Maintenance Manual for Program Charts

Version 3.0

PREREX[*]

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Contents

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[*]http://www.prerex.com

1   Introduction

This document will explain how to install and use software for modifying PREREX charts. Some of the necessary software is included in the package sent to you, but most of the software is easily downloaded from the web and so has not been supplied. We will for the most part assume that you are running some version of Microsoft Windows, but will sometimes point out comparable information for Mac or Linux users.

The following is a typical set of files making up a package for a PREREX program chart:

chart.pdf	the distributable format for the chart
chart.tex	the source file that describes the chart
prerex.sty	a file of definitions for PREREX program charts
chart.png	the chart in an image format (if requested)
manual.pdf	this document

The first step is to create a new folder and unzip these files into that folder.

2   Viewing and Printing

A program chart in Portable Document Format (PDF) can be "opened" for viewing or printing in any PDF viewer. The most popular of these is the Adobe Reader.[1] However, the Adobe Reader is quite slow to load and somewhat inconvenient to use if one wants to re-load a document after changing it (one must first close the document and then re-open it).

There are faster and more convenient alternatives to the Adobe Reader. One that is available for Windows, Macs, and Linux systems is a ghostscript-based viewer called GSview.[2] For Windows or Linux: download and install the most recent version of ghostscript for your platform,[3] and then install the most recent version of GSview for your platform.[4] For Macs: just get MacGSView.[5]

GSview is convenient for previewing charts while you're editing them, but clicking on an external URL link does not open that URL in a browser, so it may not be a good idea to set it as your *default* PDF viewer.

For Linux systems, other ghostscript-based viewers such as gv[6] are available. Also, xpdf[7] is suitable for any X-window based systems, such as any version of Linux. If you use a Gnome or KDE desktop in Linux, variants evince, and okular of these programs are available.

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[1]http://www.adobe.com/prodindex/acrobat/readstep2.html

[2]http://www.cs.wisc.edu/~ghost/

[3]http://www.cs.wisc.edu/~ghost/doc/AFPL/index.htm

[4]http://www.cs.wisc.edu/~ghost/gsview/index.htm

[5]http://www.cs.wisc.edu/~ghost/macos/index.htm

[6]http://wino.physik.uni-mainz.de/~plass/gv/

[7]http://www.foolabs.com/xpdf/home.html

If the chart was requested in an image format, it will have been supplied in Portable Network Graphics (PNG) format, which is suitable for in-line use in a web page. The .png file itself may be opened in a graphics application or a browser.

You may print your program chart from within any of these viewing applications.

3 Installing a Basic LaTeX System

If you want to make any changes to a chart, you will have to edit the corresponding "source" file (description), which will have a .tex extension. It is just an ASCII text file and so you can open it in any text editor, such as notepad++[8]. It will look very complicated at first, but in Section 8 you'll discover that it's quite easy to make any necessary changes to the chart by editing the source file and then re-processing it. To do this "processing" (to produce a revised PDF or PNG), you will need to install an application called LaTeX, together with several auxiliary applications to convert the output into Postscript and then PDF.

LaTeX is a powerful document processor based on a professional-quality typesetting program called TeX. The following web sites will point you to as much information as you might want on LaTeX and TeX:

- LaTeX Project home page[9]

- TeX Users Group home page[10]

- TeX FAQ[11]

If you use Windows, we suggest you install the "basic" version of MiKTeX.[12] If you use Mac OS X, go to the *TeX on Mac OS X* site.[13] Linux users should install texlive packages either from their distribution or from http://www.tug.org/texlive/.

The resulting installation will allow you to use the program pdflatex to process simple .tex files into PDF format. However, you won't be able to process a program-chart description until some necessary additional software is installed.

