

PROD: A PROlog Documentation, and Delivery Tool

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Abstract PROD, a Prolog documentation system, is motivated and described.

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1 What?

PROD can be used to *document* or *deliver* a Prolog application:

Delivery: The current PROD distribution comes with a set of standard Prolog applications shown in Figure 1. These programs are written in the *PROD-compatible file convention* (described in §2.2.1) which simplifies using Prolog code from different programmers. PROD files are valid Prolog code that can be loaded into a Prolog interpreter, without modification.

Documentation: A PROD file also contains L^AT_EX commands inside Prolog’s comment characters; i.e. on a line after the `%` character or between `*...*` characters. That is, as a programmer writes their code they can add in comments which, subsequently, can be typeset.

The typeset form of a PROD document looks just like this document and includes a table of contents; a list of figures; automatic numbering of sections, figures, and citations. Also, all the Prolog code is displayed as verbatim text (in a typewriter font).

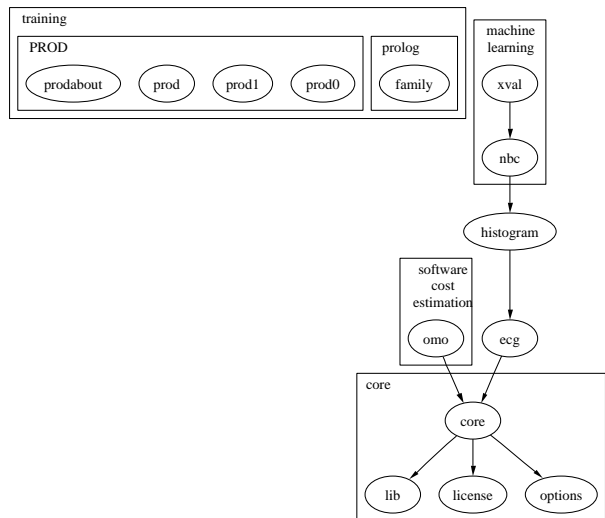


Fig. 1 Applications within the current release of PROD. $Y \rightarrow X$ indicates that Y has to first load X .

```

1 /*\documentclass[twocolumn,global]{svjour}
2 \usepackage{prod}\begin{document}
3
4 \theprogram{NAME}
5 \thetocdepth{2}
6 \thepapers{refs}
7 \thewp{PATHNAME}
8 \thetitle{TITLE}
9 \theauthor{AUTHOR1\inst{1},AUTHOR2\inst{2}}
10 \theinstitute{WHERE AUTHOR1 WORKS;\
11 \url{author1@email1.com},
12 \url{http://where.to.find.author1}
13 \and
14 WHERE AUTHOR2 WORKS}
15 \thereference{WVU, CSEE, AI lab memo \#3. Available from
16 \url{http://tim.menzies.com.pdf/03prod0.pdf}}
17 \theacknowledgement{ACKNOWLEDGEMENTS}
18 \theabstract{ONE PARAGRAPH SUMMARY}
19 */
20
21 %%% SECTION1 heading
22 /*
23 BODY OF DOCUMENT WITH A REFERENCE~\cite{swiprolog}.
24 */
25 %\input{prod0a}
26 We can include text like that shown in \fig{prod0a.tex}.
27 \SRC{prod0a.tex}{A sample include file.}
28
29 /* Some text to be typeset
30 */
31 %%% SECTION2 heading
32 /* Some text to be typeset
33 */
34 %% SECTION3 heading
35 /* Some text to be typeset
36 */
37 %%% SECTION1 heading %<
38 somePrologCode :-
39     subGoal1,
40     subGoal2.
41 %>
42 /* Some text between code.
43 */
44 %<
45 someMorePrologCode :-
46     subGoal1,
47     subGoal2.
48 %>
49 /*
50 \theend
51 \end{document}
52 */

```

Fig. 2 prod0.pl, a sample PROD file.

PROD is distributed under the GNU General Public License. Every PROD document automatically includes that license as part of its appendix.

Figure 7, at the end of this document, lists other documents relating to PROD.

