI"}*/
"NAGF02" -> "COMPCAT"
/*"NAGF02" -> {"MONOGEN"; "FRAMALG"; "FINRALG"; "CHARNZ"; "FRETRCT"}*/
/*"NAGF02" -> {"FLINEXP"; "LINEXP"; "FINITE"; "DIFEXT"; "DIFRING"}*/
/*"NAGF02" -> {"PDRING"; "FFIELDC"; "FPC"; "STEP"; "FEVALAB"}*/
/*"NAGF02" -> {"ELTAB"; "EVALAB"; "IEVALAB"; "FPATMAB"; "TYPE"}*/
/*"NAGF02" -> {"PATAB"; "TRANFUN"; "TRIGCAT"; "ATRIG"; "HYPCAT"}*/
/*"NAGF02" -> {"AHYP"; "ELEMFUN"; "PFECAT"}*/

"NAGF04" [color="#FF4488",href="bookvol10.4.pdf#nameddest=NAGF04"]
/*"NAGF04" -> {"SYMBOL"; "INT"; "REF"; "ALIST"; "LIST"; "STRING"; "CHAR"}*/
/*"NAGF04" -> {"SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"; "ISTRING"; "SRAGG-"}*/
/*"NAGF04" -> {"FLAGG-"; "LNAGG-"; "FPS"; "RNS"; "FIELD"; "EUCDOM"; "PID"}*/
/*"NAGF04" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"NAGF04" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"NAGF04" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"NAGF04" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"; "DIVRING"; "ORDRING"}*/
/*"NAGF04" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "REAL"}*/
/*"NAGF04" -> {"KONVERT"; "RETRACT"; "RADCAT"; "PATMAB"; "CHARZ"}*/
"NAGF04" -> "COMPCAT"
/*"NAGF04" -> {"MONOGEN"; "FRAMALG"; "FINRALG"; "CHARNZ"; "FRETRCT"}*/
/*"NAGF04" -> {"FLINEXP"; "LINEXP"; "FINITE"; "DIFEXT"; "DIFRING"; "PDRING"}*/
/*"NAGF04" -> {"FFIELDC"; "FPC"; "STEP"; "FEVALAB"; "ELTAB"; "EVALAB"}*/
/*"NAGF04" -> {"IEVALAB"; "FPATMAB"; "TYPE"; "PATAB"; "TRANFUN"; "TRIGCAT"}*/
/*"NAGF04" -> {"ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "PFECAT"; "INS"}*/
/*"NAGF04" -> {"OINTDOM"; "CFCAT"; "DFLOAT"}*/

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/*"NCEP" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"NCEP" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"NCEP" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
/*"NCEP" -> {"DIVRING"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"NCEP" -> {"ORDSET"; "SYMBOL"; "INT"; "REF"; "ALIST"; "LIST"; "STRING"}*/
/*"NCEP" -> {"CHAR"; "SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"; "ISTRING"}*/
/*"NCEP" -> {"SRAGG-"; "FLAGG-"; "LNAGG-"; "INS"; "OINTDOM"; "DIFRING"}*/
/*"NCEP" -> {"KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"}*/
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/*"NCEP" -> {"CHARZ"; "STEP"; "QFCAT"; "FEVALAB"; "ELTAB"; "EVALAB"}*/
/*"NCEP" -> {"IEVALAB"; "DIFEXT"; "PDRING"; "FLINEXP"; "PATAB"; "FPATMAB"}*/
/*"NCEP" -> {"TYPE"; "CHARNZ"; "PFECAT"}*/
"NCEP" -> "COMPCAT"
/*"NCEP" -> {"MONOGEN"; "FRAMALG"; "FINRALG"; "FRETRCT"; "FINITE"; "FFIELDC"}*/
/*"NCEP" -> {"FPC"; "TRANFUN"; "TRIGCAT"; "ATRIG"; "HYPCAT"; "AHYP"}*/
/*"NCEP" -> {"ELEMFUN"; "RADCAT"; "UPOLYC"; "POLYCAT"; "FAMR"; "AMR"}*/

"NLINSOL" [color="#FF4488",href="bookvol10.4.pdf#nameddest=NLINSOL"]
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/*"NLINSOL" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"NLINSOL" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"NLINSOL" -> {"MODULE"; "ENTIRER"; "ORDSET"; "KONVERT"; "OM"; "PATMAB"}*/
/*"NLINSOL" -> {"INT"; "LIST"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARZ"}*/
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/*"PSETCAT" -> {"POLYCAT"; "PDRING"; "FAMR"; "AMR"; "BMODULE"; "RMODULE"}*/
/*"PSETCAT" -> {"COMRING"; "ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"; "INTDOM"}*/
/*"PSETCAT" -> {"ENTIRER"; "FRETRCT"; "RETRACT"; "FLINEXP"; "LINEXP"}*/
/*"PSETCAT" -> {"PATMAB"; "GCDDOM"; "PFECAT"; "UFD"; "INT"; "LIST"; "ILIST"}*/
/*"PSETCAT" -> {"LSAGG-"; "STAGG-"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"}*/
/*"PSETCAT" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "FLAGG"; "ELAGG"}*/
/*"PSETCAT" -> {"OM"; "ELAGG-"; "FLAGG-"; "BOOLEAN"; "URAGG-"; "LNAGG-"}*/
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/*"PSETCAT-" -> {"RNG";  "ABELGRP";  "CABMON";  "ABELMON";  "ABELSG"}*/
/*"PSETCAT-" -> {"SGROUP";  "MONOID";  "LMODULE";  "OAMONS";  "OCAMON"}*/
/*"PSETCAT-" -> {"OAMON";  "OASGP";  "ORDSET"}*/
"PSETCAT-" -> "RPOLCAT"
/*"PSETCAT-" -> {"POLYCAT";  "PDRING";  "FAMR";  "AMR";  "BMODULE"}*/
/*"PSETCAT-" -> {"RMODULE";  "COMRING";  "ALGEBRA";  "MODULE";  "CHARZ"}*/
/*"PSETCAT-" -> {"CHARNZ";  "INTDOM";  "ENTIRER";  "FRETRCT";  "RETRACT"}*/
/*"PSETCAT-" -> {"FLINEXP";  "LINEXP";  "PATMAB";  "GCDDOM";  "PFECAT"}*/
/*"PSETCAT-" -> {"UFD";  "INT";  "LIST";  "ILIST";  "LSAGG-";  "STAGG-"}*/
/*"PSETCAT-" -> {"LSAGG";  "STAGG";  "URAGG";  "RCAGG";  "LNAGG";  "IXAGG"}*/
/*"PSETCAT-" -> {"ELTAGG";  "ELTAB";  "FLAGG";  "ELAGG";  "OM";  "ELAGG-"}*/
/*"PSETCAT-" -> {"FLAGG-";  "BOOLEAN";  "URAGG-";  "LNAGG-";  "RCAGG-"}*/
/*"PSETCAT-" -> {"IXAGG-";  "CLAGG-";  "EUCDOM";  "PID"}*/

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/*"PROJPLPS" -> {"PACFFC"}*/
"PROJPLPS" -> "PACOFF"
/*"PROJPLPS" -> {"FFIELDC"; "FPC"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"}*/
/*"PROJPLPS" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"PROJPLPS" -> {"ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"PROJPLPS" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
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/*"PSETPK" -> {"OASGP"; "ORDSET"}*/
"PSETPK" -> "RPOLCAT"
/*"PSETPK" -> {"POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARZ"; "CHARNZ"}*/
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/*"QUAT" -> {"KONVERT"; "CHARZ"; "CHARNZ"; "FIELD"; "EUCDOM"; "PID"}*/
/*"QUAT" -> {"GCDDOM"; "INTDOM"; "COMRING"; "UFD"; "INS"; "OINTDOM"}*/
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/*"QUATCT2" -> {"FEVALAB"; "ELTAB"; "EVALAB"; "IEVALAB"; "FLINEXP"}*/
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/*"RADFF" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"RADFF" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "MODULE"; "BMODULE"}*/
/*"RADFF" -> {"RMODULE"; "CHARZ"; "CHARNZ"; "COMRING"; "KONVERT"; "FRETRCT"}*/
/*"RADFF" -> {"RETRACT"; "FLINEXP"; "LINEXP"; "FINITE"; "FIELD"; "EUCDOM"}*/
/*"RADFF" -> {"PID"; "GCDDOM"; "INTDOM"; "ENTIRER"; "UFD"; "DIVRING"}*/
/*"RADFF" -> {"DIFEXT"; "DIFRING"; "PDRING"; "FFIELDC"; "FPC"; "STEP"}*/
/*"RADFF" -> {"UPOLYC"; "POLYCAT"; "FAMR"; "AMR"; "EVALAB"; "IEVALAB"}*/
/*"RADFF" -> {"ORDSET"; "PATMAB"; "PFECAT"; "ELTAB"; "QFCAT"; "FEVALAB"}*/
/*"RADFF" -> {"PATAB"; "FPATMAB"; "TYPE"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"RADFF" -> {"OCAMON"; "OAMON"; "OASGP"; "REAL"; "NNI"; "INT"; "BOOLEAN"}*/
/*"RADFF" -> {"VECTOR"; "IVECTOR"; "IARRAY1"; "INS"; "CFCAT"; "OM"; "SINT"}*/
/*"RADFF" -> {"VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"; "HOAGG"; "AGG"}*/
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/*"RDEEF" -> {"ES"; "IEVALAB"; "EVALAB"; "PATAB"; "KONVERT"; "FPATMAB"}*/
/*"RDEEF" -> {"TYPE"; "PATMAB"; "FRETRCT"; "GROUP"; "PDRING"; "FLINEXP"}*/
/*"RDEEF" -> {"CHARNZ"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"}*/
/*"RDEEF" -> {"AGG"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "FLAGG"}*/
/*"RDEEF" -> {"ELAGG"; "UPOLYC"; "POLYCAT"; "FAMR"; "AMR"; "PFECAT"}*/
/*"RDEEF" -> {"DIFRING"; "DIFEXT"; "STEP"; "SYMBOL"; "INT"; "REF"; "ALIST"}*/
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"RDEEFS" -> "ACF"
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/*"RDEEFS" -> {"TYPE"; "PATMAB"; "FRETRCT"; "GROUP"; "PDRING"; "FLINEXP"}*/
/*"RDEEFS" -> {"CHARNZ"; "UPOLYC"; "POLYCAT"; "FAMR"; "AMR"; "PFECAT"}*/
/*"RDEEFS" -> {"ELTAB"; "DIFRING"; "DIFEXT"; "STEP"; "INT"; "LIST"; "ILIST"}*/
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/*"RDIV" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"RDIV" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
/*"RDIV" -> {"DIVRING"; "UPOLYC"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"}*/
/*"RDIV" -> {"CHARZ"; "CHARNZ"; "FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"}*/
/*"RDIV" -> {"FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"; "PFECAT"}*/
/*"RDIV" -> {"ELTAB"; "DIFRING"; "DIFEXT"; "STEP"}*/
"RDIV" -> "FFCAT"
/*"RDIV" -> {"MONOGEN"; "FRAMALG"; "FINRALG"; "FINITE"; "FFIELDC"; "FPC"}*/
/*"RDIV" -> {"QFCAT"; "FEVALAB"; "PATAB"; "FPATMAB"; "TYPE"; "OINTDOM"}*/
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/*"RSETCAT" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "TSETCAT"}*/
/*"RSETCAT" -> {"PSETCAT"; "CLAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"}*/
/*"RSETCAT" -> {"IEVALAB"; "KONVERT"; "OAMONS"; "OCAMON"; "OAMON"}*/
/*"RSETCAT" -> {"OASGP"; "ORDSET"}*/
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/*"RSETCAT" -> {"PFECAT"; "UFD"; "BOOLEAN"; "INT"; "LIST"; "ILIST"}*/
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/*"RSETCAT" -> {"LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "LNAGG"; "IXAGG"}*/
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/*"RSETCAT-" -> {"BASTYPE";  "KOERCE";  "SGROUP";  "MONOID";  "LMODULE"}*/
/*"RSETCAT-" -> {"BMODULE";  "RMODULE";  "ALGEBRA";  "MODULE";  "ENTIRER"}*/
/*"RSETCAT-" -> {"TSETCAT";  "PSETCAT";  "CLAGG";  "HOAGG";  "AGG";  "TYPE"}*/
/*"RSETCAT-" -> {"EVALAB";  "IEVALAB";  "KONVERT";  "OAMONS";  "OCAMON"}*/
/*"RSETCAT-" -> {"OAMON";  "OASGP";  "ORDSET"}*/
"RSETCAT-" -> "RPOLCAT"
/*"RSETCAT-" -> {"POLYCAT";  "PDRING";  "FAMR";  "AMR";  "CHARZ";  "CHARNZ"}*/
/*"RSETCAT-" -> {"FRETRCT";  "RETRACT";  "FLINEXP";  "LINEXP";  "PATMAB"}*/
/*"RSETCAT-" -> {"PFECAT";  "UFD";  "BOOLEAN";  "INT";  "LIST";  "ILIST"}*/
/*"RSETCAT-" -> {"FINITE";  "NNI";  "LSAGG-";  "STAGG-";  "ELAGG-"}*/
/*"RSETCAT-" -> {"FLAGG-";  "LSAGG";  "STAGG";  "URAGG";  "RCAGG"}*/
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/*"RSETGCD" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "OAMONS"; "OCAMON"}*/
/*"RSETGCD" -> {"OAMON"; "OASGP"; "ORDSET"}*/
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/*"RSETGCD" -> {"POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARZ"; "CHARNZ"}*/
/*"RSETGCD" -> {"FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"; "FLINEXP"}*/
/*"RSETGCD" -> {"LINEXP"; "KONVERT"; "PATMAB"; "PFECAT"; "UFD"; "RSETCAT"}*/
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/*"RSETGCD" -> {"ELTAGG"; "ELTAB"; "FLAGG"; "ELAGG"; "BOOLEAN"; "INT"}*/
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"RULESET" -> "FS"
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/*"RULESET" -> {"SGROUP"; "GROUP"; "ABELMON"; "ABELSG"; "ABELGRP"; "CABMON"}*/
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/*"RULESET" -> {"CHARZ"; "CHARNZ"; "ALGEBRA"; "MODULE"; "BMODULE"}*/
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/*"SD" -> {"MONOID"; "GROUP"; "RING"; "PDRING"; "FLINEXP"; "LINEXP"}*/
/*"SD" -> {"CHARZ"; "CHARNZ"; "ALGEBRA"; "FIELD"; "EUCDOM"; "PID"}*/
/*"SD" -> {"GCDDOM"; "INTDOM"; "COMRING"; "ENTIRER"; "UFD"; "DIVRING"}*/
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/*"SD" -> {"FLAGG-"; "URAGG-"; "LNAGG-"; "RCAGG-"; "IXAGG-"; "CLAGG-"}*/
/*"SD" -> {"HOAGG-"; "ORDSET-"; "AGG-"; "ELTAGG-"; "SETCAT-"}*/
/*"SD" -> {"BASTYPE-"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"}*/
/*"SD" -> {"AGG"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"}*/
/*"SD" -> {"FLAGG"; "ELAGG"; "OM"; "PI"; "SYMBOL"; "REF"; "ALIST"}*/
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/*"SD" -> {" ISTRING"; "SRAGG";-" BOOLEAN"; "BSD"}*/
"SD" -> "FS"

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/*"SIGNEF" -> {"MODULE"; "ENTIRER"; "ORDSET"; "RETRACT"; "LINEXP"; "GCDDOM"}*/
/*"SIGNEF" -> {"ACF"; "FIELD"; "EUCDOM"; "PID"; "UFD"; "DIVRING"; "RADCAT"}*/
/*"SIGNEF" -> {"TRANFUN"; "TRIGCAT"; "ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"}*/
"SIGNEF" -> "FS"
/*"SIGNEF" -> {"ES"; "IEVALAB"; "EVALAB"; "PATAB"; "KONVERT"; "FPATMAB"}*/
/*"SIGNEF" -> {"TYPE"; "PATMAB"; "FRETRCT"; "GROUP"; "PDRING"; "FLINEXP"}*/
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/*"SIGNEF" -> {"PFECAT"; "CACHSET"; "LIST"; "ILIST"; "SYMBOL"; "REF"}*/
/*"SIGNEF" -> {"ALIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"}*/
/*"SIGNEF" -> {"A1AGG-"; "ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"; "LSAGG"}*/
/*"SIGNEF" -> {"STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"; "LNAGG"; "IXAGG"}*/
/*"SIGNEF" -> {"ELTAGG"; "ELTAB"; "CLAGG"; "FLAGG"; "ELAGG"; "OM"; "FPS"}*/
/*"SIGNEF" -> {"RNS"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"SIGNEF" -> {"REAL"; "DIFRING"; "INTCAT"; "QFCAT"; "FEVALAB"; "DIFEXT"}*/
/*"SIGNEF" -> {"STEP"; "OINTDOM"; "PI"; "LSAGG-"; "STAGG-"; "ELAGG-"}*/
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/*"SIGNEF" -> {"URAGG-"; "INS-"}*/

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/*"SIMPAN" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"SIMPAN" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"}*/
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/*"SIMPAN" -> {"DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"}*/
/*"SIMPAN" -> {"CFCAT"; "REAL"; "CHARZ"; "STEP"}*/
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/*"SIMPAN" -> {"ES"; "IEVALAB"; "EVALAB"; "PATAB"; "FPATMAB"; "TYPE"}*/
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/*"SIMPAN" -> {"FIELD"; "DIVRING"}*/

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/*"SFORT" -> {"ABELMON"; "ABELSG"; "ABELGRP"; "CABMON"; "RING"; "RNG"}*/
/*"SFORT" -> {"LMODULE"; "PDRING"; "FLINEXP"; "LINEXP"; "CHARZ"; "CHARNZ"}*/
/*"SFORT" -> {"ALGEBRA"; "MODULE"; "BMODULE"; "RMODULE"; "FIELD"; "EUCDOM"}*/
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/*"SOLVESER" -> {"FLAGG-"; "LNAGG-"}*/
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/*"SOLVESER" -> {"ES"; "RETRACT"; "IEVALAB"; "EVALAB"; "PATAB"; "KONVERT"}*/
/*"SOLVESER" -> {"FPATMAB"; "TYPE"; "PATMAB"; "FRETRCT"; "GROUP"; "PDRING"}*/
/*"SOLVESER" -> {"FLINEXP"; "LINEXP"; "CHARZ"; "CHARNZ"; "FIELD"; "EUCDOM"}*/
/*"SOLVESER" -> {"PID"; "GCDDOM"; "UFD"; "DIVRING"; "UPOLYC"; "POLYCAT"}*/
/*"SOLVESER" -> {"FAMR"; "AMR"; "PFECAT"; "ELTAB"; "DIFRING"; "DIFEXT"}*/
/*"SOLVESER" -> {"STEP"; "NNI"; "VECTOR"; "IVECTOR"; "IARRAY1"; "ILIST"}*/
/*"SOLVESER" -> {"PI"; "VECTCAT"; "A1AGG"; "FLAGG"; "LNAGG"; "IXAGG"}*/
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/*"SOLVETRA" -> {"DIFEXT"; "DIFRING"; "PDRING"; "FLINEXP"; "PATAB"}*/
/*"SOLVETRA" -> {"FPATMAB"; "PATMAB"; "STEP"; "OINTDOM"; "ORDRING"}*/
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/*"SOLVETRA" -> {"SRAGG-"; "FLAGG-"; "LNAGG-"; "UPOLYC"; "POLYCAT"; "FAMR"}*/
/*"SOLVETRA" -> {"AMR"; "FRETRCT"}*/
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/*"SOLVETRA" -> {"AHYP"; "ELEMFUN"; "COMBOPC"; "CFCAT"; "LFCAT"; "PRIMCAT"}*/
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/*"SOLVETRA" -> {"COMPCAT"; "MONOGEN"; "FRAMALG"; "FINRALG"; "FINITE"}*/
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/*"SUTS" -> {"UPSCAT"; "PSCAT"; "AMR"; "BMODULE"; "RMODULE"; "COMRING"}*/
/*"SUTS" -> {"ALGEBRA"; "MODULE"; "CHARZ"; "CHARNZ"; "INTDOM"; "ENTIRER"}*/
/*"SUTS" -> {"ELTAB"; "DIFRING"; "PDRING"; "RADCAT"; "TRANFUN"; "TRIGCAT"}*/
/*"SUTS" -> {"ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "INT"; "BOOLEAN"}*/
/*"SUTS" -> {"NNI"; "INS"; "UFD"; "GCDDOM"; "EUCDOM"; "PID"; "OINTDOM"}*/
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/*"SUTS" -> {"STEP"; "OM"; "STRING"; "CHAR"; "SINT"; "OUTFORM"; "LIST"}*/
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/*"TOOLSIGN" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
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/*"TOOLSIGN" -> {"RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"}*/
/*"TOOLSIGN" -> {"CHARZ"; "STEP"}*/
"TOOLSIGN" -> "FS"
/*"TOOLSIGN" -> {"ES"; "IEVALAB"; "EVALAB"; "PATAB"; "FPATMAB"; "TYPE"}*/
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/*"TRIGMNIP" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"TRIGMNIP" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "ORDSET"}*/
/*"TRIGMNIP" -> {"RETRACT"; "LINEXP"}*/
"TRIGMNIP" -> "ACF"
/*"TRIGMNIP" -> {"FIELD"; "EUCDOM"; "PID"; "UFD"; "DIVRING"; "RADCAT"}*/
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/*"TRIGMNIP" -> {"ES"; "IEVALAB"; "EVALAB"; "PATAB"; "KONVERT"; "FPATMAB"}*/
/*"TRIGMNIP" -> {"TYPE"; "PATMAB"; "FRETRCT"; "GROUP"; "PDRING"; "FLINEXP"}*/
/*"TRIGMNIP" -> {"CHARZ"; "CHARNZ"; "INT"; "LIST"; "ILIST"}*/
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/*"TRIGMNIP" -> {"MONOGEN"; "FRAMALG"; "FINRALG"; "FINITE"; "DIFEXT"}*/
/*"TRIGMNIP" -> {"DIFRING"; "FFIELDC"; "FPC"; "STEP"; "FEVALAB"; "ELTAB"}*/
/*"TRIGMNIP" -> {"PFECAT"; "OM"; "SYMBOL"; "REF"; "ALIST"; "STRING"; "CHAR"}*/
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/*"TRIGMNIP" -> {"INS-"; "NNI"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"}*/
/*"TRIGMNIP" -> {"AGG"; "LNAGG"; "IXAGG"; "ELTAGG"; "CLAGG"; "FLAGG"}*/
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/*"TRMANIP" -> {"HYPCAT"; "AHYP"; "ELEMFUN"; "SYMBOL"; "INT"; "REF"}*/
/*"TRMANIP" -> {"ALIST"; "LIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"}*/
/*"TRMANIP" -> {"PRIMARR"; "A1AGG-"; "ISTRING"; "SRAGG-"; "FLAGG-"}*/
/*"TRMANIP" -> {"LNAGG-"; "ILIST"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"}*/
/*"TRMANIP" -> {"HOAGG"; "AGG"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"}*/
/*"TRMANIP" -> {"CLAGG"; "FLAGG"; "ELAGG"; "OM"; "NNI"; "LSAGG-"; "STAGG-"}*/
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/*"TSETCAT" -> {"OAMON"; "OASGP"; "ORDSET"}*/
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/*"TSETCAT-" -> {"RMODULE";  "ALGEBRA";  "MODULE";  "ENTIRER";  "PSETCAT"}*/
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/*"UFPS" -> {"ELTAB"; "DIFRING"; "PDRING"; "RADCAT"; "TRANFUN"; "TRIGCAT"}*/
/*"UFPS" -> {"ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "OAMONS"; "OCAMON"}*/
/*"UFPS" -> {"OAMON"; "OASGP"; "ORDSET"; "INS"; "UFD"; "GCDDOM"; "EUCDOM"}*/
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/*"ULSCCAT-" -> {"ABELGRP";  "CABMON";  "ABELMON";  "ABELSG";  "SETCAT"}*/
/*"ULSCCAT-" -> {"BASTYPE";  "KOERCE";  "SGROUP";  "MONOID";  "LMODULE"}*/
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/*"ULSCCAT-" -> {"CHARZ";  "CHARNZ";  "INTDOM";  "ENTIRER";  "ELTAB"}*/
/*"ULSCCAT-" -> {"DIFRING";  "PDRING";  "RADCAT";  "TRANFUN";  "TRIGCAT"}*/
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"ULSCCAT-" -> "UTSCAT"
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/*"UPXSSING" -> {"FAMR"; "AMR"; "UPXSCCA"; "UPXSCAT"; "UPSCAT"; "PSCAT"}*/
/*"UPXSSING" -> {"ELTAB"; "DIFRING"; "NNI"; "INT"; "LIST"; "ILIST"; "INS"}*/
/*"UPXSSING" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"UPXSSING" -> {"OASGP"; "CFCAT"; "REAL"; "STEP"; "BOOLEAN"; "OM"}*/
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/*"UTSODE" -> {"UPSCAT"; "PSCAT"; "AMR"; "COMRING"; "CHARZ"; "CHARNZ"}*/
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/*"UTSODE" -> {"RADCAT"; "TRANFUN"; "TRIGCAT"; "ATRIG"; "HYPCAT"; "AHYP"}*/
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/*"UTSODETL" -> {"PID"; "FIELD"; "DIVRING"; "LODOCAT"; "OREPCAT"}*/
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/*"UTSODETL" -> {"UPSCAT"; "PSCAT"; "RADCAT"; "TRANFUN"; "TRIGCAT"}*/
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/*"UTSSOL" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
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/*"UTSSOL" -> {"FLAGG"; "ORDSET"; "ELAGG"; "OM"; "UPOLYC"; "POLYCAT"}*/
/*"UTSSOL" -> {"FAMR"; "FRETRCT"; "RETRACT"; "FLINEXP"; "LINEXP"; "PATMAB"}*/
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/*"WUTSET" -> {"CLAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
/*"WUTSET" -> {"KONVERT"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"WUTSET" -> {"CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"WUTSET" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"WUTSET" -> {"OAMONS"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
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/*"WUTSET" -> {"FRETRCT"; "RETRACT"; "FLINEXP"; "LINEXP"; "PATMAB"}*/
/*"WUTSET" -> {"GCDDOM"; "PFECAT"; "UFD"; "LSAGG"; "STAGG"; "URAGG"}*/
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/*"WUTSET" -> {"ELAGG"; "OM"; "INT"; "LIST"; "ILIST"; "LSAGG-"; "STAGG-"}*/
/*"WUTSET" -> {"ELAGG-"; "FLAGG-"; "URAGG-"; "LNAGG-"; "RCAGG-"; "IXAGG-"}*/
/*"WUTSET" -> {"CLAGG-"; "BOOLEAN"; "HOAGG-"; "ORDSET-"; "AGG-"; "ELTAGG-"}*/
/*"WUTSET" -> {"SETCAT-"; "BASTYPE-"; "FINITE"}*/
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1.4.20 Layer18