4 Additional LaTeX Software

To process descriptions of PREREX charts, some additional packages are needed. The file prerex.sty is essential and was distributed with your chart; it should be stored in the same folder as the .tex file to be processed (or in the \localtexmf tree) so the

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[8]http://notepad-plus-plus.org/

[9]http://www.latex-project.org

[10]http://www.tug.org/

[11]http://www.tex.ac.uk/cgi-bin/texfaq2html

[12]http://www.miktex.org/setup.html

[13]http://www.rna.nl/tex.html

LaTeX system can find it. Other necessary add-ons to the basic MikTeX package are as follows: `multido`, `pstricks-add`, `xcolor`, and `xkeyval`. If you are using MikTeX, these can be installed using the package manager, or, if you prefer, will be installed automatically the first time a chart description is processed. If you are not using MikTeX, all of the packages are available for download at any repository of the Comprehensive TeX Archive Network (CTAN)[14]

Finally, unless instructed otherwise, the supplied chart uses the Optima typeface; however, the font and support files for this typeface are not standard in LaTeX. If you want the charts you create to use the Optima typeface, as in the supplied chart, it will be necessary to install suitable font and support files; this is explained in detail in Section 7. For now, you may want to just use a text editor (such as Notepad) to change the line

```
\renewcommand{\sfdefault}{uop}
```

in `chart.tex` to

```
\renewcommand{\sfdefault}{cmss}
```

This will request the use of Computer Modern Sans (a standard LaTeX typeface) instead of Optima as the default typeface for *sans serif* text; otherwise, LaTeX will substitute inappropriate fonts when it can't find the metrics for the requested Optima fonts.

You are now ready to process the description for a chart. Get a command-line prompt, move to the folder with the chart description and issue the following sequence of instructions:

```
> pdflatex chart
> gsview32 chart.pdf
```

The first step does the typesetting; this step will be very lengthy if the MikTeX package manager has to download and install several additional packages. This operation will overwrite the original `chart.pdf`, so you might first re-name that file if you want to preserve it. The second step invokes the PDF viewer.

5   Installing a LaTeX Development Environment

Most beginning users will prefer to use a graphical "development environment" which supports editing, processing and previewing of documents, rather than the command-line interface. There are *many* such applications.

For Windows, we suggest you go the Texmaker download site[15] and click on the link for the self-installing archive `texmakerwin32_install.exe`. For Mac OS X, go to the same site, get the `texmakerbinmacosx` archive and follow the instructions. For Linux, install a `texmaker` package or get the source files at the Texmaker site.

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[14]http://www.ctan.org/
[15]http://www.xm1math.net/texmaker/download.html

You should now be able to open the source file for your chart, process it, and then view the result using the items in the *Tools* menu, or the *Quick Build* button. If there are any processing errors, error messages will appear in the bottom window pane.

Many other LaTeX editors are available if Texmaker doesn't satisfy you. Two of the most popular of these for Windows are WinEdt[16] and TeXnicCenter;[17] the former is "shareware" and the latter is free. Mac users may want to check out the list of "front-ends" at the *TeX on Mac OS X* site.[18]. Linux users also have Kile[19] and Klat.[20]

6   Conversion to PNG Format

To produce a PNG version of a program chart, you need a graphic-conversion program; for example, ImageMagick[21] is available for Windows and Linux.

7   Fonts

This section will explain what is involved in using non-standard typefaces for your charts. If you're happy enough with the default typeface, you may skip this section. You may also want to experiment with two other typefaces that are supported in any standard LaTeX system; try phv (Helvetica) or pag (Avant Garde) instead of uop (Optima) in the command

```
\renewcommand{\sfdefault}{...}
```

To understand why Optima looks similar to yet subtly different from these typefaces and from conventional text-body typefaces such as Times and Palatino (which is the typeface used in this document), look carefully at the following samples:

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[16]http://www.winedt.com/
[17]http://sourceforge.net/projects/texniccenter
[18]http://www.rna.nl/tex.html
[19]http://kile.sourceforge.net/
[20]http://research.edm.luc.ac.be/jori/klat/klat.html
[21]http://www.imagemagick.org/

Times
Palatino
Computer Modern Sans
Helvetica
Avant Garde
Optima

Times and Palatino are *serifed* typefaces; the serifs are the small projections at the baselines, and sometimes at the tops, of characters. Studies have shown that serifs improve the readability of *long* texts. Helvetica, Computer Modern Sans, Avant Garde, and Optima are all *sans serif* typefaces; this class of typefaces is more appropriate for use in program charts where *legibility* of fairly small and short textual fragments is of primary importance. But if you look carefully, you'll see that, unlike the boringly uniform strokes of the Computer Modern, Helvetica and Avant Garde characters, the strokes of the Optima characters are *tapered* (i.e., shaped). This gives Optima text an elegance and liveliness lacking in most other *sans serif* typefaces. Palatino and Optima were both designed by Hermann Zapf, considered the foremost type designer of the modern era.