1.1 Inside a PROD file

Figure 2 shows a sample PROD file. When typeset, L^AT_EX converts this document to the PDF file shown at <http://tim.menzies.com/pdf/prod0.pdf>. This file contains a *header*, a *preamble*, a *body*, and a *footer*.

1.1.1 The header and footer A PROD file begins with a standard *header*:

```

/*\documentclass[twocolumn,global]{svjour}
\usepackage{prod}\begin{document}

```

which starts a L^AT_EX document and loads the prod.sty style file. The file also ends with a standard *footer*:

```

/*
\theend
\end{document}
*/

```

1.1.2 The Preamble In between the footer and the header there is a *preamble* and a *body*. The preamble defines certain key parameters of the file using the following commands. For a detailed example of the use of these commands, see Figure 3.

- `\theprogram{NAME}` : Defines the NAME of the program being described. I use very short names for my programs (less than 3 letters).
- `\thetocdepth{LEVEL}` : Controls how detailed is the table of contents. A LEVEL=N, the table of contents only includes down to level N. For very short tables of contents, use N=1.
- `\theref{FILE}` : Shows the location of the file FILE.bib which contains the citations for this file. For those not familiar with L^AT_EX's citation system, Figure 4 shows a sample of the refs.bib database.
- `\thewp{PATHNAME}` : Shows where to find the source code file for this document.
- `\thetitle{TITLE}` : Defines the TITLE of the paper.
- `\theauthor{AUTHOR1 \inst{1}, AUTHOR2\inst{2}}` : Defines the AUTHORS and maps those authors to their INSTITUTIONS.
- `\theinstitute{WORK PLACE}` : Defines where the AUTHORS work. Multiple INSTITUTIONS are separated by “\and”.
- `\thereference{REFERENCE}` : Where this paper appears and where it can be downloaded from.
- `\theacknowledgement{ACKNOWLEDGEMENTS}` : Credit given where credit is due.
- `\theabstract{ONE PARAGRAPH SUMMARY}` : A short summary of the paper.

Some of the above commands can be entered in a different order but, for safety's sake, it is best to use the above ordering for the preamble.

1.1.3 The Body The *body* of a PROD file contains Prolog source code embedded in L^AT_EX commands. Within the body, the following conventions hold:

- Anything found between %< and %> is preserved as verbatim text (e.g. see lines 44 to 48 of Figure 2).
- A line starting with %\command is converted to \command (e.g. line 25 of Figure 2).
- A *level 1 heading* is declared for text found after %%% (e.g. line 37 of Figure 2).
- A *level 2 heading* is declared for text found after %% (e.g. line 31 of Figure 2).
- A *level 3 heading* is declared for text found after % (e.g. line 34 of Figure 2).

In the case of level 1,2,3 headings:

```

\theprogram{PROD1}
\thetocdepth{2}
\therefs{refs}
\thepw{~menzies/src/pl/prod/prod0.tex}

\thetitle{An example of the {\PROD}\newline Prolog
delivery and documentation system}

\theauthor{Tim Menzies\inst{1}, Sant A. Clause\inst{2}}

\theinstitute{Lane Department of Computer Science,
University of West Virginia,
PO Box 6109, Morgantown,
WV, 26506-6109, USA;\}
\url{http://tim.menzies.us};
\url{tim@menzies.us}
\and
Artic Software Solutions:
no ice cube too small, no iceberg too big;\}
\url{http://north.pole/~santac};
\url{santa@north.pole}
}

\thereference{WVU, CSEE, AI lab memo \#1, 2003.
Available from
\url{http://tim.menzies.com/pdf/03prod1.pdf}
}

\theacknowledgement{This research was conducted at

West Virginia University under NASA
contract NCC2-0979.
The work was sponsored by the NASA
Office of Safety and Mission Assurance
under the Software Assurance Research
Program led by the NASA IV&V Facility.
Reference herein to any specific
commercial product, process, or
service by trade name, trademark,
manufacturer, or otherwise, does not
constitute or imply its endorsement
by the United States Government.
}

\theabstract{This document is a minimal example of
using the {\PROD} Prolog documentation and
delivery system.
}

```

Fig. 3 A sample PROD preamble from `prod1.pl`. The results of this preamble can be viewed at <http://tim.menzies.com/pdf/prod1.pdf>.