Depends on: ACFS EXPRSOL FDIVCAT RSETCAT UFPS ULSCCAT UTSSOL Used in next layer: EXPRSOL SFRTCAT CELL

— **layer18** —

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  ${OUT}/CAD.o \
  ${OUT}/DEFINTEF.o ${OUT}/DEFINTRF.o ${OUT}/DFINTTLS.o ${OUT}/EFULS.o    \
  ${OUT}/ESCONT.o   ${OUT}/EXPR.o     ${OUT}/EXPRSOL.o  ${OUT}/EXPR2UPS.o \
  ${OUT}/FACTEXT.o  \
  ${OUT}/FDIV.o     ${OUT}/FSCINT.o   ${OUT}/FSINT.o    ${OUT}/FS2EXPXP.o \
  ${OUT}/GSERIES.o  ${OUT}/HELLFDIV.o ${OUT}/INTDIVP.o  \
  ${OUT}/INVLAPLA.o ${OUT}/IR2F.o     \
  ${OUT}/IRRF2F.o   ${OUT}/LAPLACE.o  ${OUT}/LIMITPS.o  ${OUT}/LODEEF.o   \
  ${OUT}/NODE1.o    ${OUT}/NOTTING.o \
  ${OUT}/NTSCAT.o   ${OUT}/ODECONST.o ${OUT}/ODEEF.o    \
  ${OUT}/ODEINT.o   ${OUT}/QCMPACK.o  ${OUT}/REGSET.o   ${OUT}/REP.o      \
  ${OUT}/RGCHAIN.o  ${OUT}/RSDCMPK.o  ${OUT}/SFRTCAT.o  ${OUT}/SOLVERAD.o \
  ${OUT}/SULS.o     ${OUT}/SUPXS.o    ${OUT}/UFPS1.o    ${OUT}/ULS.o      \
  ${OUT}/ULSCONS.o  ${OUT}/UPXS.o     ${OUT}/UPXSCONS.o ${OUT}/UTS.o      \
  ${OUT}/UTSZ.o \
  layer18done
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— **layerpic** —

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/* layer 18 */
/* depends on: ACFS FDIVCAT RSETCAT UFPS ULSCCAT UTSSOL CELL */

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/*"CAD" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "COMRING"} */
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/*"DEFINTEF" -> {"OAMON"; "OASGP"; "DIFRING"; "CFCAT"; "REAL"; "STEP"}*/
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/*"DEFINTEF" -> {"LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"; "LNAGG"}*/
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/*"ESCONT" -> {"ACF"; "COMBOPC"; "LFCAT"; "PRIMCAT"; "VECTOR"; "IVECTOR"}*/
/*"ESCONT" -> {"IARRAY1"; "VECTCAT-"}*/
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/*"EXPR" -> {"MODULE"; "BMODULE"; "RMODULE"; "FIELD"; "EUCDOM"; "PID"}*/
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/*"EXPR" -> {"SPFCAT"; "BOOLEAN"; "CACHSET"; "POLYCAT"; "FAMR"; "AMR"}*/
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/*"EXPR" -> {"ELTAGG"; "ELTAB"; "CLAGG"; "FLAGG"; "ELAGG"; "OM"; "NNI"}*/
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/*"EXPRSOL" -> {"ABELSG"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"EXPRSOL" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "KONVERT"}*/
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/*"EXPRSOL" -> {"PSCAT"; "AMR"; "ELTAB"; "DIFRING"; "RADCAT"; "TRANFUN"}*/
/*"EXPRSOL" -> {"TRIGCAT"; "ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "SYMBOL"}*/
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/*"EXPR2UPS" -> {"OASGP"; "DIFRING"; "CFCAT"; "REAL"; "STEP"}*/
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/*"FDIV" -> {"A1AGG-"; "INS"; "OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"}*/
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/*"IRRF2F" -> {"DIVRING"; "QFCAT"; "FEVALAB"; "ELTAB"; "DIFEXT"}*/
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/*"IRRF2F" -> {"ACF"; "RADCAT"; "TRANFUN"; "TRIGCAT"; "ATRIG"; "HYPCAT"}*/
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/*"SOLVERAD" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"SOLVERAD" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"SOLVERAD" -> {"ORDSET"; "CHARZ"; "BOOLEAN"; "FS"; "ES"; "RETRACT"}*/
/*"SOLVERAD" -> {"IEVALAB"; "EVALAB"; "PATAB"; "KONVERT"; "FPATMAB"}*/
/*"SOLVERAD" -> {"TYPE"; "PATMAB"; "FRETRCT"; "GROUP"; "PDRING"; "FLINEXP"}*/
/*"SOLVERAD" -> {"LINEXP"; "CHARNZ"; "FIELD"; "UFD"; "DIVRING"}*/
"SOLVERAD" -> "ACFS"
/*"SOLVERAD" -> {"ACF"; "RADCAT"; "TRANFUN"; "TRIGCAT"; "ATRIG"; "HYPCAT"}*/
/*"SOLVERAD" -> {"AHYP"; "ELEMFUN"; "COMBOPC"; "CFCAT"; "LFCAT"; "PRIMCAT"}*/
/*"SOLVERAD" -> {"SPFCAT"; "SYMBOL"; "INT"; "REF"; "ALIST"; "LIST"}*/
/*"SOLVERAD" -> {"STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"}*/
/*"SOLVERAD" -> {"ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"; "POLYCAT"}*/
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/*"SULS" -> {"ULSCAT"; "UPSCAT"; "PSCAT"; "AMR"; "BMODULE"; "RMODULE"}*/
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/*"SULS" -> {"ENTIRER"; "ELTAB"; "DIFRING"; "PDRING"; "RADCAT"; "TRANFUN"}*/
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/*"ULS" -> {"OAMON"; "OASGP"; "REAL"; "PFECAT"; "INT"; "UTSCAT"; "OAMONS"}*/
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/*"UTS" -> {"URAGG-"; "RCAGG-"; "IXAGG-"; "PRIMCAT"}*/
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1.4.21 Layer19

Depends on: EXPRSOL SFRTCAT FACTEXT INTDIVP DTP
Next layer depends on: RECOP

— **layer19** —

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  ${OUT}/IRURPK.o   ${OUT}/LAZM3PK.o  ${OUT}/LEXTRIPK.o ${OUT}/NORMPK.o  \
  ${OUT}/PACEXT.o   \
  ${OUT}/RECOP.o    ${OUT}/RURPK.o    ${OUT}/SFRGCD.o   ${OUT}/SFQCMPK.o \
  ${OUT}/SNTSCAT.o  ${OUT}/SRDCMPK.o  ${OUT}/SREGSET.o  ${OUT}/ZDSOLVE.o \
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— **layerpic** —

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/* EXPRSOL SFRTCAT */

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/*"IRURPK" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
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/*"LAZM3PK" -> {"FLAGG-"; "BOOLEAN"}*/

"LEXTRIPK" [color="#FF4488",href="bookvol10.4.pdf#nameddest=LEXTRIPK"]
/*"LEXTRIPK" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"LEXTRIPK" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"LEXTRIPK" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"LEXTRIPK" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "ORDFIN"}*/
/*"LEXTRIPK" -> {"ORDSET"; "FINITE"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"}*/
/*"LEXTRIPK" -> {"HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "LNAGG"}*/
/*"LEXTRIPK" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"; "FLAGG"}*/
/*"LEXTRIPK" -> {"ELAGG"; "OM"; "INT"; "LIST"; "ILIST"; "LSAGG-"; "STAGG-"}*/
/*"LEXTRIPK" -> {"ELAGG-"; "FLAGG-"; "URAGG-"; "LNAGG-"; "RCAGG-"}*/
/*"LEXTRIPK" -> "IXAGG-"; "CLAGG-"; "BOOLEAN"}*/
"LEXTRIPK" -> "SFRTCAT"
/*"LEXTRIPK" -> {"RSETCAT"; "TSETCAT"; "PSETCAT"}*/

"NORMPK" [color="#FF4488",href="bookvol10.4.pdf#nameddest=NORMPK"]
/*"NORMPK" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"NORMPK" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"NORMPK" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"NORMPK" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "OAMONS"; "OCAMON"}*/
/*"NORMPK" -> {"OAMON"; "OASGP"; "ORDSET"; "RPOLCAT"; "POLYCAT"; "PDRING"}*/
/*"NORMPK" -> {"FAMR"; "AMR"; "CHARZ"; "CHARNZ"; "FRETRCT"; "RETRACT"}*/
/*"NORMPK" -> {"EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"; "KONVERT"; "PATMAB"}*/
/*"NORMPK" -> {"PFECAT"; "UFD"; "RSETCAT"; "TSETCAT"; "PSETCAT"; "CLAGG"}*/
/*"NORMPK" -> {"HOAGG"; "AGG"; "TYPE"}*/
```

```
"NORMPK" -> "SFRTCAT"
/*"NORMPK" -> {"STRING"; "CHAR"; "SINT"; "OUTFORM"; "LIST"; "INT"; "PRIMARR"}*/
/*"NORMPK" -> {"A1AGG-"; "ISTRING"; "NNI"; "BOOLEAN"; "ILIST"}*/
/*"NORMPK" -> {"LSAGG-"; "STAGG-"}*/

"PACEXT" [color="#88FF44",href="bookvol10.3.pdf#nameddest=PACEXT"]
/*"PACEXT" -> {"FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"PACEXT" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"PACEXT" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"PACEXT" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
/*"PACEXT" -> {"DIVRING"; "CHARZ"; "RETRACT"; "XF"; "VSPACE"; "FPC"}*/
/*"PACEXT" -> {"CHARNZ"; "FINITE"; "PI"; "NNI"; "INT"; "LIST"; "ILIST"}*/
/*"PACEXT" -> {"LSAGG-"; "STAGG-"; "ELAGG-"; "FLAGG-"; "URAGG-"; "LNAGG-"}*/
/*"PACEXT" -> {"RCAGG-"; "IXAGG-"; "CLAGG-"; "HOAGG-"; "ORDSET-"; "AGG-"}*/
/*"PACEXT" -> {"ELTAGG-"; "SETCAT-"; "BASTYPE-"; "LSAGG"; "STAGG"; "URAGG"}*/
/*"PACEXT" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
/*"PACEXT" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
/*"PACEXT" -> {"FLAGG"; "ORDSET"; "ELAGG"; "OM"; "VECTOR"; "IVECTOR"}*/
/*"PACEXT" -> {"IARRAY1"; "VECTCAT-"; "A1AGG-"; "UPOLYC"; "POLYCAT"}*/
/*"PACEXT" -> {"PDRING"; "FAMR"; "AMR"; "FRETRCT"; "FLINEXP"; "LINEXP"}*/
/*"PACEXT" -> {"PATMAB"; "PFECAT"; "DIFRING"; "DIFEXT"; "STEP"; "SYMBOL"}*/
/*"PACEXT" -> {"REF"; "ALIST"; "STRING"; "CHAR"; "SINT"; "OUTFORM"}*/
/*"PACEXT" -> {"PRIMARR"; "ISTRING"; "SRAGG-"; "INS"; "OINTDOM"; "ORDRING"}*/
/*"PACEXT" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "CFCAT"; "REAL"}*/
/*"PACEXT" -> {"BOOLEAN"; "QFCAT"; "FEVALAB"; "PATAB"; "FPATMAB"; "PACPERC"}*/
/*"PACEXT" -> {"PACRATC"; "PACRAT"}*/
"PACEXT" -> "FACTEXT"

"RECOP" [color="#FF4488",href="bookvol10.4.pdf#nameddest=RECOP"]
"RECOP" -> "EXPRSOL"     /* by loadlib */
/*"RECOP" -> {"UFPS"; "UTSSOL"; "ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"RECOP" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"RECOP" -> {"ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"RECOP" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "KONVERT"; "FS"}*/
/*"RECOP" -> {"ES"; "RETRACT"; "IEVALAB"; "EVALAB"; "PATAB"; "FPATMAB"}*/
/*"RECOP" -> {"TYPE"; "PATMAB"; "FRETRCT"; "GROUP"; "PDRING"; "FLINEXP"}*/
/*"RECOP" -> {"LINEXP"; "CHARZ"; "CHARNZ"; "FIELD"; "EUCDOM"; "PID"}*/
/*"RECOP" -> {"GCDDOM"; "UFD"; "DIVRING"; "COMBOPC"; "CFCAT"; "SYMBOL"}*/
/*"RECOP" -> {"INT"; "REF"; "ALIST"; "LIST"; "STRING"; "CHAR"; "SINT"}*/
/*"RECOP" -> {"OUTFORM"; "PRIMARR"; "A1AGG-"; "ISTRING"; "SRAGG-"; "FLAGG-"}*/
/*"RECOP" -> {"LNAGG-"; "PI"; "NNI"; "ILIST"; "LSAGG-"; "STAGG-"; "LSAGG"}*/
/*"RECOP" -> {"STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"; "LNAGG"; "IXAGG"}*/
/*"RECOP" -> {"ELTAGG"; "ELTAB"; "CLAGG"; "FLAGG"; "ELAGG"; "OM"; "ELAGG-"}*/
/*"RECOP" -> {"URAGG-"; "RCAGG-"; "IXAGG-"; "CLAGG-"; "MONOID-"; "ABELMON-"}*/
/*"RECOP" -> {"ORDSET-"; "SGROUP-"; "ABELSG-"; "SETCAT-"; "BASTYPE-"}*/
/*"RECOP" -> {"UPOLYC"; "POLYCAT"; "FAMR"; "AMR"; "PFECAT"; "DIFRING"}*/
/*"RECOP" -> {"DIFEXT"; "STEP"; "BOOLEAN"; "CACHSET"; "INS-"}*/

"RURPK" [color="#FF4488",href="bookvol10.4.pdf#nameddest=RURPK"]
/*"RURPK" -> {"EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"}*/
/*"RURPK" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"RURPK" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"RURPK" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "CHARZ"}*/
/*"RURPK" -> {"SYMBOL"; "INT"; "REF"; "ALIST"; "LIST"; "STRING"; "CHAR"}*/
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```
/*"RURPK" -> {"SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"; "ISTRING"; "SRAGG-"}*/
/*"RURPK" -> {"FLAGG-"; "LNAGG-"; "ILIST"; "LSAGG-"; "STAGG-"; "ELAGG-"}*/
/*"RURPK" -> {"ORDFIN"; "ORDSET"; "FINITE"; "LSAGG"; "STAGG"; "URAGG"}*/
/*"RURPK" -> {"RCAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
/*"RURPK" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"}*/
/*"RURPK" -> {"FLAGG"; "ELAGG"; "OM"; "URAGG-"; "RCAGG-"; "IXAGG-"}*/
/*"RURPK" -> {"CLAGG-"; "BOOLEAN"}*/
"RURPK" -> "SFRTCAT"
/*"RURPK" -> {"RSETCAT"; "TSETCAT"; "PSETCAT"}*/

"SFRGCD" [color="#FF4488",href="bookvol10.4.pdf#nameddest=SFRGCD"]
/*"SFRGCD" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"SFRGCD" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"SFRGCD" -> {"SGROUP"; "MONOID"; "LMODULE"; "BMODULE"; "RMODULE"}*/
/*"SFRGCD" -> {"ALGEBRA"; "MODULE"; "ENTIRER"; "OAMONS"; "OCAMON"; "OAMON"}*/
/*"SFRGCD" -> {"OASGP"; "ORDSET"; "RPOLCAT"; "POLYCAT"; "PDRING"; "FAMR"}*/
/*"SFRGCD" -> {"AMR"; "CHARZ"; "CHARNZ"; "FRETRCT"; "RETRACT"; "EVALAB"}*/
/*"SFRGCD" -> {"IEVALAB"; "FLINEXP"; "LINEXP"; "KONVERT"; "PATMAB"}*/
/*"SFRGCD" -> {"PFECAT"; "UFD"; "RSETCAT"; "TSETCAT"; "PSETCAT"; "CLAGG"}*/
/*"SFRGCD" -> {"HOAGG"; "AGG"; "TYPE"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"}*/
/*"SFRGCD" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "FLAGG"; "ELAGG"}*/
/*"SFRGCD" -> {"BOOLEAN"; "INT"; "LIST"; "ILIST"; "LSAGG-"; "STAGG-"}*/
/*"SFRGCD" -> {"INS-"; "NNI"; "ELAGG-"; "FLAGG-"; "OM"}*/
"SFRGCD" -> "SFRTCAT"

"SFQCMPK" [color="#FF4488",href="bookvol10.4.pdf#nameddest=SFQCMPK"]
/*"SFQCMPK" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"SFQCMPK" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"SFQCMPK" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"SFQCMPK" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "OAMONS"}*/
/*"SFQCMPK" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "RPOLCAT"; "POLYCAT"}*/
/*"SFQCMPK" -> {"PDRING"; "FAMR"; "AMR"; "CHARZ"; "CHARNZ"; "FRETRCT"}*/
/*"SFQCMPK" -> {"RETRACT"; "EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"}*/
/*"SFQCMPK" -> {"KONVERT"; "PATMAB"; "PFECAT"; "UFD"; "RSETCAT"; "TSETCAT"}*/
/*"SFQCMPK" -> {"PSETCAT"; "CLAGG"; "HOAGG"; "AGG"; "TYPE"; "INT"; "LIST"}*/
/*"SFQCMPK" -> {"ILIST"; "LSAGG-"; "STAGG-"; "LSAGG"; "STAGG"; "URAGG"}*/
/*"SFQCMPK" -> {"RCAGG"; "LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "FLAGG"}*/
/*"SFQCMPK" -> {"ELAGG"; "OM"; "ELAGG-"; "FLAGG-"; "STRING"; "CHAR"; "SINT"}*/
/*"SFQCMPK" -> {"OUTFORM"; "PRIMARR"; "A1AGG-"; "ISTRING"; "NNI"; "BOOLEAN"}*/
"SFQCMPK" -> "SFRTCAT"
/*"SFQCMPK" -> {"URAGG-"; "LNAGG-"; "RCAGG-"; "IXAGG-"; "CLAGG-"}*/

"SNTSCAT" [color="#4488FF",href="bookvol10.2.pdf#nameddest=SNTSCAT"]
"SNTSCAT" -> "SFRTCAT"
/*"SNTSCAT" -> {"RSETCAT"; "TSETCAT"; "PSETCAT"; "SETCAT"; "BASTYPE"}*/
/*"SNTSCAT" -> {"KOERCE"; "CLAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"}*/
/*"SNTSCAT" -> {"IEVALAB"; "KONVERT"; "NTSCAT"}*/

"SRDCMPK" [color="#FF4488",href="bookvol10.4.pdf#nameddest=SRDCMPK"]
/*"SRDCMPK" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"SRDCMPK" -> {"CABMON"; "ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"}*/
/*"SRDCMPK" -> {"KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"SRDCMPK" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "OAMONS"}*/
/*"SRDCMPK" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "RPOLCAT"; "POLYCAT"}*/
```

```
/*"SRDCMPK" -> {"PDRING"; "FAMR"; "AMR"; "CHARZ"; "CHARNZ"; "FRETRCT"}*/
/*"SRDCMPK" -> {"RETRACT"; "EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"}*/
/*"SRDCMPK" -> {"KONVERT"; "PATMAB"; "PFECAT"; "UFD"}*/
"SRDCMPK" -> "SFRTCAT"
/*"SRDCMPK" -> {"RSETCAT"; "TSETCAT"; "PSETCAT"; "CLAGG"; "HOAGG"; "AGG"}*/
/*"SRDCMPK" -> {"TYPE"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "LNAGG"}*/
/*"SRDCMPK" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "FLAGG"; "ELAGG"; "OM"; "INT"}*/
/*"SRDCMPK" -> {"LIST"; "ILIST"; "LSAGG-"; "NNI"; "STAGG-"; "ELAGG-"}*/
/*"SRDCMPK" -> {"BOOLEAN"; "STRING"; "CHAR"; "SINT"; "OUTFORM"}*/
/*"SRDCMPK" -> {"PRIMARR"; "A1AGG-"; "ISTRING"; "FLAGG-"}*/

"SREGSET" [color="#88FF44",href="bookvol10.3.pdf#nameddest=SREGSET"]
"SREGSET" -> "SFRTCAT"
/*"SREGSET" -> {"RSETCAT"; "TSETCAT"; "PSETCAT"; "SETCAT"; "BASTYPE"}*/
/*"SREGSET" -> {"KOERCE"; "CLAGG"; "HOAGG"; "AGG"; "TYPE"; "EVALAB"}*/
/*"SREGSET" -> {"IEVALAB"; "KONVERT"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"}*/
/*"SREGSET" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"}*/
/*"SREGSET" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"SREGSET" -> {"MODULE"; "ENTIRER"; "OAMONS"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"SREGSET" -> {"ORDSET"; "RPOLCAT"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"}*/
/*"SREGSET" -> {"CHARZ"; "CHARNZ"; "FRETRCT"; "RETRACT"; "FLINEXP"; "LINEXP"}*/
/*"SREGSET" -> {"PATMAB"; "PFECAT"; "UFD"; "INT"; "LIST"; "ILIST"; "LSAGG-"}*/
/*"SREGSET" -> {"STAGG-"; "ELAGG-"; "FLAGG-"; "URAGG-"; "LNAGG-"; "RCAGG-"}*/
/*"SREGSET" -> {"IXAGG-"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "LNAGG"}*/
/*"SREGSET" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "FLAGG"; "ELAGG"; "OM"}*/
/*"SREGSET" -> {"BOOLEAN"; "CLAGG-"; "HOAGG-"; "ORDSET-"; "AGG-"; "ELTAGG-"}*/
/*"SREGSET" -> {"SETCAT-"; "BASTYPE-"; "NNI"; "MONOID-"; "ABELMON-"}*/
/*"SREGSET" -> "SGROUP-"; "ABELSG-"; "INS-"; "STRING"; "CHAR"; "SINT"}*/
/*"SREGSET" -> {"OUTFORM"; "PRIMARR"; "A1AGG-"; "ISTRING"; "FINITE"}*/