So how does one install Optima (or any other non-standard typeface) for use in a program chart? Authentic Optima fonts in Windows Postscript (Adobe type 1) format are available commercially from font vendors such as `myfonts.com`. The necessary LaTeX support files and instructions for installation into a standard LaTeX implementation may be found at CTAN;[22] the file `pop.zip` is the package of support files and `pop.txt` gives the installation instructions.

But there are less expensive alternatives. The name *Optima* is trademarked by Linotype, but other font foundries have produced good-quality clones with other names. For example, the family of Zapf-Humanist 601 fonts from Bitstream are available from commercial distributors such as `myfonts.com`. They are actually more expensive than authentic Optima; however, some of these fonts have been bundled with Corel applications such as WordPerfect, and so you may already have them. The support files for LaTeX (`bop.zip`) and instructions (`bop.txt`) are also available at the site referenced above.

Another usable clone of Optima is the URW Classico family of fonts. These are slightly less expensive than authentic Optima at commercial vendors but four Classico fonts are available in a package of 79 fonts in type 1 format that may be legally downloaded for non-commercial use from Artifex.[23] Just the four Classico font files, renamed

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[22]http://www.ctan.org/tex-archive/fonts/psfonts/w-a-schmidt/

[23]http://www.artifex.com/downloads/

for use in LaTeX, with the necessary support files (`uop.zip`) and installation instructions (`uop.txt`) are available by anonymous ftp from the PREREX ftp site.[24] The four Classico font files cannot be distributed commercially without a commercial license; please read the license in the archive before re-distributing them.

When any of these Optima or Optima-like fonts and corresponding support files have been installed, it will be possible to request their use in your charts by using `pop`, `bop`, or `uop` in the

```
\renewcommand{\sfdefault}{...}
```

command in the source file. If `cmss` is used here or this command is commented out (by preceding it with a `%` character), Computer Modern Sans will be used.

8   The Source File

8.1   Overall Structure

A `.tex` file is essentially text with interspersed LaTeX commands, much as an `.htm` file has text with Hypertext Mark-up Language (HTML) tags interspersed. Commands for LaTeX can be recognized by the initial backslash character "\".

The first several lines make up the "preamble" of the source file for a chart:

```
\documentclass{article}
\usepackage{prerex}
    :
```

This describes the kind of document to be processed (`article`, as opposed to `book` or `report`) and indicates a file of definitions to be used (`prerex.sty`). The remaining lines of the preamble specify such things as the page layout and the fonts to be used.

The structure

```
\begin{document}
    :
\end{document}
```

contains the content of the document. Typically, the first element of the content is a heading, contained within a formatting structure of the form

```
\begin{center}
    :
\end{center}
```

which specifies that each line of the material contained should be centered on the page. The double-backslash command `\\` indicates a line break.

After the heading comes the description of the chart itself:

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[24]`ftp://ftp.prerex.com/pub/`

```
\begin{chart}
   :
\end{chart}
```

Finally, there will typically be some notes to explain the abbreviations and conventions used in the chart.

8.2   Chart Instructions

In this section, we discuss the instructions that produce the boxes and arrows of the chart itself. To better understand the format of these instructions, remove the % in front of the \grid command in the first line after the \begin{chart} in the source file for your chart and re-process the chart. If you view it or print it out, you will see a light gray "coordinate grid" on which the chart is superimposed.

The "origin" of the coordinate system (with x-coordinate 0 and y-coordinate 0) is at the lower-left corner of the chart. It is likely that the leftmost and lower-most course box is centered at the origin, but this is not obligatory.