- There can be no characters to the left of the comment characters.
- If the line ends in `%<`, then the heading is declared and verbatim text starts straight after the heading.

Currently, PROD does not support headings levels greater than 3.

```

@Book{bratko01,
Author = "I. Bratko",
Title = "Prolog Programming for Artificial
Intelligence. (third edition)",
Publisher = "Addison-Wesley",
Year = 2001
}

@article{me89zb,
author = "T.J. Menzies",
title = "Domain-Specific Knowledge Representations",
month = "Summer",
journal = "AI Expert",
year = "1989",
}

@InProceedings{menz91,
AUTHOR = "T.J. Menzies",
YEAR = "1991",
TITLE = "{ISA} {O}bject {PARTOF}
{K}nowledge {R}epresentation (Part Two)?",
BOOKTITLE = "Tools Pacific 4",
EDITOR = "B. Meyer",
Note = "Available from
\url{http://tim.menzies.com/pdf/tools91.pdf}"
}

@PhdThesis{me95,
AUTHOR = "T.J. Menzies",
YEAR = "1995",
TITLE = "Principles for Generalised
Testing of Knowledge Bases",
School = "University of New South Wales",
Note = "Ph.D. thesis. Available from
\url{http://tim.menzies.com/pdf/95thesis.pdf}"
}

@TechReport{me96c,
Author = "T. Menzies and P. Haynes",
Title = "Empirical Observations of Class-level
Encapsulation and Inheritance",
Institution = "Department of Software Development,
Monash University",
Year = 1996,
Note = "Available from
\url{http://tim.menzies.com/pdf/96encap.pdf}"
}

@InCollection{mich90,
author = {R.S. Michalski},
editor = {B.G. Buchanan and D.C. Wilkins},
booktitle = {Reading in Knowledge
Acquisition and Learning},
title = {Toward a Unified Theory of Learning},
publisher = {Morgan Kaufmann},
year = 1993,
pages = {7-38}
}

@unpublished{spinmanual,
author = "{G}erard {J}. {H}olzmann",
title = "{B}asic {SPIN} {M}anual",
note = "{A}vailable at
\url{http://cm.bell-labs.com/cm/cs/what/spin/Man/Manual.htm}
"}

@Manual{swiprolog,
Title = "SWI-Prolog",
Author = "Jan Wielemaker",
Note = "Available from
\url{http://swi.psy.uva.nl/projects/xpce/SWI-Prolog.html}."
}

```

Fig. 4 A sample \LaTeX citation database.

2 How?

2.1 Installing

PROD comes as one flat directory with lots of included files. Email me at `tim@menzies.us` for that zip file. Just unzip it into a fresh directory.

If you just want to run a PROD application, all you need is a Prolog interpreter. A PROD file is a syntactically valid Prolog program that can be loaded into a Prolog interpreter without modification.

On the other hand, if you want to use PROD to document your code, then you'll need a working L^AT_EX, Prolog and Perl installation. Most UNIX installations have all three. But if you need to get your own system going under Windows, then the software shown in Figure 5 might be useful.

2.2 How to load a PROD system

PROD assumes that files come in a PROD-compatible format.

2.2.1 PROD-compatible applications A PROD-compatible Prolog system comprises several files:

1. A main load file called, say, `myfile.pl`. This main load file loads up to three other files.
2. `myfile0.pl`: a small set of pre-load actions.
3. `myfile1.pl`: the bulk of the code.
4. `myfile2.pl`: start-up actions to be performed after the the code is loaded.
5. A documentation file called `myfile.pdf` auto-generated from `myfile.pl`.