"ZDSOLVE" [color="#FF4488",href="bookvol10.4.pdf#nameddest=ZDSOLVE"]
/*"ZDSOLVE" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"ZDSOLVE" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "ABELMON"; "ABELSG"; "CABMON"}*/
/*"ZDSOLVE" -> {"ABELGRP"; "RING"; "RNG"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"ZDSOLVE" -> {"EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"; "BMODULE"}*/
/*"ZDSOLVE" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "CHARZ"; "REAL"}*/
/*"ZDSOLVE" -> {"KONVERT"; "INT"; "LIST"; "ILIST"; "LSAGG-"; "STAGG-"}*/
/*"ZDSOLVE" -> {"ELAGG-"; "FLAGG-"; "URAGG-"; "ORDFIN"; "FINITE"; "BOOLEAN"}*/
/*"ZDSOLVE" -> {"RSETCAT"; "TSETCAT"; "PSETCAT"; "CLAGG"; "HOAGG"}*/
/*"ZDSOLVE" -> {"AGG"; "TYPE"; "EVALAB"; "IEVALAB"}*/
"ZDSOLVE" -> "SFRTCAT"
/*"ZDSOLVE" -> {"QFCAT"; "FIELD"; "UFD"; "DIVRING"; "RETRACT"; "FEVALAB"}*/
/*"ZDSOLVE" -> {"ELTAB"; "DIFEXT"; "DIFRING"; "PDRING"; "FLINEXP"; "LINEXP"}*/
/*"ZDSOLVE" -> {"PATAB"; "FPATMAB"; "PATMAB"; "STEP"; "OINTDOM"; "CHARNZ"}*/
/*"ZDSOLVE" -> {"PFECAT"; "RCFIELD"; "FRETRCT"; "RADCAT"; "LSAGG"; "STAGG"}*/
/*"ZDSOLVE" -> {"URAGG"; "RCAGG"; "LNAGG"; "IXAGG"; "ELTAGG"; "FLAGG"}*/
/*"ZDSOLVE" -> {"ELAGG"; "OM"; "LNAGG-"; "RCAGG-"; "IXAGG-"; "CLAGG-"*/
```

1.4.22 Layer20

Depends on: RECOP Next layer depends on: GUESS

— **layer20** —

```
LAYER20=\
  ${OUT}/GUESS.o ${OUT}/INFCLSPT.o \
  layer20done
```

———-

— **layerpic** —

```
/* layer 20 */

"GUESS" [color="#FF4488",href="bookvol10.4.pdf#nameddest=GUESS"]
/*"GUESS" -> {"NEWTON"; "FAMR2"; "FFFG"; "FFFGF"; "SUPEXPR"; "UTSSOL"}*/
/*"GUESS" -> {"EXPRSOL"; "GOPT"; "GOPT0"; "UFPS"}*/
"GUESS" -> "RECOP"  /* by loadlib */
/*"GUESS" -> {"UFPS1"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"}*/
/*"GUESS" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"}*/
/*"GUESS" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"GUESS" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"GUESS" -> {"ENTIRER"; "UFD"; "DIVRING"; "FS"; "ES"; "ORDSET"; "RETRACT"}*/
/*"GUESS" -> {"IEVALAB"; "EVALAB"; "PATAB"; "KONVERT"; "FPATMAB"; "TYPE"}*/
/*"GUESS" -> {"PATMAB"; "FRETRCT"; "GROUP"; "PDRING"; "FLINEXP"; "LINEXP"}*/
/*"GUESS" -> {"CHARZ"; "CHARNZ"; "COMBOPC"; "CFCAT"; "LSAGG"; "STAGG"}*/
/*"GUESS" -> {"URAGG"; "RCAGG"; "HOAGG"; "AGG"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
/*"GUESS" -> {"ELTAB"; "CLAGG"; "FLAGG"; "ELAGG"; "OM"; "INT"; "LIST"}*/
/*"GUESS" -> {"ILIST"; "PI"; "NNI"; "LSAGG-"; "STAGG-"; "SINT"; "INS-"}*/
/*"GUESS" -> {"EUCDOM-"; "UFD-"; "GCDDOM-"; "INTDOM-"; "ALGEBRA-"}*/
/*"GUESS" -> {"DIFRING-"; "ORDRING-"; "MODULE-"; "RING-"; "ABELGRP-"}*/
/*"GUESS" -> {"ABELMON-"; "QFCAT"; "FEVALAB"; "DIFEXT"; "DIFRING"; "STEP"}*/
/*"GUESS" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"GUESS" -> {"REAL"; "PFECAT"; "ORDFIN"; "FINITE"; "POLYCAT"; "FAMR"}*/
/*"GUESS" -> {"AMR"; "UPOLYC"; "STRING"; "CHAR"; "OUTFORM"; "PRIMARR"}*/
/*"GUESS" -> {"A1AGG-"; "ISTRING"; "SRAGG-"; "ELAGG-"; "FLAGG-"; "URAGG-"}*/
/*"GUESS" -> {"UTSCAT"; "UPSCAT"; "PSCAT"; "RADCAT"; "TRANFUN"; "TRIGCAT"}*/
/*"GUESS" -> {"ATRIG"; "HYPCAT"; "AHYP"; "ELEMFUN"; "INS"; "VECTOR"}*/
/*"GUESS" -> {"BOOLEAN"; "SYMBOL"; "REF"; "ALIST"; "LNAGG-"; "MONOID-"}*/
/*"GUESS" -> {"ORDSET-"; "ABELSG-"; "SGROUP-"; "SETCAT-"; "RETRACT-"}*/
/*"GUESS" -> {"BASTYPE-"; "IVECTOR"; "IARRAY1"; "VECTCAT-"; "IXAGG-"}*/
/*"GUESS" -> {"RCAGG-"; "CLAGG-"}*/

"INFCLSPT" [color="#88FF44",href="bookvol10.3.pdf#nameddest=INFCLSPT"]
"INFCLSPT" -> "INFCLCT"
/*"INFCLSPT" -> {"SETCATD"; "AFFPL"; "SETCAT"; "BASTYPE"; "KOERCE"; "FIELD"}*/
/*"INFCLSPT" -> {"EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"}*/
/*"INFCLSPT" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"}*/
/*"INFCLSPT" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"INFCLSPT" -> {"MODULE"; "ENTIRER"; "UFD"; "DIVRING"; "POLYCAT"; "PDRING"}*/
/*"INFCLSPT" -> {"FAMR"; "AMR"; "CHARZ"; "CHARNZ"; "FRETRCT"; "RETRACT"}*/
/*"INFCLSPT" -> {"EVALAB"; "IEVALAB"; "FLINEXP"; "LINEXP"; "ORDSET"}*/
```

```
/*"INFCLSPT" -> {"KONVERT"; "PATMAB"; "PFECAT"; "DIRPCAT"; "IXAGG"; "HOAGG"}*/
/*"INFCLSPT" -> {"AGG"; "TYPE"; "ELTAGG"; "ELTAB"; "DIFEXT"; "DIFRING"}*/
/*"INFCLSPT" -> {"FINITE"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"INFCLSPT" -> {"OAMONS"; "VSPACE"; "PRSPCAT"; "LOCPOWC"; "UPSCAT"; "PSCAT"}*/
/*"INFCLSPT" -> {"PLACESC"; "DIVCAT"; "FAMONC"; "BLMETCT"; "SINT"; "NNI"}*/
/*"INFCLSPT" -> {"INT"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "LNAGG"}*/
/*"INFCLSPT" -> {"CLAGG"; "FLAGG"; "ELAGG"; "OM"; "LIST"; "ILIST"; "LSAGG-"}*/
/*"INFCLSPT" -> {"STAGG-"; "ELAGG-"; "FLAGG-"; "URAGG-"; "LNAGG-"; "RCAGG-"}*/
/*"INFCLSPT" -> {"IXAGG-"; "CLAGG-"; "HOAGG-"; "ORDSET-"; "AGG-"; "ELTAGG-"}*/
/*"INFCLSPT" -> {"SETCAT-"; "BASTYPE-"; "BOOLEAN"; "VECTOR"; "PACPERC"; "PI"}*/
/*"INFCLSPT" -> {"SYMBOL"; "REF"; "ALIST"; "STRING"; "CHAR"; "OUTFORM"}*/
/*"INFCLSPT" -> {"PRIMARR"; "A1AGG-"; "ISTRING"; "SRAGG-"}*/
```

————-

1.4.23 Layer21

Depends on: GUESS Next layer depends on: GUESSF1 INFCLSPT

— **layer21** —

```
LAYER21=\
  ${OUT}/GUESSAN.o  ${OUT}/GUESSINT.o ${OUT}/GUESSF1.o  ${OUT}/GUESSP.o \
  ${OUT}/GUESSUP.o  ${OUT}/ICP.o      \
  layer21done
```

————-

— **layerpic** —

```
/* layer 21 */
/* GUESS */

"GUESSAN" [color="#FF4488",href="bookvol10.4.pdf#nameddest=GUESSAN"]
/*"GUESSAN" -> {"NEWTON"; "FAMR2"; "FFFG"; "FFFGF"; "SUPEXPR"; "UTSSOL"}*/
/*"GUESSAN" -> {"EXPRSOL"; "GOPT"; "GOPT0"; "UFPS"; "RECOP"; "UFPS1"}*/
"GUESSAN" -> "GUESS" /* by loadlib */
/*"GUESSAN" -> {"ES"; "ORDSET"; "SETCAT"; "BASTYPE"; "KOERCE"; "RETRACT"}*/
/*"GUESSAN" -> {"IEVALAB"; "EVALAB"; "ACF"; "FIELD"; "EUCDOM"; "PID"}*/
/*"GUESSAN" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"GUESSAN" -> {"CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"GUESSAN" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
/*"GUESSAN" -> {"DIVRING"; "RADCAT"; "INS"; "OINTDOM"; "ORDRING"; "OAGROUP"}*/
/*"GUESSAN" -> {"OCAMON"; "OAMON"; "OASGP"; "DIFRING"; "KONVERT"; "LINEXP"}*/
/*"GUESSAN" -> {"PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "STEP"; "FS"; "PATAB"}*/
/*"GUESSAN" -> {"FPATMAB"; "TYPE"; "FRETRCT"; "GROUP"; "PDRING"; "FLINEXP"}*/
/*"GUESSAN" -> {"CHARNZ"; "OM"}*/

"GUESSINT" [color="#FF4488",href="bookvol10.4.pdf#nameddest=GUESSINT"]
/*"GUESSINT" -> {"NEWTON"; "FAMR2"; "FFFG"; "FFFGF"; "SUPEXPR"; "UTSSOL"}*/
/*"GUESSINT" -> {"EXPRSOL"; "GOPT"; "GOPT0"; "UFPS"; "RECOP"; "UFPS1"}*/
"GUESSINT" -> "GUESS" /* by loadlib */
/*"GUESSINT" -> {"INS"; "INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"}*/
```

```
/*"GUESSINT" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"GUESSINT" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"}*/
/*"GUESSINT" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"GUESSINT" -> {"ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"}*/
/*"GUESSINT" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"}*/
/*"GUESSINT" -> {"DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"}*/
/*"GUESSINT" -> {"CFCAT"; "REAL"; "CHARZ"; "STEP"; "QFCAT"; "FIELD"}*/
/*"GUESSINT" -> {"DIVRING"; "FEVALAB"; "ELTAB"; "EVALAB"; "IEVALAB"}*/
/*"GUESSINT" -> {"DIFEXT"; "PDRING"; "FLINEXP"; "PATAB"; "FPATMAB"; "TYPE"}*/
/*"GUESSINT" -> {"CHARNZ"; "PFECAT"; "FS"; "ES"; "FRETRCT"; "GROUP"; "OM"}*/

"GUESSF1" [color="#FF4488",href="bookvol10.4.pdf#nameddest=GUESSF1"]
/*"GUESSF1" -> {"NEWTON"; "FAMR2"; "FFFG"; "FFFGF"; "SUPEXPR"; "UTSSOL"}*/
/*"GUESSF1" -> {"EXPRSOL"; "GOPT"; "GOPT0"; "UFPS"; "RECOP"; "UFPS1"}*/
"GUESSF1" -> "GUESS" /* by loadlib */
/*"GUESSF1" -> {"FFIELDC"; "FPC"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM"}*/
/*"GUESSF1" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"}*/
/*"GUESSF1" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"}*/
/*"GUESSF1" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"}*/
/*"GUESSF1" -> {"MODULE"; "ENTIRER"; "UFD"; "DIVRING"; "CHARNZ"; "FINITE"}*/
/*"GUESSF1" -> {"STEP"; "DIFRING"; "KONVERT"; "INS"; "OINTDOM"; "ORDRING"}*/
/*"GUESSF1" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "RETRACT"}*/
/*"GUESSF1" -> {"LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"}*/

"GUESSP" [color="#FF4488",href="bookvol10.4.pdf#nameddest=GUESSP"]
/*"GUESSP" -> {"NEWTON"; "FAMR2"; "FFFG"; "FFFGF"; "SUPEXPR"; "UTSSOL"} */
/*"GUESSP" -> {"EXPRSOL"; "GOPT"; "GOPT0"; "UFPS"; "RECOP"; "UFPS1"}*/
"GUESSP" -> "GUESS" /* by loadlib */
/*"GUESSP" -> {"INS"; "UFD"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"}*/
/*"GUESSP" -> {"RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SETCAT"}*/
/*"GUESSP" -> {"BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"; "BMODULE"}*/
/*"GUESSP" -> {"RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "EUCDOM"; "PID"}*/
/*"GUESSP" -> {"OINTDOM"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"}*/
/*"GUESSP" -> {"ORDSET"; "DIFRING"; "KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"}*/
/*"GUESSP" -> {"CFCAT"; "REAL"; "CHARZ"; "STEP"; "POLYCAT"; "PDRING"; "FAMR"}*/
/*"GUESSP" -> {"AMR"; "CHARNZ"; "FRETRCT"; "EVALAB"; "IEVALAB"; "FLINEXP"}*/
/*"GUESSP" -> {"PFECAT"; "QFCAT"; "FIELD"; "DIVRING"; "FEVALAB"; "ELTAB"}*/
/*"GUESSP" -> {"DIFEXT"; "PATAB"; "FPATMAB"; "TYPE"; "FS"; "ES"}*/
/*"GUESSP" -> {"GROUP"; "OM"}*/

"GUESSUP" [color="#FF4488",href="bookvol10.4.pdf#nameddest=GUESSUP"]
/*"GUESSUP" -> {"NEWTON"; "FAMR2"; "FFFG"; "FFFGF"; "SUPEXPR"; "UTSSOL"} */
/*"GUESSUP" -> {"EXPRSOL"; "GOPT"; "GOPT0"; "UFPS"; "RECOP"; "UFPS1"} */
"GUESSUP" -> "GUESS"
/*"GUESSUP" -> {"MYEXPR"; "MYUP"; "INS"; "UFD"; "GCDDOM"; "INTDOM"} */
/*"GUESSUP" -> {"COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"} */
/*"GUESSUP" -> {"ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"} */
/*"GUESSUP" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"} */
/*"GUESSUP" -> {"MODULE"; "ENTIRER"; "EUCDOM"; "PID"; "OINTDOM"; "ORDRING"} */
/*"GUESSUP" -> {"OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "DIFRING"} */
/*"GUESSUP" -> {"KONVERT"; "RETRACT"; "LINEXP"; "PATMAB"; "CFCAT"; "REAL"}*/
/*"GUESSUP" -> {"CHARZ"; "STEP"; "UPOLYC"; "POLYCAT"; "PDRING"; "FAMR"}*/
/*"GUESSUP" -> {"AMR"; "CHARNZ"; "FRETRCT"; "EVALAB"; "IEVALAB"; "FLINEXP"}*/
/*"GUESSUP" -> {"PFECAT"; "ELTAB"; "DIFEXT"; "FIELD"; "DIVRING"; "QFCAT"}*/
```

```
/*"GUESSUP" -> {"FEVALAB"; "PATAB"; "FPATMAB"; "TYPE"; "FS"; "ES"}*/
/*"GUESSUP" -> {"GROUP"; "COMBOPC"}*/

"ICP" [color="#88FF44",href="bookvol10.3.pdf#nameddest=ICP"]
/*"ICP" -> {"DIVCAT"; "PROJPL"; "NSDPS"; "DIV"}*/
"ICP" -> "PLACES"
"ICP" -> "INFCLSPT"
/*"ICP" -> {"INFCLCT"; "SETCATD"; "SETCAT"; "BASTYPE"; "KOERCE"; "FIELD"}*/
/*"ICP" -> {"EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"}*/
/*"ICP" -> {"ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"}*/
/*"ICP" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"}*/
/*"ICP" -> {"UFD"; "DIVRING"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"}*/
/*"ICP" -> {"AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "LNAGG"; "IXAGG"; "ELTAGG"}*/
/*"ICP" -> {"ELTAB"; "CLAGG"; "KONVERT"; "FLAGG"; "ORDSET"; "ELAGG"; "OM"}*/
/*"ICP" -> {"INT"; "LIST"; "ILIST"; "DIRPCAT"; "FRETRCT"; "RETRACT"}*/
/*"ICP" -> {"DIFEXT"; "DIFRING"; "PDRING"; "FLINEXP"; "LINEXP"; "FINITE"}*/
/*"ICP" -> {"ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"; "OASGP"; "OAMONS"}*/
/*"ICP" -> {"VSPACE"; "PLACESC"; "BLMETCT"; "SYMBOL"; "REF"; "ALIST"}*/
/*"ICP" -> {"STRING"; "CHAR"; "SINT"; "OUTFORM"; "PRIMARR"; "A1AGG-"}*/
/*"ICP" -> {"ISTRING"; "SRAGG-"; "FLAGG-"; "LNAGG-"; "LSAGG-"; "STAGG-"}*/
/*"ICP" -> {"ELAGG-"; "URAGG-"}*/
```

———-

1.4.24 Layer22

Depends on: GUESSF1

— **layer22** —

```
LAYER22=\
  ${OUT}/GUESSF.o ${OUT}/INFCLSPS.o  \
  layer22done
```

———-

— **layerpic** —

```
/* layer 22 */
/* GUESSF */

"GUESSF" [color="#FF4488",href="bookvol10.4.pdf#nameddest=GUESSF"]
/*"GUESSF" -> { "NEWTON"; "FAMR2"; "FFFG"; "FFFGF"; "SUPEXPR" ; "UTSSOL" } */
/*"GUESSF" -> { "EXPRSOL"; "GOPT"; "GOPT0"; "UFPS"; "RECOP"; "UFPS1" } */
/*"GUESSF" -> "GUESS"*/ /* by loadlib */
"GUESSF" -> "GUESSF1" /* by loadlib */
/*"GUESSF" -> { "FFIELDC"; "FPC"; "FIELD"; "EUCDOM"; "PID"; "GCDDOM" } */
/*"GUESSF" -> {"INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"; "CABMON"} */
/*"GUESSF" -> {"ABELMON"; "ABELSG"; "SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"} */
/*"GUESSF" -> {"MONOID"; "LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"} */
/*"GUESSF" -> {"MODULE"; "ENTIRER"; "UFD"; "DIVRING"; "CHARNZ"; "FINITE"} */
/*"GUESSF" -> {"STEP"; "DIFRING"; "INS"; "OINTDOM"; "ORDRING"; "OAGROUP"} */
/*"GUESSF" -> {"OCAMON"; "OAMON"; "OASGP"; "ORDSET"; "KONVERT"; "RETRACT"} */
/*"GUESSF" -> {"LINEXP"; "PATMAB"; "CFCAT"; "REAL"; "CHARZ"; "FS"; "ES" } */
```

```
/*"GUESSF" -> {"IEVALAB"; "EVALAB"; "PATAB"; "FPATMAB"; "TYPE"; "FRETRCT"} */
/*"GUESSF" -> {"GROUP"; "PDRING"; "FLINEXP"} */

"INFCLSPS" [color="#88FF44",href="bookvol10.3.pdf#nameddest=INFCLSPS"]
"INFCLSPS" -> "PROJPLPS"
/*"INFCLSPS" -> {"PACOFF"; "NSDPS"; "PLACESPS"; "DIV"; "DIVCAT"; "INFCLCT"}*/
/*"INFCLSPS" -> {"INFCLSPT"; "SETCATD"; "SETCAT"; "BASTYPE"; "KOERCE"}*/
/*"INFCLSPS" -> {"PACFFC"; "FFIELDC"; "FPC"; "FIELD"; "EUCDOM"; "PID"}*/
/*"INFCLSPS" -> {"GCDDOM"; "INTDOM"; "COMRING"; "RING"; "RNG"; "ABELGRP"}*/
/*"INFCLSPS" -> {"CABMON"; "ABELMON"; "ABELSG"; "SGROUP"; "MONOID"}*/
/*"INFCLSPS" -> {"LMODULE"; "BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"}*/
/*"INFCLSPS" -> {"ENTIRER"; "UFD"; "DIVRING"; "CHARNZ"; "FINITE"; "STEP"}*/
/*"INFCLSPS" -> {"DIFRING"; "PACPERC"; "LSAGG"; "STAGG"; "URAGG"; "RCAGG"}*/
/*"INFCLSPS" -> {"HOAGG"; "AGG"; "TYPE"; "EVALAB"; "IEVALAB"; "LNAGG"}*/
/*"INFCLSPS" -> {"IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "KONVERT"; "FLAGG"}*/
/*"INFCLSPS" -> {"ORDSET"; "ELAGG"; "OM"; "INT"; "LIST"; "ILIST"; "DIRPCAT"}*/
/*"INFCLSPS" -> {"FRETRCT"; "RETRACT"; "DIFEXT"; "PDRING"; "FLINEXP"}*/
/*"INFCLSPS" -> {"LINEXP"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"INFCLSPS" -> {"OASGP"; "OAMONS"; "VSPACE"; "PLACESC"; "BLMETCT"}*/
/*"INFCLSPS" -> {"SYMBOL"; "REF"; "ALIST"; "STRING"; "CHAR"; "SINT"}*/
/*"INFCLSPS" -> {"OUTFORM"; "PRIMARR"; "A1AGG-"; "ISTRING"; "SRAGG-"}*/
/*"INFCLSPS" -> {"FLAGG-"; "LNAGG-"; "LSAGG-"; "STAGG-"; "ELAGG-"; "URAGG-"}*/
```

———-

1.4.25 Layer23

Depends on: INFCLSPS

Note that PAFF and PAFFFF form clique2.spad. Each one depends on the other.

— **layer23** —

```
LAYER23=\
  ${MID}/clique2.spad \
  layer23done
```

———-

— **layerpic** —

```
/* layer 23 */

"PAFF" -> "PAFFFF"
"PAFF" -> "INFCLSPS"
/*"PAFF" -> {"BLMETCT"; "GPAFF"; "PFORP"; "PACOFF"; "PROJPLPS"; "PLACESPS"}*/
/*"PAFF" -> {"NSDPS"; "LOCPOWC"; "DIV"; "SETCATD"; "PLACESC"; "DIVCAT"}*/
/*"PAFF" -> {"INFCLCT"; "DSTREE"; "DSTRCAT"; "PRSPCAT"; "UTSZ"; "PACFFC"}*/
/*"PAFF" -> {"PACPERC"; "PROJPL"; "PLACES"; "INFCLSPT"; "PROJPL"; "ICP"}*/
/*"PAFF" -> {"FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"PAFF" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"PAFF" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"PAFF" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
```

```
/*"PAFF" -> {"DIVRING"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARZ"}*/
/*"PAFF" -> {"CHARNZ"; "FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"}*/
/*"PAFF" -> {"FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"; "PFECAT"}*/
/*"PAFF" -> {"LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"}*/
/*"PAFF" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "FLAGG"}*/
/*"PAFF" -> {"ELAGG"; "OM"; "INT"; "LIST"; "ILIST"; "DIRPCAT"; "DIFEXT"}*/
/*"PAFF" -> {"DIFRING"; "FINITE"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"PAFF" -> {"OASGP"; "OAMONS"; "VSPACE"; "INS"; "OINTDOM"; "CFCAT"; "REAL"}*/
/*"PAFF" -> {"STEP"; "PI"; "NNI"; "BOOLEAN"}*/

"PAFFFF" -> "PAFF"
"PAFF" -> "INFCLSPS"
/*"PAFF" -> {"BLMETCT"; "GPAFF"; "PFORP"; "PACOFF"; "PROJPLPS"; "PLACESPS"}*/
/*"PAFF" -> {"NSDPS"; "LOCPOWC"; "DIV"; "SETCATD"; "PLACESC"; "DIVCAT"}*/
/*"PAFF" -> {"INFCLCT"; "DSTREE"; "DSTRCAT"; "PRSPCAT"; "UTSZ"; "PACFFC"}*/
/*"PAFF" -> {"PACPERC"; "PROJPL"; "PLACES"; "INFCLSPT"; "PROJPL"; "ICP"}*/
/*"PAFF" -> {"FIELD"; "EUCDOM"; "PID"; "GCDDOM"; "INTDOM"; "COMRING"}*/
/*"PAFF" -> {"RING"; "RNG"; "ABELGRP"; "CABMON"; "ABELMON"; "ABELSG"}*/
/*"PAFF" -> {"SETCAT"; "BASTYPE"; "KOERCE"; "SGROUP"; "MONOID"; "LMODULE"}*/
/*"PAFF" -> {"BMODULE"; "RMODULE"; "ALGEBRA"; "MODULE"; "ENTIRER"; "UFD"}*/
/*"PAFF" -> {"DIVRING"; "POLYCAT"; "PDRING"; "FAMR"; "AMR"; "CHARZ"}*/
/*"PAFF" -> {"CHARNZ"; "FRETRCT"; "RETRACT"; "EVALAB"; "IEVALAB"}*/
/*"PAFF" -> {"FLINEXP"; "LINEXP"; "ORDSET"; "KONVERT"; "PATMAB"; "PFECAT"}*/
/*"PAFF" -> {"LSAGG"; "STAGG"; "URAGG"; "RCAGG"; "HOAGG"; "AGG"; "TYPE"}*/
/*"PAFF" -> {"LNAGG"; "IXAGG"; "ELTAGG"; "ELTAB"; "CLAGG"; "FLAGG"}*/
/*"PAFF" -> {"ELAGG"; "OM"; "INT"; "LIST"; "ILIST"; "DIRPCAT"; "DIFEXT"}*/
/*"PAFF" -> {"DIFRING"; "FINITE"; "ORDRING"; "OAGROUP"; "OCAMON"; "OAMON"}*/
/*"PAFF" -> {"OASGP"; "OAMONS"; "VSPACE"; "INS"; "OINTDOM"; "CFCAT"; "REAL"}*/
/*"PAFF" -> {"STEP"; "PI"; "NNI"; "BOOLEAN"}*/
```

———-

1.4.26 Order

The final order of the layers is determined here. The GUESS package is broken so we remove the layers involved until this can be resolved.

— **order** —

```
ORDER=\
  ${LAYER0BOOTSTRAP}     ${LAYER0}  ${LAYER1}  ${LAYER2}  ${LAYER3}  \
  ${LAYER4}   ${LAYER5}  ${LAYER6}  ${LAYER7}  ${LAYER8}  ${LAYER9}  \
  ${LAYER10}  ${LAYER11} ${LAYER12} ${LAYER13} ${LAYER14} ${LAYER15} \
  ${LAYER16}  ${LAYER17} ${LAYER18} ${LAYER19} ${LAYER20} ${LAYER21} \
  ${LAYER22}  ${LAYER23} ${LAYER0COPY}
```

———-

```
ORDER=\
  ${LAYER0BOOTSTRAP}     ${LAYER0}  ${LAYER1}  ${LAYER2}  ${LAYER3}  \
  ${LAYER4}   ${LAYER5}  ${LAYER6}  ${LAYER7}  ${LAYER8}  ${LAYER9}  \
  ${LAYER10}  ${LAYER11} ${LAYER12} ${LAYER13} ${LAYER14} ${LAYER15} \
  ${LAYER16}  ${LAYER17} ${LAYER18} ${LAYER19} ${LAYER0COPY}
```

1.5 Cliques

The algebra code sometimes have circular references. The compiler can resolve these references directly if all of the required sources are in the same source file.

So the idea to remove the BOOTSTRAP code is to cluster the spad sources into "cliqueN.spad" files and feed them all to the compiler at once.

— **newcode** —

```
CLIQUE1FILES = ${OUT}/MYUP.o  ${OUT}/MYEXPR.o

${MID}/clique1.spad: ${CLIQUE1FILES}
@echo sa01 making ${OUT}/MYUP.o from ${MID}/clique1.spad
@echo sa02 making ${OUT}/MYEXPR.o from ${MID}/clique1.spad
@ (cd ${MID} ; \
   cat ${IN}/MYUP.spad >clique1.spad ; \
   cat ${IN}/MYEXPR.spad >>clique1.spad ; \
   if [ -z "${NOISE}" ] ; then \
    echo ")co clique1.spad" | ${INTERPSYS}  ; \
           else \
    echo ")co clique1.spad" | ${INTERPSYS} >${TMP}/trace ; \
   fi )
@ cp ${MID}/MYUP.nrlib/code.o ${OUT}/MYUP.o
@ cp ${MID}/MYEXPR.nrlib/code.o ${OUT}/MYEXPR.o
```

————-

Here we have the general case where two files are co-dependent, that is, PAFF and PAFFFF both have to be compiled together. They also have a set of prerequired files that must be loaded since they are not yet in the new database.

— **newcode** —

```
CLIQUE2FILES = ${OUT}/PAFF.o ${OUT}/PAFFFF.o
CLIQUE2DEPS  = BLMETCT GPAFF PFORP PACOFF PROJPLPS PLACESPS NSDPS LOCPOWC \
               DIV SETCATD PLACESC DIVCAT INFCLSPS INFCLCT DSTREE DSTRCAT \
               PRSPCAT UTSZ PACFFC PACPERC PROJPL PLACES INFCLSPT PROJPL ICP

${MID}/clique2.spad: ${CLIQUE2FILES}
@echo sa03 making ${OUT}/PAFF.o from ${MID}/clique2.spad
@echo sa04 making ${OUT}/PAFFFF.o from ${MID}/clique2.spad
@ (cd ${MID} ; \
   cat ${IN}/PAFF.spad >clique2.spad ; \
   cat ${IN}/PAFFFF.spad >>clique2.spad ; \
   if [ -z "${NOISE}" ] ; then \
    echo -e ")lib ${CLIQUE2DEPS} \n )co clique2.spad" \
             | ${INTERPSYS} ; \
           else \
    echo -e ")lib ${CLIQUE2DEPS} \n )co clique2.spad" \
      | ${INTERPSYS} >${TMP}/trace ; \
    echo ")co clique2.spad" | ${INTERPSYS} >${TMP}/trace ; \
   fi )
@ cp ${MID}/PAFF.nrlib/code.o ${OUT}/PAFF.o
@ cp ${MID}/PAFFFF.nrlib/code.o ${OUT}/PAFFFF.o
```

———-

— **ignore** —

```
EXPRDEPS  = LF

${MID}/EXPR.nrlib/code.o: ${MID}/EXPR.spad
@echo sa05 newcode EXPR.o depends on LF.o
@ ( cd ${MID} ; \
            echo -e ")lib ${EXPRDEPS} \n )co EXPR.spad" | ${INTERPSYS} )
@ cp ${MID}/EXPR.nrlib/code.o ${OUT}/EXPR.o
```

———-

1.6 Broken Files

These files are Aldor files

```
axtimer.as Timer
iviews.as  InventorRenderPackage IVREND
ffrac.as   FormalFraction FORMAL
iviews.as  InventorViewPort IVVIEW
iviews.as  InventorDataSink IVDATA
herm.as    PackedHermitianSequence PACKED
nsfip.as   NagSpecialFunctionsInterfacePackage NAGSPE
nrc.as     NagResultChecks NAGRES
nqip.as    NagQuadratureInterfacePackage NAGQUA
noptip.as  NagOptimizationInterfacePackage NAGOPT
nepip.as   NagEigenInterfacePackage NAGEIG
ndftip.as  NagDiscreteFourierTransformInterfacePackage NAGDIS
```

These domains are referenced but don't exist

```
OBJECT
```

1.7 The Environment

1.7.1 The working directories

We define 5 directories for this build. The**IN** directory contains the pamphlet files for the algebra. These are expanded into the**MID** directory as either .spad or .as files. The .spad files are compiled by the native spad internal compiler. The .as files are compiled using the Aldor compiler. The output of the compilation has two purposes. Part of the information is used to build various database files (daase files). The other part is executable code which is placed in the **OUT** directory. When invoked as "make document" we construct the .dvi files in the**DOC** directory.

The `OUTSRC=${MNT}/${SYS}/src/algebra` subdirectory contains the algebra source files extracted from the pamphlet files. These sources allow the end user to change the algebra if needed.

— **environment** —

```
# see books/bookvol10.pamphlet for source

IN=${SRC}/algebra
MID=${INT}/algebra
OUT=${MNT}/${SYS}/algebra
DOC=${MNT}/${SYS}/doc/src/algebra
OUTSRC=${MNT}/${SYS}/src/algebra
OUTSPAD=${MNT}/${SYS}/src/algebra
INPUT=${INT}/input
LISP=${OBJ}/${SYS}/bin/lisp
LISPTANGLE=${OBJ}/${SYS}/bin/lisp
BOOKSRC=${SPD}/books/bookvol5.pamphlet
```

———-

1.7.2 The depsys variable

The **depsys** image is the compile-time environment for boot and lisp files.

— **environment** —

```
DEPSYS=${OBJ}/${SYS}/bin/depsys
```

———-

1.7.3 The interpsys variable

The **interpsys** image is the compile-time environment for algebra files.

— **environment** —

```
INTERPSYS=${OBJ}/${SYS}/bin/interpsys
```

———-

1.7.4 The shell variable

We use the “-e” flag to echo which is not supported by the “sh” shell but is supported by “bash”. The “-e” flag to echo causes it to interpret special characters, in our case newlines.

— **environment** —

```
SHELL=bash
```

———-

1.8 The Makefile Stanzas

A spad pamphlet can contain many Axiom categories, domains, and packages.

For the purpose of explanation we assume that the pamphlet file is named foo.spad.pamphlet. It contains the domains BAR, BAX, and BAZ. Thus there will be a subsection named foo.spad.

Since pamphlet files (e.g. foo.spad.pamphlet contain a spad file e.g. foo.spad, it follows that every subsection contains a Makefile stanza that extract the foo.spad file using notangle.

Since pamphlet files are intended as documents it follows that each subsection contains a Makefile stanza that extracts a dvi file using noweave.

We could have a category, domain, or package that is in the "bootstrap" list. Bootstrap spad files contain their generated lisp code in special sections. The way bootstrapping works is that we extract the lisp code and compile it rather than extracting the spad code. We do this because we need the domain to exist before we can compile the domain. Some domains depend on themselves directly. Some domains depend on themselves thru a long chain of other domains. In either case we can't compile the domain until it exists so we cache the generated lisp code and, when we need to bootstrap the domain, we compile the raw lisp rather than the spad.

This will only happen when the system is built from scratch. Once the system has been built the bootstrap code is no longer executed and these algebra files will appear as normal algebra files. That means that once the system has been built once only the last three rules will ever be executed. The first two rules happen when the system is built from scratch.

A 5 stanza group for this case performs the following functions:

1. extract the lisp BAR.lsp from the pamphlet foo.spad.pamphlet
2. compile and copy the bootstrap lisp to the final algebra directory
3. extract the bootstrap BAR.lsp from the spad file foo.spad
4. compile the extracted BAR domain
5. copy the compiled BAR to the final algebra directory

The subtle point here occurs in the first item. The bootstrap code group (in the layer0 bootstrap code chunk above) asks for the compiled ".o" files in the `\${MID}` directory. Essentially this code group calls for intermediate compiled files. This triggers the bootstrap stanzas (items 1 and 2 above). All of the other layer chunks ask for compiled code in the `\${OUT}` directory which is the final algebra directory.

The bootstrap process works because first we ask for the compiled lisp code stanzas (the `\${MID}/BAR.o` files), THEN we ask for the final algebra code stanzas (the `\${OUT}/BAR.o` files). This is a very subtle point so think it through carefully. The layer0 bootstrap list is the only file list that calls for `\${MID}` files. All other layers ask for `\${OUT}` files. Make sure you understand this before you change things. If you break it the world will no longer compile.

So we have a 3 stanza group for normal files, a 3+2 (5) stanza group for normal files with default code, and a 3+2 (5) stanza group for normal files that need to be bootstrapped. There is another combination that occurs, namely bootstrap code that also contains default code which gives a 3+2+2+2 (9) stanza case. (see TSETCAT for an example. Be sure to read the items in reverse order).

A 9 stanza group for this case performs the following functions:

1. extract the bootstrap BAR.lsp from the foo.spad.pamphlet
2. compile the bootstrap BAR.lsp and copy to the intermediate directory
3. extract the bootstrap BAR-.lsp from the foo.spad.pamphlet
4. compile the bootstrap BAR-.lsp and copy to intermediate directory
5. extract the spad BAR.spad from the pamphlet foo.spad.pamphlet
6. compile the extracted BAR.spad domain (to get BAR.o)
7. copy the BAR.o to the final algebra directory
8. compile the extracted BAR.spad domain (to get BAR-.o)
9. copy the BAR-.o to the final algebra directory

As you can see this is just the combination of the two possible 5 stanza case. We just have to deal with the BAR- both in regular and bootstrap files. The first four stanzas will only happen when the system is built from scratch. Once the system is built these four rules no longer apply and these stanzas effectively act like the 5 stanza rules above.

I'm sure all of this seems confusing but it is very stylized code. Basically you need to figure out which kind of stanza group you need, copy an existing stanza group, and do a correct renaming of the parts. The decision tree looks something like:

```
IF (you have a regular spad domain)
 THEN use a 3 stanza form (see YSTREAM)
IF (you have a default spad domain (it generates ``-'' files)) AND
   (it does not require bootstrapping)
 THEN use the first 5 stanza form explained above (see LIECAT)
IF (you have a normal spad domain) AND
   (it requires bootstrapping)
 THEN use the second 5 stanza form explained above (see VECTOR)
IF (you have a default spad domain (it generates ``-'' files)) AND
   (it requires bootstrapping)
 THEN use the 9 stanza form explained above (see TSETCAT)
```

1.9 Generic Make Rules

The idea is to use generic rules to try to cut down the size of this file.

This Makefile works very hard to cache intermediate results in order to minimize the re-build time. The cached files are kept in the int or obj directories. If one of these files disappears but the original pamphlet file is unchanged we only need to rebuild the intermediate file. These rule will attempt to do that and they succeed however these are intermediate files created by implicit rules so they would normally be deleted. To prevent the removal the nrlib directory and its contents, the files are marked as .PRECIOUS.

The output of the compile step is saved in a file of the same name and extension .out in the $MID directory. These files are useful for deriving the dependencies by scanning the "Loading ..." messages.

— **genericDotOfiles** —

```
${OUT}/%.o: ${MID}/%.nrlib/code.o
@ echo sa06 copying $*.nrlib to $*.o
@ cp ${MID}/$*.nrlib/code.o ${OUT}/$*.o
```

———-

— genericnrlibfiles —

```
.PRECIOUS: ${MID}/%.nrlib/code.o
${MID}/%.nrlib/code.o: ${MID}/%.spad
@ echo sa07 compiling $*.spad to $*.nrlib
@ if [ -z "${NOISE}" ] ; then \
   (cd ${MID} ; \
    echo ")co $*.spad" | ${INTERPSYS} ) ; \
           else \
   (cd ${MID} ; \
     echo ")co $*.spad" | ${INTERPSYS} ) 1>/dev/null 2>/dev/null ; \
   fi
```

———-

— genericBOOTSTRAPfiles —

```
${MID}/%.o: ${MID}/%.lsp
@ echo sa08 compiling $*.lsp to $*.o
@ (cd ${MID} ; \
  if [ -z "${NOISE}" ] ; then \
   echo '(progn (in-package (quote boot)) (compile-file "$*.lsp" :output-file "$*.o"))'\
            | ${DEPSYS} ; \
  else \
   echo '(progn (in-package (quote boot)) (compile-file "$*.lsp" :output-file "$*.o"))'\
           | ${DEPSYS} 1>/dev/null 2>/dev/null ; \
  fi )
@ cp ${MID}/$*.o ${OUT}/$*.o
```

———-

— genericSPADfiles —

```
${OUTSRC}/%.spad: ${IN}/%.pamphlet
@ echo sa09tangling $*.pamphlet to $*.spad
@(cd ${OUTSRC} ; \
 ${TANGLE} ${IN}/$*.pamphlet >$*.spad )
```

———-

— genericDOCfiles —

```
${DOC}/%.dvi: ${IN}/%.pamphlet ${DOC}/ps
@ echo sa10 latexing $*.pamphlet to ${DOC}/$*.dvi
@ (cd ${DOC} ; \
cp ${IN}/$*.pamphlet ${DOC} ; \
${DOCUMENT} ${NOISE} $* ; \
rm -f ${DOC}/$*.pamphlet ; \
rm -f ${DOC}/$*.tex ; \
rm -f ${DOC}/$* )
```

————

— **genericRules** —

```
\getchunk{genericDotOfiles}
\getchunk{genericnrlibfiles}
\getchunk{genericBOOTSTRAPfiles}
\getchunk{genericSPADfiles}
\getchunk{genericDOCfiles}
```

————

— **libdb.text (OUT from IN)** —

```
${OUT}/libdb.text: ${IN}/libdb.text
@ echo sa11 copying ${IN}/libdb.text to ${OUT}/libdb.text
@ cp ${IN}/libdb.text ${OUT}/libdb.text
```

————

— **ps (DOC from SRC)** —

```
${DOC}/ps: ${SRC}/doc/ps
@echo sa12 making ${DOC}/ps from ${SRC}/doc/ps
@cp -pr ${SRC}/doc/ps ${DOC}
```

————

1.10 Pamphlet file structure

Because the individual .spad files are grouped into higher-level algebra pamphlet files, the rules for extracting them are coded below as simple "awk" scripts that are called when the Makefile is constructed.

— **findAlgebraFiles** —

```
\getchunk{findSpadFiles}
\getchunk{findBootstrapFiles}
```

———-

There are, at present, 2 kinds of algebra files to be handled.

There are the bootstrap files. These files live within their respective pamphlet files and are "captured" lisp code. These are necessary to create the algebra. See the src/algebra/Makefile.pamphlet for details.

Second, there are 3 "types" of algebra which are all treated the same at compile time, namely the "domain", "category", and "package" algebra.

1.10.1 Finding the algebra code

Step 1 is to scan all of the algebra pamphlet files for the chunk names which contain the string "domain", "package", or "category". This is done using grep -E (same as egrep, which means that the pattern is an extended regular expression) because extended regular expressions allows the use of alternatives written as (domain—package—category). Thus the command

```
grep -E '\\begin{chunk}{(domain|package|category)\ .*}' *.pamphlet
```

will scan the algebra files looking for special chunknames. Axiom's chunk names are written in a stylized form so that each algebra chunk name begins with one of those three symbols. Thus in bookvol10.3.pamphlet the LexTriangularPackage chunkname is:

```
begin{chunk}{package LEXTRIPK LexTriangularPackage}
```

so this grep will generate an output line, prefixed by the filename that looks like:

```
bookvol10.3.pamphlet:begin{chunk}{package LEXTRIPK LexTriangularPackage}
```

There can be many lines of output per pamphlet file, one for each domain, package and category cod chunk contained in the file. The results are sorted and made unique.

Step 2 is an awk command line.

1.10.2 Write the Makefile stanzas for the algebra files

— findSpadFiles —

```
grep -E 'begin{chunk}{category\ .*}' ${BOOKS}/bookvol10.2.pamphlet | sort | uniq | awk -F: '{
  chunk=substr($1,15,length($1)-15);
  split(chunk,part," ");
  spadfile="${MID}/"part[2]".spad";
  print spadfile": ${BOOKS}/bookvol10.2.pamphlet";
  print "    @echo \x27(tangle \"${BOOKS}/bookvol10.2.pamphlet\" \""chunk"\" \""part[2]".spad\")\x27 | ${LISPTAN
  print "";
}'

grep -E 'begin{chunk}{domain\ .*}' ${BOOKS}/bookvol10.3.pamphlet | sort | uniq | awk -F: '{
  chunk=substr($1,15,length($1)-15);
  split(chunk,part," ");
  spadfile="${MID}/"part[2]".spad";
  print spadfile": ${BOOKS}/bookvol10.3.pamphlet";
  print "    @echo \x27(tangle \"${BOOKS}/bookvol10.3.pamphlet\" \""chunk"\" \""part[2]".spad\")\x27 | ${LISPTAN
```

```
  print "";
}'

grep -E 'begin{chunk}{package\ .*}' ${BOOKS}/bookvol10.4.pamphlet | sort | uniq | awk -F: '{
  chunk=substr($1,15,length($1)-15);
  split(chunk,part," ");
  spadfile="${MID}/"part[2]".spad";
  print spadfile": ${BOOKS}/bookvol10.4.pamphlet";
  print "    @echo \x27(tangle \"${BOOKS}/bookvol10.4.pamphlet\" \""chunk"\" \""part[2]".spad\")\x27 | ${LISPTAN
  print "";
}'

grep -E 'begin{chunk}{package\ .*}' ${BOOKS}/bookvol10.5.pamphlet | sort | uniq | awk -F: '{
  chunk=substr($1,15,length($1)-15);
  split(chunk,part," ");
  spadfile="${MID}/"part[2]".spad";
  print spadfile": ${BOOKS}/bookvol10.5.pamphlet";
  print "    @echo \x27(tangle \"${BOOKS}/bookvol10.5.pamphlet\" \""chunk"\" \""part[2]".spad\")\x27 | ${LISPTAN
  print "";
}'
```

awk processes each line of the grep output.

The awk script uses "-F:" which is a flag that says that a ":" is the field separator. As a result the $1 and $2 in the awk script refer to the parts of the grep output that come before and after the ":" respectively.

The variable "chunk" is assigned the actual chunk name minus the '`\begin{chunk}{`' and '`}`' delimiters. In the example given above this will become

`package LEXTRIPK LexTriangularPackage`

The call to "split" splits the chunk into parts separated by spaces. Thus

```
  part[1]=package
  part[2]=LEXTRIPK
  part[3]=LexTriangularPackage
```

The variable "spadfile" in the above example is set to

`${MID}/LEXTRIPK.spad`

Finally, in the domain example given above we print two lines. The first line is the Makefile stanza header which depends on the original "zerodim.spad.pamphlet" file.

The second line is the body of the makefile stanza which calls notangle to extract the algebra from the original pamphlet using the chunk name and writes it to the intermediate subdirectory. In the case above this would resolve to `\${MID}/LEXTRIPK.spad`.

For the line given above it outputs the following:

```
${MID}/LEXTRIPK.spad: ${IN}/bookvol10.3.pamphlet
    echo '(tangle "bookvol10.4.pamphlet" "package LEXTRIPK LexTrianglularPackage" "LEXTRIPK.spad")' | ${LISPTANG
```

1.10.3 Find the algebra bootstrap code

Step 3 works like step 1 above except that we are looking for chunk names that have the "BOOTSTRAP" string. The output will look like:

```
bookvol10.3.pamphlet:begin{chunk}{VECTOR.lsp BOOTSTRAP}
```

This output, which can consist of many lines per input file is piped into "awk".

1.10.4 Write the Makefile stanzas for the bootstrap files

For each of the above output lines we run an "grep" command:

— **findBootstrapFiles** —