2.2.2 Sample pre-load actions in `myfile0.pl`

- *Loads of other Prolog systems*: In the case where you are loading other PROD-compatible files, then you'll have to carefully inspect the pre-load and start-up actions of the systems you are loading. In the best case, you can just load the main files of the other PRODs. However, sometimes you have to skip loading those pre-load and start-up files, but weave their actions in with your own pre-loads and start-ups.
- *Operator definitions*.
- *Flags* such as what predicates are dynamic.
- *Hooks into the Prolog reader*: such as `'goal_expansion/2'` and `'term_expansion/2'`.
- *Hacks*: those shameful things we can't avoid. So we keep separate from the rest of our beautiful code in a separate section. And we don't talk too much about them. So lets go to a new section.

2.2.3 Start-up actions in `myfile2.pl` These are application-specific and may include actions like loading configuration files, then some domain-specific assertions, then calling the main processing predicate of the system.

2.3 How to document a PROD system

2.3.1 Starting from scratch To start writing PROD code, copy the `template.pl` (which comes with the standard PROD distribution) and rename it to (e.g.) `yourfile.pl`. Once that is done, then two programs are required to convert your code into a PDF format.

$$\text{your file.pl} \xrightarrow{\text{prep}} \text{your file.tex} \xrightarrow{\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}} \text{your file.pdf}$$

The `prep` and L^AT_EX programs are described below.

2.3.2 Prep: converting `*.pl` to `*.tex` The pre-processor `prep` converts the file (e.g.) `prep0.pl` to `prep0.tex`. It is convenient to create a file `preps` that lists all your files that will need prepping. For example:

```
perl prep file1
prep prep file2
```

When executed, this script looks for (e.g.) a `file.pl` and `file2.pl` and generates the files `file1.tex`, `file2.pl`. Note that during that translation,

- The characters `*` and `*` are deleted. Hence, the characters on (e.g.) line 47 and 51 of Figure 2 are deleted.
- A line starting with `%\command` is converted to `\command` (e.g. line 24 of Figure 2).

The resulting `*.tex` file can then be converted to PDF using some L^AT_EX system.

2.3.3 L^AT_EX: converting `*.tex` to `*.pdf` On my UNIX system, the script `mytex` generates PDF files from L^AT_EX files, then copies it to my web site. The command line

```
mytex prod0 03prod0
```

takes Figure 2 and generates the file that can be viewed at <http://tim.menzies.com/pdf/03prod0.pdf>.

Incidentally, this file is <http://tim.menzies.com/pdf/03prod.pdf> and was generated using the command line

```
mytex prod 03prod
```

2.3.4 Load order and documentation order Sometimes, the order in which you load files into Prolog is *not* the order in which you want to explain an application. For example, consider an application containing some low-level support code. The support code may have to be loaded *first*, before the rest of the application can be loaded. However, in terms of motivating and explaining the application, you want to explain that support code *last*.

The solution to this problem is to separate the Prolog loads from the L^AT_EX loads. This technique is used in the `lib.pl` as follows. Note in the following code segment, the use of `\input{libx}` after the call to the Prolog `load_files`:

<p>PERL:</p> <ul style="list-style-type: none"> -✓ Perl can be downloaded from many sources. For example, it comes as part of the <i>CYGWIN</i> distribution from http://xfree86.cygwin.com.
<p>PROLOG:</p> <ul style="list-style-type: none"> -✓ Interpreters: SWI-Prolog http://www.swi-prolog.org. -✓ Editors: <ul style="list-style-type: none"> - Some of my students speak highly of the <i>Prolog IDE</i> editor http://www.bildung.hessen.de/abereich/inform/skii/material/swing/indexe.htm. - I prefer <i>EMACS</i>, a Windows version of which can be found at http://www.gnu.org/software/emacs/windows - \$ An excellent alternative to <i>EMACS</i> is <i>TEXTPAD</i>: http://www.textpad.com/download/. It has ignorable nag screens which can be removed for \$27 (ish). - A simpler editor, that is free, and has a smaller footprint, is <i>PFE</i>. Its a very useful editor and it can be installed without super users. http://www.lancs.ac.uk/people/cpaap/pfe/.
<p>L^AT_EX:</p> <ul style="list-style-type: none"> - Postscript processing <ul style="list-style-type: none"> -✓ <i>GHOSTSCRIPT</i> and <i>GSVIEW</i> are the core postscript processing utilities: http://www.cs.wisc.edu/~ghost. - A L^AT_EX compiler: <ul style="list-style-type: none"> -✓ <i>MIKTEX</i> is a good Windows-based L^AT_EX distribution: http://www.miktex.org - L^AT_EX training material can be found in many places including http://www.ling.upenn.edu/advice/latex.html. For this page you can find the very excellent: <ul style="list-style-type: none"> • Quick start directions: http://www.ling.upenn.edu/advice/latex/starting.html • The Not So Short Introduction to L^AT_EX (highly recommended): ftp://ftp.tex.ac.uk/tex-archive/info/lshort/english/lshort.pdf. This document may also be found with the standard PROD distribution. • Guide to Including Graphics http://www.ling.upenn.edu/advice/latex/grfguide.pdf - Editing L^AT_EX: <ul style="list-style-type: none"> -✓ \$ Under Windows, <i>WINEDT</i> is the recommended L^AT_EX editor: http://www.winedt.com. It has some ignorable nag screens which can be removed for \$30 (ish). - Viewing the output. L^AT_EX generates DVI files, postscript files, and Acrobat files. <ul style="list-style-type: none"> -✓ DVI files can be viewed using the <i>YAP</i> viewer that comes with <i>MIKTEX</i>. -✓ Postscript files can be viewed using the <i>GSVIEW</i> program from http://www.cs.wisc.edu/~ghost. -✓ The Acrobat reader can be downloaded from http://www.adobe.com/products/acrobat/readstep2.html. - Plotting scientific data: <ul style="list-style-type: none"> - The <i>GNUplot</i> utility from http://www.gnuplot.vt.edu/ can generate postscript plots of scientific data. - Drawing packages: <ul style="list-style-type: none"> - \$ <i>MAYURA DRAW</i> is a vector drawing utility for creating SVG and EPS illustrations: http://www.mayura.com/. It can be used for free for 30 days (ish) then a registration must be bought for \$30 (ish). - The amazingly useful, and very small, <i>jpeg2ps</i> converts any JPEG file to an eps: http://www.pdflib.com/jpeg2ps/. Now, any graphic that can be converted to a JPEG can be EPS-ed and included into a L^AT_EX document. - And to convert anything to JPEG, use <i>IRFANVIEW</i>: http://www.irfanview.com - Finally, if you can't import it any other way, get it on the screen, screen size it with <i>SCREENSIZE</i> (http://www.pcmag.com/article2/0,4149,10206,00.asp, copy and paste it to <i>IRFANVIEW</i> then <i>jpeg2ps</i> it. - Auto-layout of directed and undirected graphs: <ul style="list-style-type: none"> - <i>DOT</i>: The GRAPHVIZ distribution from Bell Labs contains the <i>DOT</i> graph layout and visualization tool: www.research.att.com/sw/tools/graphviz. <i>DOT</i> can generate EPS files. - Spell checking L^AT_EX: <ul style="list-style-type: none"> - The <i>ISPELL</i> checker is a good UNIX-based spell checker. Most UNIX installations integrate it with <i>EMACS</i>. - <i>WINEDT</i> has a good editor.

Fig. 5 Support code for PROD, under Windows. For a minimal installation, only get the items marked with ✓. This software is freeware, except the items marked with \$.

```

1 latex $1 > /dev/null
2 grep "Warning:" $1.log
3 bibtex $1 > /dev/null
4 grep "Warning:" $1.blg
5 latex $1 > /dev/null
6 latex $1 >/dev/null
7 dvips -q $1.dvi -o $1.ps
8 ps2pdf $1.ps $1.pdf
9 rm $1.ps # save space- zap postscript file
10 cp $1.pdf $HOME/public_html/pdf/$2.pdf
11 chmod a+r
$HOME/public_html/pdf/$2.pdf