```
grep 'begin{chunk}{.*BOOTSTRAP}' ${BOOKS}/bookvol10.2.pamphlet | sort | uniq | \
awk -F: '{
  chunk=substr($1,15,length($1)-15);
  split(chunk,part," ");
  lspfile="${MID}/"part[1];
  print lspfile": ${BOOKS}/bookvol10.2.pamphlet";
  print "   @echo \x27(tangle \"${BOOKS}/bookvol10.2.pamphlet\" \""chunk"\" \""lspfile"\")\x27 | ${LISPTANGLE} "
  print "";
}'

grep 'begin{chunk}{.*BOOTSTRAP}' ${BOOKS}/bookvol10.3.pamphlet | sort | uniq | \
awk -F: '{
  chunk=substr($1,15,length($1)-15);
  split(chunk,part," ");
  lspfile="${MID}/"part[1];
  print lspfile": ${BOOKS}/bookvol10.3.pamphlet";
  print "   @echo \x27(tangle \"${BOOKS}/bookvol10.3.pamphlet\" \""chunk"\" \""lspfile"\")\x27 | ${LISPTANGLE} "
  print "";
}'
```

———-

The process is the same way as described above except that there are only two parts to the chunk names

```
  part[1]=VECTOR.lsp
  part[2]=BOOTSTRAP
```

The lspfile variable is assigned

```
${MID}/VECTOR.lsp
```

Finally we output two lines:

```
${MID}/vector.spad.pamphlet: ${IN}/bookvol10.3.pamphlet
 @echo '(tangle "${IN}/bookvol10.4.pamphlet" "VECTOR.lsp BOOTSTRAP" "VECTOR.lsp")' | ${LISPTANGLE}
```

The first line is the stanza head and creates a dependence between the intermediate file, in this case int/algebra/VECTOR.lsp and the input file src/algebra/vector.spad.pamphlet

The second line calls the lisp "tangle" to extract the required chunk from the source file.

1.11 Stage markers

We output these as each stage completes.

— **stages** —

```
layer0bootstrap:
@ echo ==========================================
@ echo === algebra bootstrap complete bookvol10
@ echo ==========================================

layer0copy:
@ echo =======================================
@ echo === layer  0 copy complete bookvol10
@ echo =======================================

layer0done:
@ echo =======================================
@ echo === layer  0 of 24 complete bookvol10
@ echo =======================================

layer1done:
@ echo =======================================
@ echo === layer  1 of 24 complete bookvol10
@ echo =======================================

layer2done:
@ echo =======================================
@ echo === layer  2 of 24 complete bookvol10
@ echo =======================================

layer3done:
@ echo =======================================
@ echo === layer  3 of 24 complete bookvol10
@ echo =======================================

layer4done:
@ echo =======================================
@ echo === layer  4 of 24 complete bookvol10
@ echo =======================================

layer5done:
@ echo =======================================
@ echo === layer  5 of 24 complete bookvol10
@ echo =======================================

layer6done:
@ echo =======================================
@ echo === layer  6 of 24 complete bookvol10
@ echo =======================================

layer7done:
@ echo =======================================
@ echo === layer  7 of 24 complete bookvol10
```

```
@ echo =======================================

layer8done:
@ echo =======================================
@ echo === layer  8 of 24 complete bookvol10
@ echo =======================================

layer9done:
@ echo =======================================
@ echo === layer 9 of 24 complete bookvol10
@ echo =======================================

layer10done:
@ echo =======================================
@ echo === layer 10 of 24 complete bookvol10
@ echo =======================================

layer11done:
@ echo =======================================
@ echo === layer 11 of 24 complete bookvol10
@ echo =======================================

layer12done:
@ echo =======================================
@ echo === layer 12 of 24 complete bookvol10
@ echo =======================================

layer13done:
@ echo =======================================
@ echo === layer 13 of 24 complete bookvol10
@ echo =======================================

layer14done:
@ echo =======================================
@ echo === layer 14 of 24 complete bookvol10
@ echo =======================================

layer15done:
@ echo =======================================
@ echo === layer 15 of 24 complete bookvol10
@ echo =======================================

layer16done:
@ echo =======================================
@ echo === layer 16 of 24 complete bookvol10
@ echo =======================================

layer17done:
@ echo =======================================
@ echo === layer 17 of 24 complete bookvol10
@ echo =======================================

layer18done:
@ echo =======================================
```

```
@ echo === layer 18 of 24 complete bookvol10
@ echo =======================================

layer19done:
@ echo =======================================
@ echo === layer 19 of 24 complete bookvol10
@ echo =======================================

layer20done:
@ echo =======================================
@ echo === layer 20 of 24 complete bookvol10
@ echo =======================================

layer21done:
@ echo =======================================
@ echo === layer 21 of 24 complete bookvol10
@ echo =======================================

layer22done:
@ echo =======================================
@ echo === layer 22 of 24 complete bookvol10
@ echo =======================================

layer23done:
@ echo =======================================
@ echo === layer 23 of 24 complete bookvol10
@ echo =======================================

layer24done:
@ echo =======================================
@ echo === layer 24 of 24 complete bookvol10
@ echo =======================================
```

1.11.1 Regression testing

There is a Makefile variable called REGRESS in the algebra Makefile:

```
REGRESS=\
 AssociationList.regress  BalancedBinaryTree.regress \
```

This is part of a Makefile that structure within the algebra Makefile. This Makefile gets extracted by the Makefile in the input subdirectory. Thus there is a connection between the two Makefiles (algebra and input). This algebra regression Makefile goes by the chunk name **algebra.regress**. It contains a list of regression files and a single stanza:

```
%.regress: %.input
@ echo sa13 algebra regression testing $*
@ (cd ${MID} ; \
  rm -f $*.output ; \
  if [ -z "${NOISE}" ] ; then \
          echo ')read $*.input' | ${TESTSYS} ; \
  else \
```

```
          echo ')read $*.input' | ${TESTSYS} >${TMP}/trace ; \
 fi ; \
 if [ -z "${NOISE}" ] ; then \
          echo ')lisp (regress "$*.output")' | ${TESTSYS} \
               | egrep -v '(Timestamp|Version)' | tee $*.regress ; \
 else \
          echo ')lisp (regress "$*.output")' | ${TESTSYS} \
               | egrep -v '(Timestamp|Version)' > $*.regress ; \
 fi ; \
 fgrep "regression result" $*.regress )
```

The input Makefile extracts **algebra.regress** and then calls make to process this file.

This keeps the regression test list in the algebra Makefile.

The algebra files contain input chunks in regress format. This stanza is extracted by the src/input/Makefile after all of the other regression tests are complete. This stanza is put into a int/Makefile.algebra and then executed by make.

— **algebra.regress** —

```
TESTSYS=  ${OBJ}/${SYS}/bin/interpsys

REGRESS= \
 AbelianGroup.regress \
 AbelianMonoid.regress \
 AbelianMonoidRing.regress \
 AbelianSemiGroup.regress \
 AdditiveValuationAttribute.regress \
 AffineAlgebraicSetComputeWithGroebnerBasis.regress \
 AffineAlgebraicSetComputeWithResultant.regress \
 AffinePlane.regress \
 AffinePlaneOverPseudoAlgebraicClosureOfFiniteField.regress \
 AffineSpace.regress \
 AffineSpaceCategory.regress \
 Aggregate.regress \
 Algebra.regress \
 AlgebraGivenByStructuralConstants.regress \
 AlgebraicallyClosedField.regress \
 AlgebraicallyClosedFunctionSpace.regress \
 AlgebraicFunctionField.regress \
 AlgebraicFunction.regress \
 AlgebraicHermiteIntegration.regress \
 AlgebraicIntegrate.regress \
 AlgebraicIntegration.regress \
 AlgebraicManipulations.regress \
 AlgebraicMultFact.regress \
 AlgebraicNumber.regress \
 AlgebraPackage.regress \
 AlgFactor.regress \
 AnnaNumericalIntegrationPackage.regress \
 AnnaNumericalOptimizationPackage.regress \
 AnnaOrdinaryDifferentialEquationPackage.regress \
 AnnaPartialDifferentialEquationPackage.regress \
 AnonymousFunction.regress \
 AntiSymm.regress \
```

```
Any.regress \
AnyFunctions1.regress \
ApplicationProgramInterface.regress \
ApplyRules.regress \
ApplyUnivariateSkewPolynomial.regress \
ApproximateAttribute.regress \
ArbitraryExponentAttribute.regress \
ArbitraryPrecisionAttribute.regress \
ArcHyperbolicFunctionCategory.regress \
ArcTrigonometricFunctionCategory.regress \
ArrayStack.regress \
Asp1.regress \
Asp10.regress \
Asp12.regress \
Asp19.regress \
Asp20.regress \
Asp24.regress \
Asp27.regress \
Asp28.regress \
Asp29.regress \
Asp30.regress \
Asp31.regress \
Asp33.regress \
Asp34.regress \
Asp35.regress \
Asp4.regress \
Asp41.regress \
Asp42.regress \
Asp49.regress \
Asp50.regress \
Asp55.regress \
Asp6.regress \
Asp7.regress \
Asp73.regress \
Asp74.regress \
Asp77.regress \
Asp78.regress \
Asp8.regress \
Asp80.regress \
Asp9.regress \
AssociatedEquations.regress \
AssociatedJordanAlgebra.regress \
AssociatedLieAlgebra.regress \
AssociationList.regress \
AssociationListAggregate.regress \
AttachPredicates.regress \
AttributeButtons.regress \
Automorphism.regress \
AxiomServer.regress \
BalancedBinaryTree.regress \
BalancedFactorisation.regress \
BalancedPAdicInteger.regress \
BalancedPAdicRational.regress \
BagAggregate.regress \
```

```
BasicFunctions.regress \
BasicOperator.regress \
BasicOperatorFunctions1.regress \
BasicStochasticDifferential.regress \
BasicType.regress \
Bezier.regress \
BezoutMatrix.regress \
BiModule.regress \
BinaryExpansion.regress \
BinaryFile.regress \
BinaryRecursiveAggregate.regress \
BinarySearchTree.regress \
BinaryTournament.regress \
BinaryTree.regress \
BinaryTreeCategory.regress \
BitAggregate.regress \
Bits.regress \
BlasLevelOne.regress \
BlowUpMethodCategory.regress \
BlowUpPackage.regress \
BlowUpWithHamburgerNoether.regress \
BlowUpWithQuadTrans.regress \
Boolean.regress \
BoundIntegerRoots.regress \
BrillhartTests.regress \
CachableSet.regress \
CancellationAbelianMonoid.regress \
CanonicalAttribute.regress \
CanonicalClosedAttribute.regress \
CanonicalUnitNormalAttribute.regress \
CardinalNumber.regress \
CartesianTensor.regress \
CartesianTensorFunctions2.regress \
Cell.regress \
CentralAttribute.regress \
ChangeOfVariable.regress \
Character.regress \
CharacterClass.regress \
CharacteristicNonZero.regress \
CharacteristicPolynomialInMonogenicalAlgebra.regress \
CharacteristicPolynomialPackage.regress \
CharacteristicZero.regress \
ChineseRemainderToolsForIntegralBases.regress \
CliffordAlgebra.regress \
CoercibleTo.regress \
CoerceVectorMatrixPackage.regress \
Collection.regress \
Color.regress \
CombinatorialFunction.regress \
CombinatorialFunctionCategory.regress \
CombinatorialOpsCategory.regress \
CommonDenominator.regress \
CommonOperators.regress \
CommutativeRing.regress \
```

```
CommutativeStarAttribute.regress \
Commutator.regress \
CommuteUnivariatePolynomialCategory.regress \
Comparable.regress \
Complex.regress \
ComplexCategory.regress \
ComplexDoubleFloatMatrix.regress \
ComplexDoubleFloatVector.regress \
ComplexFactorization.regress \
ComplexIntegerSolveLinearPolynomialEquation.regress \
ComplexFunctions2.regress \
ComplexPattern.regress \
ComplexPatternMatch.regress \
ComplexRootFindingPackage.regress \
ComplexRootPackage.regress \
ComplexTrigonometricManipulations.regress \
ConstantLODE.regress \
ContinuedFraction.regress \
ConvertibleTo.regress \
CoordinateSystems.regress \
CRApackage.regress \
CycleIndicators.regress \
CyclicStreamTools.regress \
CyclotomicPolynomialPackage.regress \
CylindricalAlgebraicDecompositionPackage.regress \
CylindricalAlgebraicDecompositionUtilities.regress \
dasum.regress \
daxpy.regress \
dcabs1.regress \
dcopy.regress \
Database.regress \
DataList.regress \
DecimalExpansion.regress \
DefiniteIntegrationTools.regress \
DegreeReductionPackage.regress \
Dequeue.regress \
DequeueAggregate.regress \
DeRhamComplex.regress \
DesingTree.regress \
DesingTreeCategory.regress \
DesingTreePackage.regress \
Dictionary.regress \
DictionaryOperations.regress \
DifferentialExtension.regress \
DifferentialPolynomialCategory.regress \
DifferentialRing.regress \
DifferentialSparseMultivariatePolynomial.regress \
DifferentialVariableCategory.regress \
DiophantineSolutionPackage.regress \
DirectProduct.regress \
DirectProductCategory.regress \
DirectProductFunctions2.regress \
DirectProductMatrixModule.regress \
DirectProductModule.regress \
```

```
DirichletRing.regress \
DiscreteLogarithmPackage.regress \
DisplayPackage.regress \
DistributedMultivariatePolynomial.regress \
DistinctDegreeFactorize.regress \
DivisionRing.regress \
Divisor.regress \
DivisorCategory.regress \
DoubleFloat.regress \
DoubleFloatMatrix.regress \
DoubleFloatSpecialFunctions.regress \
DoubleFloatVector.regress \
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SAERationalFunctionAlgFactor.regress \
ScriptFormulaFormat.regress \
ScriptFormulaFormat1.regress \
Segment.regress \
SegmentBindingFunctions2.regress \
SegmentCategory.regress \
SegmentExpansionCategory.regress \
SegmentFunctions2.regress \
SemiGroup.regress \
Set.regress \
SetAggregate.regress \
SetCategory.regress \
SetCategoryWithDegree.regress \
SetOfMIntegersInOneToN.regress \
SequentialDifferentialPolynomial.regress \
SequentialDifferentialVariable.regress \
SExpression.regress \
SExpressionCategory.regress \
SExpressionOf.regress \
ShallowlyMutableAttribute.regress \
SimpleAlgebraicExtension.regress \
SimpleAlgebraicExtensionAlgFactor.regress \
SimpleCell.regress \
SimpleFortranProgram.regress \
SingleInteger.regress \
SingletonAsOrderedSet.regress \
SimplifyAlgebraicNumberConvertPackage.regress \
SmithNormalForm.regress \
SortedCache.regress \
SortPackage.regress \
SparseEchelonMatrix.regress \
SparseTable.regress \
SparseMultivariatePolynomial.regress \
SparseMultivariateTaylorSeries.regress \
SparseUnivariateLaurentSeries.regress \
SparseUnivariatePolynomial.regress \
SparseUnivariatePolynomialExpressions.regress \
SparseUnivariatePolynomialFunctions2.regress \
SparseUnivariatePuiseuxSeries.regress \
SparseUnivariateSkewPolynomial.regress \
SparseUnivariateTaylorSeries.regress \
SpecialFunctionCategory.regress \
SpecialOutputPackage.regress \
SplitHomogeneousDirectProduct.regress \
SplittingNode.regress \
SplittingTree.regress \
```

```
SquareMatrix.regress \
SquareFreeNormalizedTriangularSetCategory.regress \
SquareFreeQuasiComponentPackage.regress \
SquareFreeRegularSetDecompositionPackage.regress \
SquareFreeRegularTriangularSet.regress \
SquareFreeRegularTriangularSetCategory.regress \
SquareFreeRegularTriangularSetGcdPackage.regress \
SquareMatrixCategory.regress \
Stack.regress \
StackAggregate.regress \
StepThrough.regress \
StochasticDifferential.regress \
StorageEfficientMatrixOperations.regress \
Stream.regress \
StreamAggregate.regress \
StreamFunctions1.regress \
StreamFunctions2.regress \
StreamFunctions3.regress \
StreamInfiniteProduct.regress \
StreamTaylorSeriesOperations.regress \
StreamTensor.regress \
StreamTranscendentalFunctions.regress \
StreamTranscendentalFunctionsNonCommutative.regress \
String.regress \
StringAggregate.regress \
StringCategory.regress \
StringTable.regress \
StructuralConstantsPackage.regress \
SturmHabichtPackage.regress \
SubResultantPackage.regress \
SubSpace.regress \
SubSpaceComponentProperty.regress \
SuchThat.regress \
SupFractionFactorizer.regress \
Switch.regress \
Symbol.regress \
SymbolTable.regress \
SymmetricFunctions.regress \
SymmetricGroupCombinatoricFunctions.regress \
SymmetricPolynomial.regress \
SystemODESolver.regress \
SystemSolvePackage.regress \
Table.regress \
TableAggregate.regress \
Tableau.regress \
TableauxBumpers.regress \
TabulatedComputationPackage.regress \
TangentExpansions.regress \
TaylorSeries.regress \
TaylorSolve.regress \
TemplateUtilities.regress \
TexFormat.regress \
TexFormat1.regress \
TextFile.regress \
```

```
TheSymbolTable.regress \
ThreeDimensionalMatrix.regress \
ThreeDimensionalViewport.regress \
ThreeSpace.regress \
ThreeSpaceCategory.regress \
ToolsForSign.regress \
TopLevelDrawFunctions.regress \
TopLevelDrawFunctionsForAlgebraicCurves.regress \
TopLevelDrawFunctionsForCompiledFunctions.regress \
TopLevelDrawFunctionsForPoints.regress \
TopLevelThreeSpace.regress \
TranscendentalFunctionCategory.regress \
TranscendentalHermiteIntegration.regress \
TranscendentalIntegration.regress \
TranscendentalManipulations.regress \
TranscendentalRischDE.regress \
TranscendentalRischDESystem.regress \
TransSolvePackage.regress \
TransSolvePackageService.regress \
Tree.regress \
TriangularSetCategory.regress \
TriangularMatrixOperations.regress \
TrigonometricFunctionCategory.regress \
TrigonometricManipulations.regress \
TubePlot.regress \
TubePlotTools.regress \
Tuple.regress \
TwoDimensionalArray.regress \
TwoDimensionalArrayCategory.regress \
TwoDimensionalPlotClipping.regress \
TwoFactorize.regress \
UnaryRecursiveAggregate.regress \
UniqueFactorizationDomain.regress \
UnitsKnownAttribute.regress \
UnivariateFactorize.regress \
UnivariateFormalPowerSeries.regress \
UnivariateFormalPowerSeriesFunctions.regress \
UnivariateLaurentSeries.regress \
UnivariateLaurentSeriesCategory.regress \
UnivariateLaurentSeriesConstructor.regress \
UnivariateLaurentSeriesConstructorCategory.regress \
UnivariateLaurentSeriesFunctions2.regress \
UnivariatePolynomial.regress \
UnivariatePolynomialCategory.regress \
UnivariatePolynomialCategoryFunctions2.regress \
UnivariatePolynomialCommonDenominator.regress \
UnivariatePolynomialDecompositionPackage.regress \
UnivariatePolynomialDivisionPackage.regress \
UnivariatePolynomialFunctions2.regress \
UnivariatePolynomialMultiplicationPackage.regress \
UnivariatePolynomialSquareFree.regress \
UnivariatePowerSeriesCategory.regress \
UnivariatePuiseuxSeries.regress \
UnivariatePuiseuxSeriesCategory.regress \
```

```
 UnivariatePuiseuxSeriesConstructor.regress \
 UnivariatePuiseuxSeriesConstructorCategory.regress \
 UnivariatePuiseuxSeriesFunctions2.regress \
 UnivariatePuiseuxSeriesWithExponentialSingularity.regress \
 UnivariateSkewPolynomial.regress \
 UnivariateSkewPolynomialCategory.regress \
 UnivariateSkewPolynomialCategoryOps.regress \
 UnivariateTaylorSeries.regress \
 UnivariateTaylorSeriesCZero.regress \
 UnivariateTaylorSeriesCategory.regress \
 UnivariateTaylorSeriesFunctions2.regress \
 UnivariateTaylorSeriesODESolver.regress \
 UniversalSegment.regress \
 UniversalSegmentFunctions2.regress \
 UserDefinedPartialOrdering.regress \
 UserDefinedVariableOrdering.regress \
 UTSodetools.regress \
 U8Matrix.regress \
 U16Matrix.regress \
 U32Matrix.regress \
 U32VectorPolynomialOperations.regress \
 U8Vector.regress \
 U16Vector.regress \
 U32Vector.regress \
 Variable.regress \
 Vector.regress \
 VectorCategory.regress \
 VectorFunctions2.regress \
 VectorSpace.regress \
 ViewDefaultsPackage.regress \
 ViewportPackage.regress \
 Void.regress \
 WeightedPolynomials.regress \
 WeierstrassPreparation.regress \
 WildFunctionFieldIntegralBasis.regress \
 WuWenTsunTriangularSet.regress \
 XAlgebra.regress \
 XDistributedPolynomial.regress \
 XExponentialPackage.regress \
 XFreeAlgebra.regress \
 XPBWPolynomial.regress \
 XPolynomial.regress \
 XPolynomialRing.regress \
 XPolynomialsCat.regress \
 XRecursivePolynomial.regress \
 ZeroDimensionalSolvePackage.regress
# these requires graphics
# TwoDimensionalViewport

%.regress: %.input
@ echo sa14 algebra regression testing $*
@ rm -f $*.output
@ if [ -z "${NOISE}" ] ; then \
          echo ')read $*.input' | ${TESTSYS} ; \
```

```
  else \
          echo ')read $*.input' | ${TESTSYS} >${TMP}/trace ; \
  fi
@ rm $*.input
@ if [ -z "${NOISE}" ] ; then \
          echo ')lisp (regress "$*.output")' | ${TESTSYS} \
               | egrep -v '(Timestamp|Version)' | tee $*.regress ; \
  else \
          echo ')lisp (regress "$*.output")' | ${TESTSYS} \
               | egrep -v '(Timestamp|Version)' > $*.regress ; \
  fi
@ fgrep "regression result" $*.regress

all: announce ${REGRESS} finish
@echo sa15 algebra test cases complete.

announce:
@ echo ===================================================
@ echo src/algebra RUNNING REGRESSION TESTING bookvol10
@ echo ===================================================

finish:
@ echo ==================================================
@ echo src/algebra RUNNING REGRESSION FINISH bookvol10
@ echo ==================================================
```

————-

1.12 The Makefile

— **Makefile** —

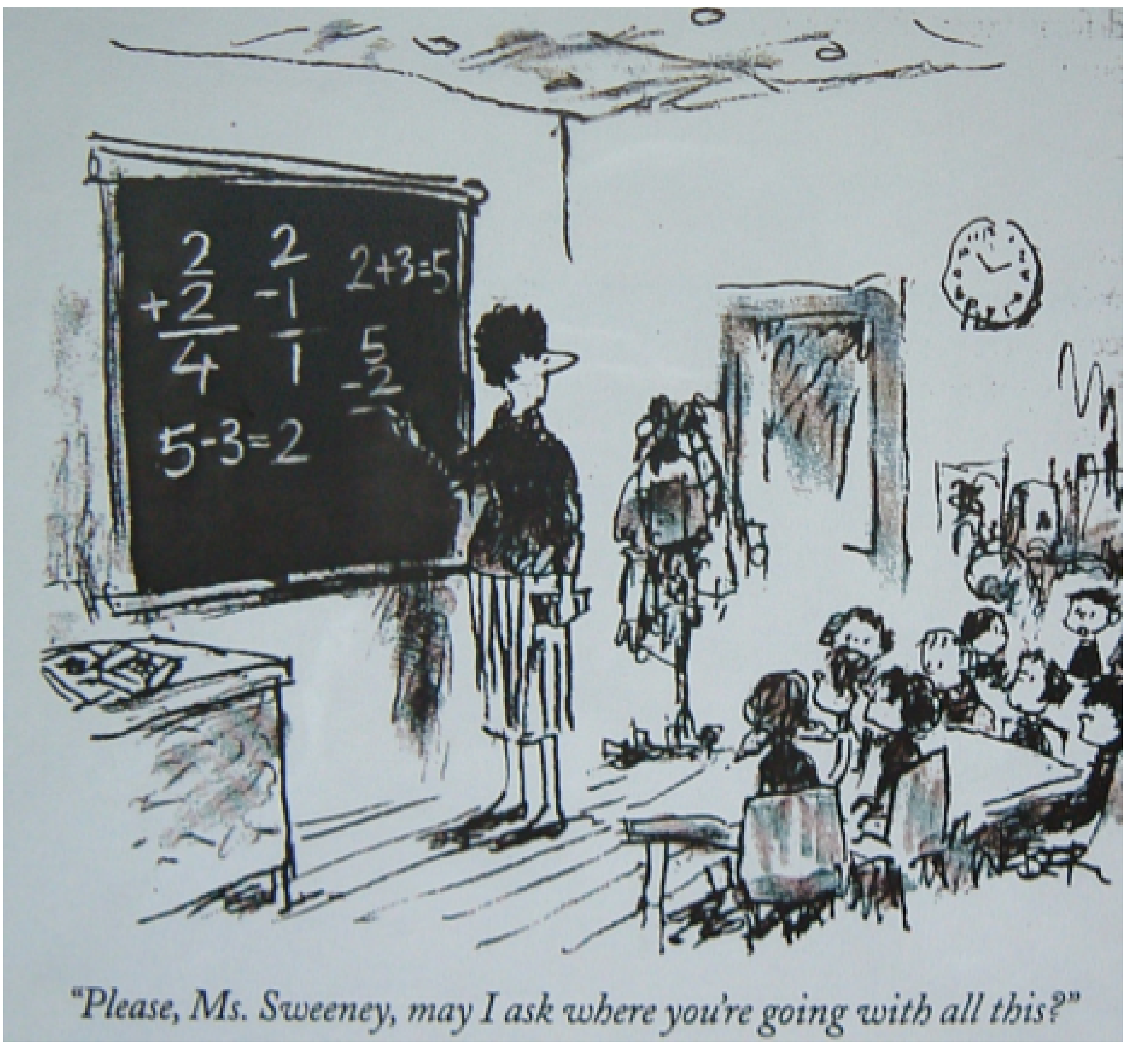
```
\getchunk{environment}

\getchunk{layer0 bootstrap}
\getchunk{layer0 copy}
\getchunk{layer0}
\getchunk{layer1}
\getchunk{layer2}
\getchunk{layer3}
\getchunk{layer4}
\getchunk{layer5}
\getchunk{layer6}
\getchunk{layer7}
\getchunk{layer8}
\getchunk{layer9}
\getchunk{layer10}
\getchunk{layer11}
\getchunk{layer12}
\getchunk{layer13}
```

```
\getchunk{layer14}
\getchunk{layer15}
\getchunk{layer16}
\getchunk{layer17}
\getchunk{layer18}
\getchunk{layer19}
\getchunk{layer20}
\getchunk{layer21}
\getchunk{layer22}
\getchunk{layer23}
\getchunk{order}

all: fasthelp fastinput fastxhtml src ${OUT}/libdb.text \
     ${SPADBIN}/index.html gloss copyspad
@ echo sa16 finished ${IN}

fasthelp:
@ echo ==========================================
@ echo src/algebra BUILDING HELP FILES bookvol10
@ echo ==========================================
@echo sa17 making .help files with lisp
@ echo "(makeHelpFiles)" | ${LISP}

fastinput:
@ echo ===========================================
@ echo src/algebra BUILDING INPUT FILES bookvol10
@ echo ===========================================
@echo sa18 making .input files with lisp
@ echo "(makeInputFiles)" | ${LISP}

fastxhtml:
@ echo ===========================================
@ echo src/algebra BUILDING XHTML FILES bookvol10
@ echo ===========================================
@echo sa19 making .xhtml files with lisp
@ mkdir -p ${MNT}/doc
@ echo "(makeXHTMLFiles)" | ${LISP}

copyspad:
@ echo ===========================================
@ echo src/algebra COPYING SPAD FILES TO ${OUTSPAD}
@ echo ===========================================
@echo sa20 copying .spad files to ${OUTSPAD}
@ cp *.spad ${OUTSPAD}

\getchunk{newcode}

${SPADBIN}/index.html:
@ echo sa20 making ${SPADBIN}/index.html
@ echo "<html><head>Axiom Algebra</head><body>" >${SPADBIN}/index.html
@- (for i in ${IN}/*.pamphlet ; do \
   ${TANGLE} -R'algebra html' $$i 2>/dev/null | \
             sed -e 's?DOC?${DOC}?g' >>${SPADBIN}/index.html ; \
   done)
```

```
@ echo "</body></html>" >>${SPADBIN}/index.html

gloss:
@ echo sa21 copying glossary files
@ cp ${SRC}/share/algebra/gloss.text ${MNT}/${SYS}/algebra
@ cp ${SRC}/share/algebra/glossdef.text ${MNT}/${SYS}/algebra
@ cp ${SRC}/share/algebra/glosskey.text ${MNT}/${SYS}/algebra

everything: lib db cmd gloss
@ echo sa22 invoking make in `pwd` with parms:
@ echo SYS= ${SYS} LSP= ${LSP} PART= ${PART} SUBPART= ${SUBPART}
@ echo SPAD= ${SPAD} SRC= ${SRC} INT= ${INT}
@ echo OBJ= ${OBJ} MNT= ${MNT} O=${O} LISP=${LISP} BYE=${BYE}

src: announce ${ORDER}
@ echo sa23 Finished uilding nrlibS from spad sources

announce:
@ echo ==============================================
@ echo src/algebra BUILDING ALGEBRA FILES bookvol10
@ echo ==============================================

\getchunk{genericRules}
\getchunk{ps (DOC from SRC)}
\getchunk{libdb.text (OUT from IN)}
\getchunk{stages}

clean:
@echo sa24 src/algebra cleaned
```

Chapter 2

Algebra Background



"Please, Ms. Sweeney, may I ask where you're going with all this?"

"source: Kaisler[Kais09] Complex Adaptive Systems"

2.1 How NAG Libraries were used

Based on our experiences with IRENA, we decided to use generic inter-process communication tools for the link to AXIOM. This has the added advantage that we can operate across a network. The main technique we use is the *Remote Procedure Call* (RPC) [Sun Microsystems Inc., 1988] which allows us to interact with a server on another machine (or on the local machine). RPC takes care of differences in data representation (e.g. the byte-order of floating point numbers) on different architectures.

AXIOM is a multi-process package. Normally when a user starts up the system they start up the various components which then interact via standard socket operations. If they are using the line, they start up a new process: the NAG Manager (NAGMAN for short). Additionally, there will be a NAG daemon (NAGD) running on any machine on which the user may wish to execute NAG routines (which could include the local host). NAGMAN commnicates with the running AXIOM system via a socket down which is transmitted the details of and data for the particular routine to be called. NAGMAN calls a NAGD on another machine via RPC and eventually returns the results to AXIOM.

NAGD consists of the server program, and a set of stub codes designed to call individual NAG routines. It is, in effect, a remotely-callable version of the NAG library. There is no reason why AXIOM should be the only system to use it, and indeed there are plans to incorporate the ability to call NAGD into other systems.

An ASP is treated just like any other piece of data by the AXIOM-NAG link. The source code is passed to NAGD and compiled. (There are various optimisations to prevent the same code being compiled multiple times, but the details needn't concern us here.) This compiled code is linked with the NAG Library to make the executable. Thus if a user calls the same NAG routine with different ASPs the routine will be relinked each time.

It would be nice if this were not necessary. The authors of the link considered two other possibilities:

- Have AXIOM simulate the ASPs, so that the NAG Library would call back to AXIOM when it wanted to call an ASP. This was rejected as being far too slow across a network.
- Give NAGD the ability to interpret AXIOM or Fortran code. Thus the NAG routine would call a function which would evaluate a representation of an ASP to get the required values. This may happen in the future if data interchange mechanisms between systems are stanardised, but was rejected for the time being since such a system would have to be tailored to match each Fortran compiler that NAGD used.

By transmitting source code for ASPs we allow the remote Fortran compiler to take care of low-level portability problems.

2.2 Algebraic Function Fields and Algebraic Geometry

Axiom implements the PAFF package by Hache[Hach95] which deals with algebraic geometry codes.

2.2.1 The Genus of a Plane Curve

From Doctor Vogler[Vogl07] and Walker[Walk78]:

Computing the genus of a curve defined by one equation is a straight-forward process. Most of this comes from Walker's book "Algebraic Curves."

Suppose you have a plane curve (let's call it C) defined by one equation

$$f(x,y) = 0$$

where $f(x,y)$ is a polynomial in two variables (x and y). Suppose that the degree of this polynomial is d. (That is, add up the exponents of x and y in each term, and take the largest sum. That's d.) Then the genus of C is **at most** $(d-1)(d-2)/2$. In fact, the genus is exactly $(d-1)(d-2)/2$ if and only if C is nonsingular.

What is a nonsingular curve? Every curve has finitely many singular points. If there are none, then the curve is nonsingular (also called smooth).

What is a singular point? Intuitively, a singular point is where something "funny" happens on the curve, such as two branches crossing ($y^2 = x^3 + x^2$) or a sharp corner ($y^2 = x^3$). Mathematically, it is where you have a simultaneous solution (in any complex numbers, not just rational numbers) to the three equations

$$f(x,y) = 0$$
$$f_x(x,y) = 0$$
$$f_y(x,y) = 0$$

That is, the polynomial function and its two partial derivatives (with respect to x and to y) are all zero. Since there are more equations in this system than variables, you **usually** have no solutions (in the sense that most real numbers are not rational, but then most numbers you encounter in math class are rational). When you **do** have solutions, then every such solution is a singular point on your curve. Not all singular points are rational points.

For example, let's find the singular points on the curve

$$x^2y^2 + 36x + 24y + 108 = 0$$

Taking derivatives with respect to x and y, we get the equations

$$2xy^2 + 36 = 0$$
$$2yx^2 + 24 = 0$$

which means that any singular point (x,y) must satisfy

$$xy^2 = -18$$
$$yx^2 = -12$$
$$y = -12/x^2$$
$$x(-12/x^2)^2 = -18$$

$$1/x^3 = -18/12^2$$
$$x^3 = -8$$

You might be tempted to conclude that $x = -2$, but there are actually three complex solutions to this equation. But we still need to use the third equation:

$$x^2y^2 + 36x + 24y + 108 = 0$$
$$x^2(-12/x^2)^2 + 36x + 24(-12/x^2) + 108 = 0$$
$$144/x^2 + 36x - 288/x^2 + 108 = 0$$
$$36x - 144/x^2 + 108 = 0$$

And since we already know $x^3 = -8$, that means that $1/x^2 = -x/8$ and therefore

$$36x - 144(-x/8) + 108 = 0$$
$$36x + 18x = -108$$
$$x = -108/54 = -2$$

(of course, this example was carefully crafted to have a rational singular point), and

$$y = -12/x^2 = -12/4 = -3$$

And then you should double-check that $(-2, -3)$ does indeed satisfy all three equations (which it does).

Each singular point reduces the genus (from the starting point of $(d-1)(d-2)/2$) by at least 1. Consequently, for example, if $d = 3$ and you have a singular point, then the genus must be 0 (because the genus is never negative). To determine exactly how much the singular point reduces the genus, you should compute the multiplicity r of the singular point. How do you compute this? Let (a, b) be your singular point (and let x, y, and t be variables), and write out the polynomial

$$f(a + xt, b + yt)$$

is a polynomial in t. The first term (coefficient of t^0) is

$$f(a, b)$$

which is 0 whenever (a, b) is a point on your curve. The next term (coefficient of t^1) is

$$(f_x(a, b)x + f_y(a, b)y)t$$

which is 0 whenever (a, b) is a singular point on your curve. The smallest integer r such that the coefficient of t^r is **not** the zero polynomial (as a polynomial in x and y) is the multiplicity of the point (a, b). So points not on the curve have multiplicity 0, nonsingular points on the curve have multiplicity 1, and singular points have multiplicity at least 2. Each ordinary singular point reduces the genus by exactly $r(r-1)/2$.

So what is an ordinary singular point? Let's look again at the polynomial

$$f(a + xt, b + yt)$$

The coefficient of t^r is a homogeneous polynomial in x and y of degree r. (Homogeneous means that **every** term has degree r.) That means that you can write this coefficient as

$$y^r g(x/y)$$

for some polynomial g of degree at most r. If you think of the polynomial $g(z)$ as a degree-r polynomial in one complex variable z, then it has exactly z complex roots, counting multiplicity. (The multiplicity of the point at infinity is r minus the actual degree of g. Note that you can also switch x and y and get the reverse polynomial, which changes roots z to roots $1/z$, and switches 0 and infinity.) Each of these roots z gives you a tangent line to the curve, namely

$$y = z(x - a) + b$$

(or the vertical line $x = a$ when $z = \infty$). (Note that some tangent lines might be rational, in the sense that the root z is rational, but they won't always be.) The singular point is **ordinary** if all of these r tangent lines are distinct, that is, if there are no multiple roots of the polynomial $g(z)$ and its degree is either r or $r-1$ (so that infinity is not a multiple root). Note that you can check that a polynomial has no multiple roots without computing all of the complex roots; all you need to do is take the polynomial GCD of $g(z)$ and its derivative $g^{'}(z)$. You'll get 1 if there are no multiple roots.

Now let's compute the genus of the curve we described earlier,

$$x^2 * y^2 + 36x + 24y + 108 = 0$$

which we already determined to have exactly one singular point at $(-2, -3)$. We look at the polynomial

$$\begin{aligned} f(-2 + xt, -3 + yt) & \\ &= (-2 + xt)^2(-3 + yt)^2 + 36(-2 + xt) + 24(-3 + yt) + 108 \\ &= (9x^2 + 24xy + 4y^2)t^2 - (6yx^2 + 4xy^2)t^3 + (y^2x^2)t^4 \end{aligned}$$

and we find that the multiplicity is $r = 2$, since that is the smallest exponent of t that we see, and the tangent lines are given by the polynomial

$$g(z) = 9z^2 + 24z + 4$$

which is a quadratic with nonzero discriminant, so it has two distinct roots. Therefore, the singular point $(-2, -3)$ is ordinary, and since the degree of the curve is 4, the genus is

$$(4 - 1)(4 - 2)/2 - 2(2 - 1)/2 = 2$$

So what happens if your singular point is not ordinary? Well, then things get a little more complicated. These will still reduce the genus by at least $r(r - 1)/2$, and sometimes they will reduce the genus by more. I'm not sure if there is a more direct way to compute the amount by which these points reduce the genus, but one way (described in Walker) is to transform the curve into another one where the singular point is ordinary. Walker describes how to transform the curve into one with the same genus but with **only** ordinary singular points. But you can actually do each singular point separately instead of all at once, which can keep things manageable when you have many non-ordinary singular points. The trick is to keep track of things.

A birational transformation from one curve C to another curve $C^{'}$ is a map

$$(x, y) \mapsto (x^{'}, y^{'})$$

from points (x, y) on the curve C to points $(x^{'}, y^{'})$ on the curve $C^{'}$, where $x^{'}$ and $y^{'}$ can each be written as a rational function of x and y (that is, a polynomial in x and y divided by another polynomial in x and y), and the inverse map

$$(x^{'}, y^{'}) \mapsto (x, y)$$

also has the same property, that x and y can each be written as rational functions of $x^{'}$ and $y^{'}$. Such birational maps are nice because they generally map rational points on one curve to rational points on the other, but sometimes they do funny things to certain points (such as where denominators are 0) although only finitely many such points. Importantly, not all pairs of curves have birational maps between them. In fact, if two curves are birational (there exist such maps), then the two curves have the same genus. So if we can transform our curve to a birational curve with only ordinary singular points, then we can compute the genus of our original curve by computing the genus of the other one. Better yet, by watching where singular points go, we can compute the contributions of each singular point individually.

Walker does this using a quadratic transformation of homogeneous curves, so let's first convert your curve into a homogeneous one. The polynomial

$$F(X_0, X_1, X_2) = X_0^d f(X_1/X_0, X_2/X_0)$$

is a degree-d homogeneous polynomial in the three variables X_0, X_1, and X_2 (sometimes people use z, x, and y, but I won't in order to avoid confusing by repeating so many variable names), from which you can get f again by the formula

$$f(x, y) = F(1, x, y)$$

Dealing with your curve in the homogeneous form makes certain concepts (such as points at infinity) much more natural. In our case, the transformation that changes x to $1/x$ and y to $1/y$ can be written in terms of polynomials in the homogeneous (also called projective) variables by mapping

$$X_0 \mapsto X_2 X_1$$
$$X_1 \mapsto X_2 X_0$$
$$X_2 \mapsto X_1 X_0$$

This map causes some of those "funny things" to happen in a useful way, in certain circumstances. Those circumstances are the following:

- The point that concerns us (generally a non-ordinary singular point) is $(1, 0, 0)$ in projective coordinates.
- The points $(0, 1, 0)$ and $(0, 0, 1)$ are not on the curve.
- The line $x_0 = 0$ intersects the curve with no multiple points.
- The lines $x_1 = 0$ and $x_2 = 0$ intersect the curve with no multiple points other than $(1, 0, 0)$, which has multiplicity r.

Satisfying all of these conditions, however, only requires a bit of simple shifting of the curve. I shall first describe what happens when these conditions are satisfied, and then I'll show you the kind of shifting to do using a couple of examples.

Recall that our curve, in projective coordinates, is defined by the homogeneous polynomial

$$F(X_0, X - 1, X_2) = X_0^d f(X_1/X_0, X_2/X_0)$$

Now we will define a new function by the formula

$$G(Y_0, Y_1, Y_2) = F(Y_1Y_2, Y_0Y_2, Y_0Y_1)$$

It turns out that conditions (1) and (2) guarantee that this new homogeneous polynomial is divisible by Y_0^r (where r is the multiplicity of the point $(1, 0, 0)$ on our curve). The other factor,

$$H(Y_0, Y_1, Y_2) = G(Y_0, Y_1, Y_2)/Y_0^r$$

defines a new curve, and this new curve is birational to the first by the same map, so it has the same genus. Its degree is $2d - r$, which is generally higher than d (the degree of F), but this new curve split the singularity $(1, 0, 0)$. It also gained several new singular points, namely at $(1, 0, 0)$ and $(0, 1, 0)$ and $(0, 0, 1)$, but conditions (3) and (4) guarantee that these are ordinary singular points of multiplicity d, $d - r$, and $d - r$, respectively. Other singular points map to identical singular points, but the point $(1, 0, 0)$ splits apart. Namely, the line $Y_0 = 0$ intersects the curve $H(Y_0, Y_1, Y_2) = 0$ in two of the new singular points $(0, 1, 0)$ and $(0, 0, 1)$ and also in one point for each tangent line (namely $(0, 1, z)$ for the root z), preserving multiplicity. These points are what $(1, 0, 0)$ splits into; it splits into different points for each tangent line. For a non-ordinary point (with double tangent lines, for example), some of the multiplicity of this intersection will be caused by multiplicity of points on the curve, and some will be caused by the line being tangent to the curve. The overall effect is to reduce the number of non-ordinary singular points on your curve. You can find proofs for all of this in Walker's book.

A "random" point will generally not lie on your curve. Similarly, a "random" point on your curve will generally not be singular. In this sense, conditions (2), (3), and (4) will usually be satisfied for a "random" curve, but condition (1) will not. So let's say we have a (non-ordinary singular) point on our curve (a, b) and we want to move it to $(0, 0)$. So we translate the whole curve by $(-a, -b)$ by changing the defining polynomial $f(x, y)$ to

$$f(x + a, y + b)$$

(The birational maps, between our curve and the translated curve, and their inverses respectively add and subtract a and b.) Next, we homogenize by defining the homogeneous polynomial

$$F(X_0, X_1, X_2) = X_0^d f(X_1/X_0 + a, X_2/X_0 + b)$$

which now has the point in question at $(1, 0, 0)$, just like we wanted. You could also think of doing the homogenizing first, and then translate the homogenized curve by changing the homogeneous function to

$$F_2(Z_0, Z_1, Z_2) = F(Z_0, Z_1 + aZ_0, Z_2 + aZ_0).$$

After doing this, you should check if the other conditions, (2), (3), and (4), are satisfied already. If not, then you can cause them to be so by doing things like switching variables, or adding some multiple of one variable to another.

Let's do this to the curve

$$y^2 = x^3$$

If we homogenize, the curve takes the form

$$X_0 X_2^2 = X_1^3$$

This has a singular point at $(1, 0, 0)$, a non-ordinary double point whose double tangent is $y = 0$. This satisfies condition (1), but the point $(0, 0, 1)$ is also on the curve, conflicting condition (2), the line $X_0 = 0$ intersects the curve with a triple point at $(0, 0, 1)$, conflicting condition (3), and the line $X_2 = 0$ intersects the curve with a triple point at $(1, 0, 0)$, conflicting condition (4), since the point $(1, 0, 0)$ has multiplicity 2, not 3.

If we set $Z_0 = X_0 + X_2$, $Z_1 = X_1$, $Z_2 = X_2$, (the inverse map is $X_0 = Z_0 - Z_2$, $X_1 = Z_1$, $X_2 = Z_2$), then our curve becomes

$$(Z_0 - Z_2)Z_2^2 = Z_1^3$$

which now satisfies conditions (1), (2), and (3), but still doesn't satisfy (4).

If we set $Z_0 = X_0 + X_2 - X_1$, $Z_1 = X_1$, $Z_2 = X_2 - X_1$, (the inverse map is $X_0 = Z_0 - Z_2$, $X_1 = Z_1$, $X_2 = Z_1 + Z_2$), then our curve becomes

$$(Z_0 - Z_2)(Z_1 + Z_2)^2 = Z_1^3,$$

which now satisfies all four conditions.

Then we can transform our curve by replacing Z_0 by Y_1Y_2, Z_1 by Y_0Y_2, and Z_2 by Y_0Y_1, giving

$$G(Y_0, Y_1, Y_2) = (Y_1Y_2 - Y_0Y_1)(Y_0Y_2 + Y_0Y_1)^2 - (Y_0Y_2)^3$$

which, sure enough, is divisible by Y_0^2, and the remaining curve is

$$
\begin{aligned}
H(Y_0, Y_1, Y_2) &= G(Y_0, Y_1, Y_2)/Y_0^2 \\
&= Y_1(Y_2 - Y_0)(Y_2 + Y_1)^2 - Y_0 Y_2^3
\end{aligned}
$$

You'll see the double tangent that our singular point had appearing now as the double intersection of the line $Y_0 = 0$ with our curve at the point $(0, 1, -1)$, but this is due to the line being tangent there, because the point $(0, 1, -1)$ is not a singular point on the new curve. This new curve has degree 4 and has one ordinary singular point at $(1, 0, 0)$ of multiplicity 3, which means that it has genus

$$(4-1)(4-2)/2 - 3(3-1)/2 = 0$$

There is also much to be learned about singular points by examining "places" in the form of power series representations of the curve at points on the curve, which I find to be very helpful in defining rational maps when you get zeros in the denominator (that is, in describing the "funny things" that happen). But I won't get into this here, and will instead only recommend that you read Walker's book.

2.2.2 Algebraic Curves with PAFF

This example compute the genus of the projective plane curve defined by

```
  5    2 3      4
 X  + Y Z  + Y Z  = 0
```

over the field $GF(2)$.

First we define the field $GF(2)$.

```
K:=PF 2
```

```
   (1)  PrimeField(2)
                                                    Type: Domain
```

Next, we define the polynomial ring over which the polynomial is defined. You have the choice for the name of the three variables (always three !!) but the domain DMP must be used. DMP is an AXIOM domain and stands for DistributedMultivariatePolymnomial.

```
R:=DMP([X,Y,Z],K)
```

```
   (2)  DistributedMultivariatePolynomial([X,Y,Z],PrimeField(2))
                                                    Type: Domain
```

Then we tell to the package `PAFF` over which field the computation must be done. Also, you must give the same list of variables which is used to defined the polynomial.

BLQT Stand for BlowUpWithQuadTrans which specified the method used for blowing-up (there will be another one using similar techniques to Hamburger-Nother expansions).

```
P:=PAFF(K,[X,Y,Z],BLQT)
```

```
   (3)
   PackageForAlgebraicFunctionField(PrimeField(2),[X,Y,Z],BlowUpWithQuadTrans)
                                                    Type: Domain
```

We defined now the polynomial of the curve.