```

Fig. 6 mytex: generating pdf files from L^AT_EX, then copying the result to a web-enable directory so it can be browsed. Assumes that the directory `$HOME/public_html/pdf/` has already been generated. The call to `bibtex` on line 3 generates the bibliography. The multiple passes through L^AT_EX on lines 5 and 6 fix up all the bibliography and figure references.

```

%%## Installation %<
:- load_files([lib0 % pre-load actions
              ,lib1 % predicates
              ,lib2 % start-up commands
              ],[silent(yes),if(changed)]).
%>
%\input{lib0}
%\input{lib1}
%\input{lib2}

```

One nice side-effect of this technique is that the `PROD` source code can be divided up into simple chunks. The files `lib0.pl`, `lib1.pl`, and `lib2.pl` only contain `PROD` body content since the `PROD` header, preamble and footer is only needed once in the `lib.pl` container file.

3 Known Bugs

1. Fonts are a problem. If I use the standard Computer Modern font, the preview looks bad on the web. But if I use Times, then sometimes I get funny **fi** characters in the font. So, for now, I use Times in order to get decent web previews.

Acknowledgements This research was conducted at West Virginia University under NASA contract NCC2-0979. The work was sponsored by the NASA Office of Safety and Mission Assurance under the Software Assurance Research Program led by the NASA IV&V Facility. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not constitute or imply its endorsement by the United States Government.

References

A License

This software is distributed under the GNU General Public License.

A.1 nowarranty.txt

`PROD` comes with ABSOLUTELY NO WARRANTY: for more details type 'warranty'.

This is free software, and you are welcome to redistribute it under certain conditions: for more details, type 'conditions'.

A.2 warranty.txt

This program is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation; version 2 (see <http://www.gnu.org/copyleft/gpl.html> or type 'conditions').

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.

You should have received a copy of the GNU General Public License along with this program; if not, write to the Free Software Foundation, Inc., 59 Temple Place - Suite 330, Boston, MA 02111-1307, US.

A.3 conditions.txt

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a) You must cause the modified files to carry prominent notices stating that you changed the files and the date of any change.

b) You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License.

c) If the modified program normally reads commands interactively when run, you must cause it, when started running for such interactive use in the most ordinary way, to print or display an announcement including an appropriate copyright notice and a notice that there is no warranty (or else, saying that you provide a warranty) and that users may redistribute the program under these conditions, and telling the user how to view a copy of this License. (Exception: if the Program itself is interactive but does not normally print such an announcement, your work based on the Program is not required to print an announcement.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Program, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program.

In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may copy and distribute the Program (or a work based on it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you also do one of the following:

1. *prod1.pl* : “An example of the PROD Prolog delivery and documentation system.”
Available from <http://tim.menzies.com/pdf/03prod1.pdf>.
2. *prod.pl* : “A **PRO**log **D**ocumentation, and **D**elivery Tool”.
Available from <http://tim.menzies.com/pdf/03prod.pdf>.
3. *prod0.pl* : “TITLE”: a bare-bones minimal example of PROD.
Available from <http://tim.menzies.com/pdf/03prod0.pdf>.
4. *prodabout.pl* : “Motivations”: the why and who of PROD.
Available from Available from <http://tim.menzies.com/pdf/03prodabout.pdf>.
5. *family.pl* : “A family database”: documentation of a very simple Prolog family database.
Available from <http://tim.menzies.com/pdf/03family.pdf>.
6. *lib.pl* : “Commonly used predicates”:
Available from <http://tim.menzies.com/pdf/03lib.pdf>.
7. *cfg.pl* : “Handler for config files and command line options”:
Available from <http://tim.menzies.com/pdf/03cfg.pdf>.
8. *gpl.pl* : “Including GPL-2 in Prod”:
Available from <http://tim.menzies.com/pdf/03gpl.pdf>.
9. *omo.pl* : “Software cost estimation”:
Available from <http://tim.menzies.com/pdf/03gpl.pdf>.

Fig. 7 This document is part of the PROD delivery and documentation tool for Prolog applications. To find out more about PROD, the best place to start is memo #2.

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