```
C:R:=X^5 + Y^2*Z^3+Y*Z^4
```

```
         5    2 3      4
   (4)  X  + Y Z  + Y Z
              Type: DistributedMultivariatePolynomial([X,Y,Z],PrimeField(2))
```

We give it to the package `PAFF(K,[X,Y,Z])` which was assigned to the variable P

```
setCurve(C)$P
```

```
         5    2 3      4
   (5)  X  + Y Z  + Y Z
              Type: DistributedMultivariatePolynomial([X,Y,Z],PrimeField(2))
```

To compute the genus of the curve, simply do

```
genus()$P
```

```
   (6)  2
                                                   Type: NonNegativeInteger
```

To compute the genus, the package use the genus formula given by the blow-up theory. That means that the singular points has been computed.

```
singularPoints()$P
```

```
                1
   (7)  [(0:1:0) ]
                                       Type: List(ProjectivePlane(PrimeField(2)))
```

The results of `singularPoints()$P` is the list of all the singular points of the curve in the projective plane.

The Brill-Noether algorithm use the notion of "adjunction divisor". To compute it simply do `adjunctionDivisor()$P` You should obtained something like

```
           1
       8 %I1
```

This is a divisor of the function field of the curve, consisting of 8 times the place `%I1` which is of degree 1 (the exponant). The place `%I1` is a place above a singular point (the unique one for this example). This mean that the "desingularization tree" has been computed.

```
adjunctionDivisor()$P
```

```
             1
   (8)  8 %I1
                                           Type: Divisor(Places(PrimeField(2)))
```

To compute the "desingularization tree" simply do: `desingTree()$P`

For this example, you should obtained from `desingTree()$P`

```
        ["UU.."]
```

This a list of desingularization tree for each singular point. Here there is only one, which is "UU..". To interpret the result, you have to do some manual drawing. The letter U means "Up", and a . (dot) means "down".

```
              o
              |
           ^  |  |
```

```
  |  |  | .
U |  |  |
  |  |  v
     |
     |
     o
     |
  ^  |  |
  |  |  | .
U |  |  |
  |  |  v
     |
     |
     o
```

```
desingTree()$P
```

```
   (9)  ["UU.."]
  Type: List(DesingTree(InfClsPt(PrimeField(2),[X,Y,Z],BlowUpWithQuadTrans)))
```

To see more information about the desingularization trees, issue the command, `fullDesTree()$P`, and recall the command `desingTree()$P`. Here you have a bit more information about the infinitly near points in the desingularization trees. For this example, the result corresponds to the following

```
%I1  o  multiplicity = 1
     |
     |
     |
     |
     |
     |
     |
%I0  o  multiplicity = 2
     |
     |
     |
     |
     |
     |
     |
%P0  o  multiplicity = 3
```

```
fullDesTree()$P
                                                                  Type: Void
```

```
desingTree()$P
```

```
   (11)  [[name= %P0,mult= 3]([name= %I0,mult= 2]([name= %I1,mult= 1]))]
  Type: List(DesingTree(InfClsPt(PrimeField(2),[X,Y,Z],BlowUpWithQuadTrans)))
```

To see everything about desingularization trees, issue the following

```
fullInfClsPt()$P
                                                                  Type: Void
```

```
desingTree()$P
```

```
   (13)
   [
                        1                                  5    4    3
     [dominate= (0:1:0) , name= %P0, mult= 3, defCurve= X  + Y  + Y ,
                        1                                              1
      localPoint= (0:0) , chart= [exCoord= 0,affNeigh= 2], expD= 3 %I1 ]
                           1                                 2      4    3
        [dominate= (0:1:0) , name= %I0, mult= 2, defCurve= X  + X Y  + Y ,
                           1                                              1
         localPoint= (0:0) , chart= [exCoord= 1,affNeigh= 2], expD= 2 %I1 ]
                              1                                 2      3
           [dominate= (0:1:0) , name= %I1, mult= 1, defCurve= X  + X Y  + Y,
                              1                                            1
            localPoint= (0:0) , chart= [exCoord= 2,affNeigh= 2], expD= %I1 ]
     ]
  Type: List(DesingTree(InfClsPt(PrimeField(2),[X,Y,Z],BlowUpWithQuadTrans)))
```

You can ask for all the place of degree 1

```
placesOfDegree(1)$P
```

```
                 1        1    1
   (14)  [[0:1:1] ,[0:0:1] ,%I1 ]
                                          Type: List(Places(PrimeField(2)))
```

With those places, you can create divisors

```
listOfDiv:=placesOfDegree(1)$P :: List DIV PLACES PF 2
```

```
                 1        1    1
   (15)  [[0:1:1] ,[0:0:1] ,%I1 ]
                                 Type: List(Divisor(Places(PrimeField(2))))
```

You can add the divisors.

```
D:=reduce(+, listOfDiv)
```

```
                1          1      1
   (16)  [0:1:1]  + [0:0:1]  + %I1
                                       Type: Divisor(Places(PrimeField(2)))
```

You can multiply the divisor by an integer

```
D10 := 10 * D
```

```
                   1             1         1
   (17)  10 [0:1:1]  + 10 [0:0:1]  + 10 %I1
                                       Type: Divisor(Places(PrimeField(2)))
```

You can ask for the degree of the divisor

```
degree D10
```

```
   (18)  30
                                                    Type: PositiveInteger
```

You can compute the basis of the vector space $L(D10)$. The results is an Axiom Record. The first selector "num" corresponds to the numerators of the elements of the basis, and the second selector "den" is the common denominator.

```
baseOfLofD:= lBasis(D10)$P

   Trying to interpolate with forms of degree:
   8
   Denominator found
   Intersection Divisor of Denominator found

   (19)
   [
     num =
         8   5 3   6 2     7     4 3     5 2   2 6   2 3 3   2 4 2   2 5
       [Z , Y Z , Y Z , X Z , X Y Z , X Y Z , X Z , X Y Z , X Y Z , X Y Z,
         3 5   3 2 3   3 3 2   3 4    4 4   4   3   4 2 2   4 3    4 4   5 3
        X Z , X Y Z , X Y Z , X Y Z, X Z , X Y Z , X Y Z , X Y Z, X Y , X Z ,
         5   2   5 2    5 3   6 2   6     6 2   7    7    8
        X Y Z , X Y Z, X Y , X Z , X Y Z, X Y , X Z, X Y, X ]
     ,
          5 2     5   2
    den= X Y Z + X Y Z ]
Type: Record(num: List DistributedMultivariatePolynomial(...
```

Of course, the number of element in the list of numerator is the dimension of the vector space $L(D10)$. According to the Riemann-Roch Theorem, since

```
  deg D10 >= 2 g - 1
```

we should have

```
 dim L(D10) = deg D10 - g + 1
```

```
((# baseOfLofD.num) = degree D10 - genus()$P + 1 ) :: Boolean

   (20)  true
                                                    Type: Boolean
```

2.2.3 Algebraic Curves with PAFFFF

This example is to show how to compute the generator matrix of an algebraic geometric code (AG-codes, or geometric Goppa code). Here we use the same curve has the example in the previous example, that is the curve defined by

```
       5    2 3      4
      X  + Y Z  + Y Z  = 0
```

NOTE THAT we will use the package PAFFFF instead of PAFF.

With `PAFFFF` the computation are done using dynamic extension over the FINITE ground field that is given to PAFFFF.

For example,

```
PAFFFF(K,[X,Y,Z])
```

will do computation in any finite extension of K when NEEDED ONLY, while

```
PAFF(K,[X,Y,Z])
```

only do computation over the field K and, when some extension is needed, `PAFF` cannot go further and stop.

In fact the difference between `PAFF(K,[X,Y,Z])` and `PAFFFF(K,[X,Y,Z])` is that `PAFFFF(K,[X,Y,Z])` will do the computation using the domain

```
PseudoAlgebraicClosureOfFiniteField  (abbreviation PACOFF)
```

Note that it is almost right to say that `PAFFFF(K,[X,Y,Z])` is the same as `PAFF(PACOFF(K),[X,Y,Z])` but `PAFFFF(K,[X,Y,Z])` is easier to use.

We want here to construct an AG-code over the field $GF(2^4)$ and also, we want the code to be of length equal to the number of places of degree 1 of the function field of the curve. To do this we consider the following

Let F be the function field of the curve with constant field $GF(2)$

Let $F4$ be the function field of the curve with constant field $GF(2^4)$ ($F4$ is the field obtained from F by taking a constant field extension)

It is clear that F is a subfield of $F4$, but since $GF(2^3)$ is not a subfield of $GF(2^4)$, any place of F of degree 3 will not split in $F4$ and in particular, any place of F of degree 3 is dominated by a unique place of $F4$ of degree 3.

Let P be a place of degree 3 of F and Q be the unique place of $F4$ above P (i.e. $Q|P$). It is well known that a basis of $L(nP)$ is a basis of $L(nQ)$ (n being an integer). Using this fact, we can contruct an AG-code of length equal to the number of places of degree 1 of the function field of the curve.

First, let us find all the places of degree 3 of F. The results from `PAFFFF` will be something like this:

```
              2       3          2   3
    [[%D4:%D4   + 1:1] ,[%D4:%D4  :1] ]
```

What you have here is 2 places of degree 3 (the degree is given by the exponent). Also, they correspond to simple points of the curve defined in an extension of degree 3.

```
K1:= PF(2)

   (1)  PrimeField(2)

R1:= DMP([X,Y,Z],K1)

   (2)  DistributedMultivariatePolynomial([X,Y,Z],PrimeField(2))

P1:= PAFFFF(K1,[X,Y,Z],BLQT)

   (3)
     PackageForAlgebraicFunctionFieldOverFiniteField(PrimeField(2),
                                        [X,Y,Z],BlowUpWithQuadTrans)


C1:R1:=X^5 + Y^2*Z^3+Y*Z^4

         5    2 3      4
   (4)  X  + Y Z  + Y Z


setCurve(C1)$P1
```

```
        5    2 3      4
   (5)  X  + Y Z  + Y Z
```

```
plc3:= placesOfDegree(3)$P1
```

```
                 2   3         2       3
   (6)  [[%D5:%D5 :1] ,[%D5:%D5  + 1:1] ]
```

%D5 is an element created by the domain `PACOFF`: it is a root of the irreducible polynomial of degree 3 that is used to defined the extension of degree 3 of $GF(2)$.

To see the irreducible polynomial you can issue the following that will retrieve the first coordinate of the simple point corresponding to the first place of the list of places of degree 3.

Then we look at the defining polynomial of the element:

```
a:= elt( first % , 1 )
```

```
   (7)  %D5
```

```
definingPolynomial(a)
```

```
        3    2
   (8)  ?  + ?  + 1
```

```
a^3 + a^2 + 1
```

```
   (9)  0
```

As you can see, %D5 is the root of an irreducible poynomial of degree 3.

Now we construct a divisor using the places of degree 3. It will be 2 times the sum of the 2 places of degree 3.

```
D:= 2 * reduce(+,(plc3 :: List DIV PLACESPS PF 2))
```

```
                   2   3            2       3
   (10)  2 [%D5:%D5 :1]  + 2 [%D5:%D5  + 1:1]
```

Now we compute a basis of $L(D)$

```
lB1:= lBasis(D)$P1
```

```
   Trying to interpolate with forms of degree:
   4
   Denominator found
   Intersection Divisor of Denominator found

   (11)
          4    3  2 2    3      2    2   2 2  2     3   3   4
   [num= [Z ,Y Z ,Y Z ,X Z ,X Y Z ,X Y Z,X Z ,X Y Z,X Z,X Y,X ],
         4      2         2    4
```

```
den= X  + X Y Z + X Y Z  + Z ]
```

Since we want to construct a code over $GF(2^4)$, we defined the package PAFFFF over $GF(2^4)$ to compute all the places of degree 1

```
K4:= FFCG(2,4)

   (12)  FiniteFieldCyclicGroup(2,4)


R4:= DMP([X,Y,Z],K4)

   (13)


P4:= PAFFFF(K4,[X,Y,Z],BLQT)

   (14)
  PackageForAlgebraicFunctionFieldOverFiniteField(
     FiniteFieldCyclicGroup(2,4),[X,Y,Z],BlowUpWithQuadTrans)


C4:R4:=C1

          5    2 3      4
   (15)  X  + Y Z  + Y Z


setCurve(C4)$P4

          5    2 3      4
   (16)  X  + Y Z  + Y Z


plc1 := placesOfDegree(1)$P4

   (17)
         10    1        5    1      1    4    1      1    1    1      2    8    1
   [[1:%A  :1] , [1:%A :1] , [%A :%A :1] , [%A :%A :1] , [%A :%A :1] ,
      2    2    1      3    10    1      3    5    1      4    4    1      4    1    1
    [%A :%A :1] , [%A :%A  :1] , [%A :%A :1] , [%A :%A :1] , [%A :%A :1] ,
      5    8    1      5    2    1      6    10    1      6    5    1      7    4    1
    [%A :%A :1] , [%A :%A :1] , [%A :%A  :1] , [%A :%A :1] , [%A :%A :1] ,
      7    1    1      8    8    1      8    2    1      9    10    1      9    5    1
    [%A :%A :1] , [%A :%A :1] , [%A :%A :1] , [%A :%A  :1] , [%A :%A :1] ,
      10    4    1      10    1    1      11    8    1      11    2    1      12    10    1
    [%A  :%A :1] , [%A  :%A :1] , [%A  :%A :1] , [%A  :%A :1] , [%A  :%A  :1] ,
      12    5    1      13    4    1      13    1    1      14    8    1      14    2    1
    [%A  :%A :1] , [%A  :%A :1] , [%A  :%A :1] , [%A  :%A :1] , [%A  :%A :1] ,
           1          1      1
    [0:0:1] , [0:1:1] , %I3 ]
```

Now, we can construct the matrix of the AG-code, which code-words consist of the evaluation of function in $L(D)$ at each places of $F4$ of degree 1. Note that we call the function eval of the package $P4$: this function evaluate function at a place by taking as arguments the numerator and the denominator of a function and a place.

```
mG:= matrix [ [ eval( f, lB1.den, pl )$P4 for pl in plc1 ] for f in lB1.num ]

   (18)
   [
            4    4    8    8    10    10    1    1    10    10    5    5
     [1, 1, %A , %A , %A , %A , %A  , %A  , %A , %A , %A  , %A  , %A , %A ,
        11    11    2    2    5    5    5    5    13    13    10    10    14
      %A  , %A  , %A , %A , %A , %A , %A , %A , %A  , %A  , %A  , %A  , %A  ,
        14    7    7
      %A  , %A , %A , 1, 1, 0]
     ,

        10    5    8    5    1    10    5        5    2    3    12        10
     [%A  , %A , %A , %A , %A , %A  , %A , 1, %A , %A , %A , %A  , 1, %A  , 1,
        12    10    4        10    9    6    6        5        3          9
      %A  , %A  , %A , 1, %A  , %A , %A , %A , 1, %A , 1, %A , 1, 1, %A , 0, 1,
      0]
     ,

        5    10    12    6    9    12        5    9    3    11    14    10
     [%A , %A  , %A  , %A , %A , %A  , 1, %A , %A , %A , %A  , %A  , %A  , 1,
        4    13    3    6    10        13    7    14    2        5    7    1
      %A , %A  , %A , %A , %A  , 1, %A  , %A , %A  , %A , 1, %A , %A , %A ,
        8    11
      %A , %A  , 0, 1, 0]
     ,

            5    5    10    10    13    13    5    5          11    11    3
     [1, 1, %A , %A , %A  , %A  , %A  , %A  , %A , %A , 1, 1, %A  , %A  , %A ,
        3    10    10    14    14          9    9    7    7    12    12    6
      %A , %A  , %A  , %A  , %A  , 1, 1, %A , %A , %A , %A , %A  , %A  , %A ,
        6
      %A , 0, 0, 0]
     ,

        10    5    9    6    3    12    8    3    9    6    8    2    6    1
     [%A  , %A , %A , %A , %A , %A  , %A , %A , %A , %A , %A , %A , %A , %A ,
        7    4    3    12    9    4    4    1    2    11    2    12    1    13
      %A , %A , %A , %A  , %A , %A , %A , %A , %A , %A  , %A , %A  , %A , %A  ,
        14    8
      %A  , %A , 0, 0, 0]
     ,

        5    10    13    7    11    14    3    8    13    7    1    4    1
     [%A , %A  , %A  , %A , %A  , %A  , %A , %A , %A  , %A , %A , %A , %A ,
        6    11    5    11    14    4    9    8    2    10    13    12    2
      %A , %A  , %A , %A  , %A  , %A , %A , %A , %A , %A  , %A  , %A  , %A ,
        5    14    7    10
      %A , %A  , %A , %A  , 0, 0, 1]
     ,

            6    6    12    12    1    1    9    9    5    5    2    2    10
     [1, 1, %A , %A , %A  , %A  , %A , %A , %A , %A , %A , %A , %A , %A , %A  ,
        10    3    3    8    8    10    10    5    5    4    4    10    10
```

```
 %A  , %A , %A , %A , %A , %A  , %A  , %A , %A , %A , %A , %A  , %A  ,
   5    5
 %A , %A , 0, 0, 0]
,

   10    5    10    7    5    14    11    6    13    10    13    7    12
[%A  , %A , %A  , %A , %A , %A  , %A  , %A , %A  , %A  , %A  , %A , %A  ,
   7    14    11    11    5    3    13    14    11    13    7    14    9
 %A , %A  , %A  , %A  , %A , %A , %A  , %A  , %A  , %A  , %A , %A  , %A ,
   14    11    13    7
 %A  , %A  , %A  , %A , 0, 0, 0]
,

         7    7    14    14    4    4    13    13    10    10    8    8
[1, 1, %A , %A , %A  , %A  , %A , %A , %A  , %A  , %A  , %A  , %A , %A ,
   2    2    11    11    2    2    5    5    1    1    1    1    8    8
 %A , %A , %A  , %A  , %A , %A , %A , %A , %A , %A , %A , %A , %A , %A ,
   4    4
 %A , %A , 0, 0, 0]
,

   10    5    11    8    7    1    14    9    2    14    3    12    3
[%A  , %A , %A  , %A , %A , %A , %A  , %A , %A , %A  , %A , %A  , %A ,
   13    6    3    4    13    12    7    9    6    9    3    11    6
 %A  , %A , %A , %A , %A  , %A  , %A , %A , %A , %A , %A , %A  , %A ,
   12    9    12    6
 %A  , %A , %A  , %A , 0, 0, 0]
,

         8    8    1    1    7    7    2    2           14    14    9    9
[1, 1, %A , %A , %A , %A , %A , %A , %A , %A , 1, 1, %A  , %A  , %A , %A ,
   4    4    11    11           12    12    13    13    6    6    3    3
 %A , %A , %A  , %A  , 1, 1, %A  , %A  , %A  , %A  , %A , %A , %A , %A ,
 0, 0, 0]
]
                               Type: Matrix(FiniteFieldCyclicGroup(2,4)
```

The preceding matrix is the generator matrix of a $[n, k, d]$-code over $GF(2^4)$ where

```
n = nb. of places of degree 1 = 33

k = dim L(D) = deg D - g + 1 = 11  ( since deg D >= 2g -1)

d >= 33 - degree D = 33 - 12 = 21
```

In fact, if one look at the row echelon form of the matrix, they will find out that there is a code word of weight 21, so that code has a minimum distance $d = 21$. (Of course this doesn't work all the time, that we don't always find a word of minimal weight in the row echelon form of the generator matrix).

```
reduce(min, [33 - count(zero?,l) for l in listOfLists rowEchelon mG])

   (19)  21
```

Let's look at a second example.

```
p:= nextPrime(2^20)

   (1)  1048583


K:=PF p

   (2)  PrimeField(1048583)


R:=DMP([x,y,z],K)

   (3)  DistributedMultivariatePolynomial([x,y,z],PrimeField(1048583))


P:=PAFFFF( K, [x,y,z], BLQT)

   (4)
  PackageForAlgebraicFunctionFieldOverFiniteField(
      PrimeField(1048583),[x,y,z],BlowUpWithQuadTrans)


ProjPl := PROJPLPS PrimeField p

   (5)
  ProjectivePlaneOverPseudoAlgebraicClosureOfFiniteField(PrimeField(1048583))


f:R:= y^2 - (x-1)*(x-2)*(x-3)*(x-4)*(x-5)

                5      4           3       2               2
   (6)  1048582x  + 15x  + 1048498x  + 225x  + 1048309x + y  + 120
         Type: DistributedMultivariatePolynomial([x,y,z],PrimeField(1048583))


fh:R:= homogenize( f , 3 )$P

                5      4            3 2       2 3            4    2 3       5
   (7)  1048582x  + 15x z + 1048498x z  + 225x z  + 1048309x z  + y z  + 120z


setCurve(fh)$P

                5      4            3 2       2 3            4    2 3       5
   (8)  1048582x  + 15x z + 1048498x z  + 225x z  + 1048309x z  + y z  + 120z


g:=genus()$P

   (9)  2


divZ := intersectionDivisor(z)$P

              1
   (10)  5 %I7
```

```
pInf:= first supp divZ

            1
   (11)  %I7


p1:= projectivePoint( [1,0,1] :: List K )$ProjPl

                1
   (12)  (1:0:1)


pl1:= first placesAbove( p1 )$P

                1
   (13)  [1:0:1]


p2:= projectivePoint( [2,0,1] :: List K )$ProjPl

                1
   (14)  (2:0:1)


pl2:= first placesAbove( p2 )$P

                1
   (15)  [2:0:1]


p3:= projectivePoint( [3,0,1] :: List K )$ProjPl

                1
   (16)  (3:0:1)


pl3:= first placesAbove( p3 )$P

                1
   (17)  [3:0:1]


p4:= projectivePoint( [4,0,1] :: List K )$ProjPl

                1
   (18)  (4:0:1)


pl4:= first placesAbove( p4 )$P

                1
   (19)  [4:0:1]


p5:= projectivePoint( [5,0,1] :: List K )$ProjPl

                1
   (20)  (5:0:1)
```

```
pl5:= first placesAbove( p5 )$P

                1
   (21)  [5:0:1]

D:= pl1+pl2+ 3*pl3   -  5* pInf

                1          1            1        1
   (22)  [1:0:1]  + [2:0:1]  + 3 [3:0:1]  - 5 %I7

lb:= lBasis( D + g*pInf )$P

   Trying to interpolate with forms of degree:
   2
   Trying to interpolate with forms of degree:
   3
   Denominator found
   Intersection Divisor of Denominator found

   (23)
                           2              3    2             2         2     3
   [num= [873819x y z + y z ],den= 873819x  + x z + 174762x z  + 87382y z + z ]

g1:= first lb.num

                          2
   (24)  873819x y z + y z

g0:= lb.den

                3    2             2         2     3
   (25)  873819x  + x z + 174762x z  + 87382y z + z

intersectionDivisor(g1)$P - intersectionDivisor(g0)$P + D

                1          1        1
   (26)  [5:0:1]  + [4:0:1]  - 2 %I7
```

2.3 Groebner Basis

Given a set of polynomials we'd like to find a 'basis set' (think of the $x - y$ axis in some polynomial space) that is, in some sense, an easier set to use.

2.3.1 How To Compute A Groebner Basis

From Verschelde[Vers16] and Norman[Normxx] we have the algorithm for computing a Groebner Basis.

Let $I =< f_1, f_2, \cdots, f_t >$. Write $F = \{f_1, f_2, \cdots, f_t\}$.

S-polynomials (Subtraction polynomials)

A term is a product of a coefficient and a monomial.

The leading term of a polynomial p (under some monomial ordering, dicussed below) we will call $LT(p)$.

The leading monomial of the polynomial we will call $LM(p)$.

The least common multiple of two monmials x^a and x^b we will call $LCM(x^a, x^b)$

To eliminate the leading term of two nonzero polynomials p and q, we construct the S-polynomial

$$S(p,q) = \frac{LCM(LM(p), LM(q))}{LT(p)} \cdot p - \frac{LCM(LM(p), LM(q))}{LT(q)} \cdot q$$

If p and q belong to the same ideal I the $S(p,q) \in I$.

The use of S polynomials to eliminate leading terms of multivariate polynomials generalizes the row reduction algorithm for systems of linear equations. If we take a system of homogeneous linear equations (i.e. the constant coefficient equals zero), then bringing the system into triangular form yields a Groebner basis.

Buchberger's Algorithm:

Choose a pair f_i, f_j and compute $\overline{S(f_i, f_j)}^F = h$. If this is zero, then go to the next pair. If it is not zero, adjoin h to the set F. Then start over with the enlarged F in place of the original F. If the S polynomials are zero for all pairs, then stop.

Example 1 Let $I =< f_1 = xy - x, f_2 = x^2 - y >$. We use the lexicographic order with $x > y$.

1. We compute
$$S(f_1, f_2) = \frac{x^2y}{xy} \cdot (xy - x) - \frac{x^2y}{x^2} \cdot (x^2 - y) = -x^2 + y^2$$
2. We compute $\overline{S(f_1, f_2)}^F$. It is $f_3 = y^2 - y$. We adjoin this to F, so that F is now $F = \{f_1, f_2, f_3\}$.
3. We start over with the new F. It is automatic that $\overline{S(f_i, f_j)}^F = 0$. We need to compute $S(f_1, f_3)$ and $S(f_2, f_3)$.
4. We compute $S(f_1, f_3) = 0$
5. We compute $S(f_2, f_3) = x^3 - xy^2$. We compute $\overline{x^3 - xy^2}^F = 0$. Note that $F = \{f_1, f_2, f_3\}$.

We see that $\{f_1, f_2, f_3\}$ is a Groebner basis for the ideal I.

Each step creates a larger set of generators of the ideal I because we add non-zero elements to our set of generators.

Eventually we find an element in the ideal whose leading term is not divisible by any of the leading terms in our set of generators. We reach a stage where, for every pair of elements

f, g we see that $\overline{S(f,g)}^{F_m} = 0$. This means we have found a Groebner basis. However, this basis is not unique.

We can compute a unique, minimal Groebner basis by noticing that, if the leadingTerm(p) is a member of the basis formed by the leadingTerms of all of the elements of the set when p is removed, then that smaller set is also a Groebner basis.

By definition, a Groebner basis G of an ideal I is a minimal basis provided it satisfies

1. $leadingCoefficient(p) = 1 \forall p \in G$
2. $\forall p \in G, theleadingTerm(p) \notin < leadingTerm(G - p) >$

To construct this minimal bases we divide each element in the given basis by its leading coefficient. Now put the elements in some arbitrary order. If the first element in p is in $< leadingTerm(G - p) >$ the remove it from G. Now go to the second element and perform the same operation. Once all of the elements are processed the Groebner basis is minimal (but not unique). Fixing the monomial order will guarantee a unique reduced Groebner basis.

2.3.2 Monomial Ordering

Four common monomial orderings are Lexicographic (dictionary), Degree Lexicographic, Reverse Lexicographic, and Degree Reverse Lexicographic.[Coxx07]

Given
$$f = 4xy^2z + 4z^2 - 5x^3 + 7x^2z^2$$
and each monomial has the form
$$m_1 = x_1^{i_1} \ldots x_n^{i_n}$$
$$m_2 = x_1^{j_1} \ldots x_n^{j_n}$$

In **Lexicographic** order, then $m_1 < m_2$ if

$$i_1 = j_1, \ldots, \imath_{k-1} = j_{k-1}, i_k < j_k$$

for some k. That is $m_1 < m_2$ if the first variable with different exponents has a lower degree in m_1 than in m_2.

Sorting f in Lexicographic order (Lex) we see

$$f = -5x^3 + 7x^2z^2 + 4xy^2z + 4z^2$$

In **Degree Lexicographic** order, then $m_1 < m_2$ if $mdeg(m_1) < mdeg(m_2)$ or if $mdeg(m_1) = mdeg(m_2)$ and $m_1 < m_2$ with respect to Lex.

Sorting f in Degree Lexicographic order (Deglex) we see

$$f = 7x^2z^2 + 4xy^2z - 5x^3 + 4z^2$$

In **Reverse Lexicographic** order, then $m_1 < m_2$ if

$$i_n = j_n, \ldots, i_{k+1} = j_{k+1}, i_k > j > k$$

That is, $m_1 < m_2$ if the last variable with different exponents has a higher degree in m_1 than in m_2.

Sorting f in Reverse Degree Lexicographic order (Revlex) we see

$$f = -5x^3 + xxy^2z + 4z^2 + 7x^2z^2$$

In **Degree Reverse Lexicographic** order, then $m_1 < m_2$ if $mdeg(m_1) < mdeg(m_2)$ or if $mdeg(m_1) = mdeg(m_2)$ and $m_1 < m_2$ with respect to Revlex.

Sorting f in Degree Reverse Lexicographic order (Degrevlex) we see

$$f = 4xy^2z + 7x^2z^2 = 5x^3 + 4z^2$$

2.3.3 Variable Ordering

Each monomial ordering depends **on the ordering of the variables**. For instance, Lex with the ordering $x > y > z$ is a different ordering than Lex with $y > x > z$. In the above examples, we order

$$x_1 > x_2 > \cdots > x_n$$

but this is arbitrary. For each of the four common monomial orderings we have $n!$ possible orderings.

So in Axiom, we can specify the order of the variables:

```
(1) -> f=4*x*y^2*z + 4*z^2 - 5*x^3 + 7*x^2*z^2

                2      2       2      3
   (1)  f= (7x  + 4)z  + 4x y z - 5x
                                          Type: Equation(Polynomial(Integer))
(2) -> f1:DMP([x,y,z],INT):=4*x*y^2*z + 4*z^2 - 5*x^3 + 7*x^2*z^2

             3     2 2       2      2
   (2)  - 5x  + 7x z  + 4x y z + 4z
                       Type: DistributedMultivariatePolynomial([x,y,z],Integer)
(3) -> f2:DMP([z,y,x],INT):=4*x*y^2*z + 4*z^2 - 5*x^3 + 7*x^2*z^2

           2 2     2       2      3
   (3)  7z x  + 4z  + 4z y x - 5x
                       Type: DistributedMultivariatePolynomial([z,y,x],Integer)
```

2.3.4 Combined Ordering

2.3.5 An Example Computation

Suppose we are given a set of polynomials. We choose a variable ordering (in this case $w < p < z < t < s < b$) and a coefficient field (in this case Fraction(Integer)).

```
s1:DMP([w,p,z,t,s,b],FRAC(INT)):= 45*p + 35*s - 165*b - 36
s2:DMP([w,p,z,t,s,b],FRAC(INT)):= 35*p + 40*z + 25*t - 27*s
s3:DMP([w,p,z,t,s,b],FRAC(INT)):= 15*w + 25*p*s + 30*z - 18*t - 165*b**2
s4:DMP([w,p,z,t,s,b],FRAC(INT)):= -9*w + 15*p*t + 20*z*s
s5:DMP([w,p,z,t,s,b],FRAC(INT)):= w*p + 2*z*t - 11*b**3
```

```
s6:DMP([w,p,z,t,s,b],FRAC(INT)):= 99*w - 11*b*s + 3*b**2
s7:DMP([w,p,z,t,s,b],FRAC(INT)):= b**2 + 33/50*b + 2673/10000

sn7:=[s1,s2,s3,s4,s5,s6,s7]
```

We can compute a Groebner basis of this set asking for additional information during the process. Notice that there is "intermediate expression swell". That is, the Critpair polynomial coefficients can get very large.

Also notice that Axiom is providing information about which steps it is considering. So the line that reads:

```
[[ci= p,tci= 4,cj= p,tcj= 4,c= z,tc= 5,rc= z,trc= 5,tF= 4,tD= 3]]
```

tells us that

- **ci= p** Leading monomial for critpair calculation
- **tci= 4** Number of terms of polynomial i
- **cj= p** Leading monomial for critpair calculation
- **tcj= 4** Number of terms of polynomial j
- **c= z** Leading monomial of critpair polynomial
- **tc= 5** Number of terms of critpair polynomial
- **rc= z** Leading monomial of redcritpair polynomial
- **trc= 5** Number of terms of redcritpair polynomial
- **tF= 4** Number of polynomials in reduction list F
- **tD= 3** Number of critpairs still to do

```
groebner(sn7,"redcrit","info")

    reduced Critpair - Polynom :

       5     61     77      7
   z + - t - -- s + -- b + --
       8     45     24     10

   [[ci= p,tci= 4,cj= p,tcj= 4,c= z,tc= 5,rc= z,trc= 5,tF= 4,tD= 3]]

    reduced Critpair - Polynom :

         66         603      278  2   11        672      2277      415881
   t s - -- t b + ---- t - --- s  + -- s b - --- s - ---- b - ------
         29        1450     435       29        725      7250      725000

   [[ci= w,tci= 3,cj= w,tcj= 5,c= p t,tc= 6,rc= t s,trc= 8,tF= 5,tD= 2]]

    reduced Critpair - Polynom :

       100  2   160        104      37      79
   t + --- s  - --- s b - --- s - --- b - ---
       189       63         63     105     125

   [[ci= w,tci= 3,cj= w,tcj= 3,c= p t,tc= 4,rc= t,trc= 6,tF= 5,tD= 2]]
```

```
 reduced Critpair - Polynom :


 3   1026  2    5424  2   2529       1326807     12717      660717
s  - ---- s b - ---- s  - ---- s b - ------- s + ----- b + -------
      145       3625       725        362500      6250     3625000
                                                 3
[[ci= t s,tci= 8,cj= t,tcj= 6,c= t b,tc= 9,rc= s ,trc= 7,tF= 6,tD= 1]]

 reduced Critpair - Polynom :

   2     91248294  2   6550614        7087292937     20020838931
  s b + --------- s  - ------- s b + ----------- s - ----------- b
        128176525      5127061       12817652500     12817652500
+
    37595502243
  - -----------
    51270610000
                                                   2
[[ci= w p,tci= 3,cj= w,tcj= 3,c= p s b,tc= 4,rc= s b,trc= 6,tF= 7,tD= 2]]

 reduced Critpair - Polynom :

   2   4746183626079988       1015195815329760     30723564870033201
  s  - ---------------- s b - ---------------- s - ----------------- b
        987357073521193        987357073521193     24683926838029825
+
    3696123458901625353
  - -------------------
    2468392683802982500

       2             2             2             2
[[ci= b ,tci= 3,cj= s b,tcj= 6,c= s b,tc= 6,rc= s ,trc= 5,tF= 6,tD= 2]]

 reduced Critpair - Polynom :

0

       2              2            2
[[ci= s b,tci= 6,cj= s ,tcj= 5,c= s ,tc= 7,rc= 0,trc= 0,tF= 6,tD= 1]]

 reduced Critpair - Polynom :


        16827373608076633182513471     1262793163581645698534964
  s b + -------------------------- s - ------------------------- b
        23063714246644859914108300     5765928561661214978527075
+
   91594345205981119652436033
  ---------------------------
  144148214041530374463176875

       3             2            2
```

```
[[ci= s ,tci= 7,cj= s ,tcj= 5,c= s b,tc= 6,rc= s b,trc= 4,tF= 7,tD= 2]]

 reduced Critpair - Polynom :

    5      9
s - - b - ---
    2     200

       2
[[ci= b ,tci= 3,cj= s b,tcj= 4,c= s b,tc= 4,rc= s,trc= 3,tF= 6,tD= 2]]

 reduced Critpair - Polynom :

0

[[ci= s b,tci= 4,cj= s,tcj= 3,c= s,tc= 4,rc= 0,trc= 0,tF= 6,tD= 1]]

 reduced Critpair - Polynom :

0

       2
[[ci= s ,tci= 5,cj= s,tcj= 3,c= s b,tc= 4,rc= 0,trc= 0,tF= 6,tD= 0]]

  There are

6

  Groebner Basis Polynomials.

    THE GROEBNER BASIS POLYNOMIALS

(12)
      19       1323       31      153       49      1143       37       27
[w + --- b + -----, p - -- b - ---, z + -- b + ----, t - -- b + ---,
     120      20000       18      200       36      2000       15      250
     5      9    2   33       2673
 s - - b - ---, b  + -- b + -----]
     2     200        50     10000
```

2.4 Elementary Functions

2.4.1 Rationale for Branch Cuts and Identities

Perhaps one of the most vexing problems to be addressed when attempting to determine a set of mathematical function definitions is the choice of the principal branches of the inverses of the exponential, trigonometric and hyperbolic functions, and, further, the mathematical form that these functions take on their domains (the complex plane slit by the corresponding branch cuts). The fundamental issue facing the mathematical library developer is the plethora of possibilities, and while some choices are demonstrably inferior, there is rarely a choice which is clearly best.

Following Kahan[Kaha86], we will refer to the mathematical formula we use to define the principal branch of each such function as its principal expression. For the inverse trigonometric and inverse hyperbolic functions, this principal expression is given in terms of the functions $\ln z$ and $\sqrt{z}$.

The choices set out in this Standard are derived from the following principles:

1. Branch cuts must lie completely within either the real or imaginary axis.
2. The principal expression must not have any singularities at finite points which the original function does not share.
3. Branch cuts end at branch points.
4. Where not otherwise determined, the value of a function on its branch cut or cuts is obtained by taking a limit along a path which approaches the branch cut in a counterclockwise manner around one of the branch points which terminate the cut (counterclockwise continuity, or CCC for short).
5. Each inverse trigonometric or hyperbolic function must be real-valued on the range of the corresponding trigonometric or hyperbolic function when restricted to the real axis.

Further explanation of these principles can be found in [1].

While standard identities such as $\ln \frac{1}{x} = -\ln x$ hold for $x > 0$, they generally fail to hold for complex arguments of principal branches, even complex arguments which do not lie on a branch cut. Consequently, a definition of, say,

$$\arctan z = \frac{i}{2}(\ln(1 - iz) - \ln(1 + iz))$$

is not the same as the apparently equivalent

$$i \ln\left(\sqrt{\frac{1 - iz}{1 + iz}}\right)$$

. It can be challenging to decide if two candidate expressions for representing an inverse trigonometric or hyperbolic function which agree in the mathematical domain are the same in the restricted computational realm of principal expressions.

If the underlying computational mathematical system supports a signed zero, as prescribed by the IEEE/754 Standard [2], then a larger set of identities will hold. For example,

$$\ln \frac{1}{z} = -\ln z$$

holds for all complex z in such a system, as do conjugate symmetry relations for functions such as $\arcsin z$. However, identities such as $\ln zw = \ln z + \ln w$ still fail to hold for some complex z and w.

A useful function for representing identities involving complex functions which are related to the logarithm function is the complex signum function, defined as:

$$\operatorname{csgn}(z) = \begin{cases} 1, & \text{if } \Re z > 0 \text{ or } \Re z = 0 \text{ and } \Im z > 0 \\ -1, & \text{if } \Re z < 0 \text{ or } \Re z = 0 \text{ and } \Im z < 0 \end{cases}$$

The value of $\operatorname{csgn}(0)$ is unspecified. Note, for example, that $\sqrt{z^2} = z\operatorname{csgn}(z)$.

Using the principal expressions for each of the 12 inverse trigonometric and hyperbolic functions as given in this Standard, we have the following relations and identities:

2.4.2 Inverse trigonometric functions

$\arcsin(z)$	$= -\arcsin(-z)$ $= \frac{\pi}{2} - \arccos(z)$ $= -i\text{arcsinh}(iz)$
$\arccos(z)$	$= \pi - \arccos(-z)$ $= \frac{\pi}{2} - \arcsin(z)$ $= i\text{csgn}(i(z-1))\text{arccosh}(z)$
$\arctan(z)$	$= -\arctan(-z)$ $= \frac{\pi}{2} - \text{arccot}(z)$ $= -i\text{arctanh}(iz)$ $= -i\ln\left(\frac{1+iz}{\sqrt{z^2+1}}\right)$
$\text{arccot}(z)$	$= \pi - \text{arccot}(-z)$ $= \frac{\pi}{2} - \arctan(z)$ $= i\text{arccoth}(iz) + \frac{\pi}{2}(1 - \text{csgn}(z+i))$ $= -i\ln\left(\frac{z+i}{\sqrt{z^2+1}}\right)$
$\text{arccsc}(z)$	$= -\text{arccsc}(-z)$ $= \arcsin(\frac{1}{z})$ $= \frac{\pi}{2} - \text{arcsec}(z)$ $= i\ \text{arccsch}(iz)$
$\text{arcsec}(z)$	$= \pi - \text{arcsec}(-z)$ $= \arccos(\frac{1}{z})$ $= \frac{\pi}{2} - \text{arccsc}(z)$ $= i\text{csgn}(i(\frac{1}{z}-1))\text{arcsech}(z)$

2.4.3 Inverse hyperbolic functions

$\mathrm{arcsin}h(z)$	$= -\mathrm{arcsinh}(-z)$ $= \frac{\pi}{2}i - \mathrm{csgn}(i - z)\mathrm{arccosh}(-iz)$ $= -i\mathrm{arcsin}(iz)$
$\mathrm{arccosh}(z)$	$= i\mathrm{csgn}(i(1-z))\mathrm{arccos}(z)$ $= \mathrm{csgn}(i(1-z))(\frac{\pi}{2}i - \mathrm{arcsinh}(iz))$
$\mathrm{arctanh}(z)$	$= -\mathrm{arctanh}(-z)$ $= \mathrm{arccoth}(z) - \frac{\pi}{2}i\mathrm{csgn}(i(z-1))$ $= -i\mathrm{arctan}(iz)$ $= -\ln\left(\frac{1-z}{\sqrt{1-z^2}}\right)$
$\mathrm{arccoth}(z)$	$= \mathrm{arctanh}(z) + \frac{\pi}{2}i\mathrm{csgn}(i(z-1))$ $= i\mathrm{arccot}(iz) + \frac{\pi}{2}i(\mathrm{csgn}(i(z-1)) - 1)$ $= i\mathrm{arctan}(-iz) + \frac{\pi}{2}i\mathrm{csgn}(i(z-1))$
$\mathrm{arccsch}(z)$	$= -\mathrm{arccscn}(-z)$ $= \mathrm{arcsinn}(\frac{1}{z})$ $= \mathrm{csgn}(i + \frac{1}{z})\mathrm{arcsech}(-iz) - \frac{\pi}{2}i$ $= i\mathrm{arccsc}(iz)$
$\mathrm{arcsech}(z)$	$= \mathrm{arccosh}(\frac{1}{z})$ $= i\mathrm{csgn}(i(1 - \frac{1}{z}))\mathrm{arcsec}(z)$ $= \mathrm{csgn}(i(1 - \frac{1}{z}))(\frac{\pi}{2}i + \mathrm{arccsch}(iz))$

Bibliography

[Coxx07] David Cox, John Little, and Donald O'Shea. *Ideals, varieties and algorithms. An introduction to computational algebraic geometry and commutative algebra.* Springer, 2007, 978-0-387-35650-1.

Abstract: Around 1980 two new directions in science and technique came together. One was Buchbergers algorithms in order to handle Groebner bases in an effective way for solving polynomial equations. The second one was the development of the personal computers. This was the starting point of a computational perspective in commutative algebra and algebraic geometry. In 1991 the three authors invented the first edition of their book as an introduction for undergraduates to some interesting ideas in commutative algebra and algebraic geometry with a strong perspective to practical and computational aspects. A second revised edition appeared in 1996. That means from the very beginning the book provides a bridge for the new, computational aspects in the field of commutative algebra and algebraic geometry. To be more precise, the book gives an introduction to Buchbergers algorithm with applications to syzygies, Hilbert polynomials, primary decompositions. There is an introduction to classical algebraic geometry with applications to the ideal membership problem, solving polynomial equations, and elimination theory. Some more spectacular applications are about robotics, automatic geometric theorem proving, and invariants of finite groups. It seems to the reviewer to carry coals to Newcastle for estimating the importance and usefulness of the book. It should be of some interest to ask how many undergraduates have been introduced to algorithmic aspects of commutative algebra and algebraic geometry following the line of the book. The reviewer will be sure that this will continue in the future too. What are the changes to the previous editions? There is a significant shorter proof of the Extension Theorem, see 3.6 in Chapter 3, suggested by A.H.M. Levelt. A major update has been done in Appendix C "Computer Algebra Systems". This concerns in the main the section about MAPLE. Some minor updated information concern the use of AXIOM, CoCoA, Macaulay2, Magma, Mathematica, and SINGULAR. This reflects about the recent developments in Computer Algebra Systems. It encourages an interested reader to more practical exercises. The authors have made changes on over 200 pages to enhance clarity and correctness. Many individuals have reported typographical errors and gave the authors feedback on the earlier editions. The book is well-written. The reviewer guesses that it will become more and more difficult to earn 1 dollar (sponsored by the authors) for every new typographical error as it was the case also with the first and second edition. The reviewer is sure that it will be a excellent guide to introduce further undergraduates in the algorithmic aspect of commutative algebra and algebraic geometry.

Link: http://www.dm.unipi.it/~caboara/Misc/Cox,%20Little,%20O'Shea%20-%20Ideals,%20varieties%20and%20algorithms.pdf

Algebra:
(p??) package GB GroebnerPackage
(p??) package PSEUDLIN PseudoLinearNormalForm
(p??) package PGROEB PolyGroebner
(p??) domain DMP DistributedMultivariatePolynomial
(p??) domain GDMP GeneralDistributedMultivariatePolynomial
(p??) domain HDMP HomogeneousDistributedMultivariatePolynomial

[Hach95] G. Haché and D. Le Brigand. Effective construction of algebraic geometry codes. *IEEE Transaction on Information Theory*, 41(6):1615–1628, November 1995.

Abstract: We intend to show that algebraic geometry codes (AG-codes, introduced by Goppa in 1977 [5]) can be constructed easily using blowing-up theory. This work is based on a paper by Le Brigand and Risler. Given a plane curve, we desingularize the curve by means of blowing-up, and then using the desingularisation trees and the monoidal transformations associated to the blowing-up morphisms, we compute the adjoint divisor of the curve. Finally we show how to use the algorithm of Brill-Noether to compute a basis of the vector space associated to a divisor of the curve. Two examples of constructions of AG-codes are given at the end.

Link: https://hal.inria.fr/inria-00074404/file/RR-2267.pdf

Algebra:
(p??) package GPAFF GeneralPackageForAlgebraicFunctionField
(p??) package PAFFFF PackageForAlgebraicFunctionFieldOverFiniteField
(p??) package PAFF PackageForAlgebraicFunctionField

[Kaha86] W. Kahan. Branch cuts for complex elementary functions. In M.J.D Powell and A. Iserles, editors, *The State of the Art in Numerical Analysis*. Oxford University Press, April 1986.

[Kais09] Stephen H. Kaisler and Gregory Madey. Complex Adaptive Systems: Emergence and Self-Organization, 2009.

Comment: source for Sweeney.eps

Link: http://www3.nd.edu/~gmadey/Activities/CAS-Briefing.pdf

[Normxx] Arthur C. Norman. Notes 13: How to Compute a Groebner Basis.

Link: http://people.math.umass.edu/~norman/462_11/notes/m462notes13.pdf

Algebra:
(p??) package AFALGGRO AffineAlgebraicSetComputeWithGroebnerBasis
(p??) package GBEUCLID EuclideanGroebnerBasisPackage
(p??) package GBF GroebnerFactorizationPackage
(p??) package GBINTERN GroebnerInternalPackage

(p??) package GB GroebnerPackage
(p??) package GROEBSOL GroebnerSolve
(p??) package INTERGB InterfaceGroebnerPackage
(p??) package LGROBP LinGroebnerPackage
(p??) package PGROEB PolyGroebner

[Vers16] Jacques Verstraete. Combinatorial Calculus of Formal Power Series.

Comment: 264A Lecture B

Link: http://www.math.ucsd.edu/~jverstra/264A-LECTUREB.pdf

[Vogl07] Doctor Vogler. Genus of a Plane Curve, 2007.

Link: http://mathforum.org/library/drmath/view/71229.html

Algebra:
(p??) package GPAFF GeneralPackageForAlgebraicFunctionField
(p??) package PAFFFF PackageForAlgebraicFunctionFieldOverFiniteField
(p??) package PAFF PackageForAlgebraicFunctionField

[Walk78] Robert J. Walker. *Algebraic Curves*. Princeton University Press, 1978, 978-0-387-90361-3. **Algebra:**
(p??) package GPAFF GeneralPackageForAlgebraicFunctionField
(p??) package PAFFFF PackageForAlgebraicFunctionFieldOverFiniteField
(p??) package PAFF PackageForAlgebraicFunctionField