8.2.1   Course Boxes

The following instruction constructs a course box for a half-credit course centered at coordinates $(15, 0)$:

```
\halfcourse 15,0:{406}{Coding\\Theory}{W22}
```

After \halfcourse come the x- and y-coordinates (15 and 0), followed by a colon (:), followed by three brace-enclosed strings for

   (i)   the course code (406),

  (ii)   the course title (Coding Theory), and

 (iii)   the timetable slot for the course (W22).

A line break (\\) is used in the course title to prevent the box from being too wide. There are similar instructions for required half-credit courses (\reqhalfcourse), for full-credit courses (\fullcourse), and for required full-credit courses (\reqfullcourse); these produce course boxes of different size and/or weight. If a c character is appended to any of these instructions, you can add an additional argument to specify the background colour of the course box, as in

```
\halfcoursec 15,0:{406}{Coding\\Theory}{W22}{blue!25}
```

The !25 suffix produces a pastel shade, suitable as a background. To change the *default* background for course boxes, see Section 8.4 on page 11 below.

There is an instruction that produces a "mini" course box with an invisible outline; such course boxes are normally placed just above an ordinary course box, when an ordinary prerequisite arrow would not be feasible. The format of the instruction for a mini course box is as follows: `\mini` x,y:{*course code*}. The y-coordinate of the mini course box should be 6 units greater than the y-coordinate of the course box it is above; the x-coordinate of the mini should normally be either 3 units smaller or 3 units greater than the x-coordinate of the course box, but in some circumstances other x-coordinate differences must be used. In all cases, the coordinates are those of the *centres* of the boxes, not the edges or corners.

A text-line is produced by a command of the form

> `\text` x,y :{ *line of text* }

There are several differences between minis and text-lines. The maximum length allowed for a course-code may be less than that for a text-line. A sans-serif font and a reduced font size is used for a course-code. A course-code may be hyperlinked but a text-line is not (except when the coordinate grid is on). A LaTeX `\parbox` command may be used if more than one line is desired.

8.2.2 Arrows

The instruction

> `\prereq 10,10,0,0:`

draws a (solid) arrow oriented from the centre of a (previously-drawn) box at coordinates $10, 10$ to the centre of another (previously-drawn) box at $0, 0$, with the arrow tail abutting the outline of the source box and the arrow head abutting the outline of the target box. Note that the instructions that produce the source and target boxes must *precede* the instruction for the arrow; this is the only ordering constraint on chart instructions.

There are similar instructions to produce *dotted* arrows (`\coreq`) and *dashed* arrows (`\recomm`), to denote co-requisites and recommended pre-requisites, respectively. Arrows from "mini" course boxes to the course boxes they are immediately above work in exactly the same way, except that the outlines of the mini boxes are invisible.

Arrows by default are slightly curved (except very short ones). It is possible to increase or decrease the degree of curvature of a particular arrow by using an instruction like

> `\prereqc 10,10,0,0;0:`

which draws a (solid) arrow as before, but with curvature 0; i.e., it will be straight. To increase the degree of curvature, use a larger number (up to 100). To change the default curvature for arrows, see Section 8.4 on page 11 below.

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8.2.3   In-Line Diagrams

Notes explaining the diagram conventions may need to use small examples of course boxes or arrows in running text; the following instructions can be used:

`\solidarrow`	⟶
`\dottedarrow`	····▸
`\dashedarrow`	---▸
`\lightbox`	light
`\boldbox`	**bold**

8.2.4   Instruction Summary

Table 1 on page 11 summarizes the formats of the instructions defined by `prerex.sty`.

8.3   LaTeX Input Conventions

The following are some of the input conventions for LaTeX that you might want to know about while editing the source file for a program chart.

- The characters # $ % &   _ { } ˜ ˆ \   are interpreted in special ways by LaTeX; to produce any of the first seven of these characters, you will have to "escape" them with a backslash, as in, for example, `\&`. The `\\` combination produces a line break; to produce a backslash, use `\backslash`. The remaining two special characters, ˜ and ˆ, may also be escaped with a backslash but produce accents; for example, `\ˆ{u}` produces û.

- To produce a space where LaTeX would normally not do so, use `\ `. For example, LaTeX normally interprets a period immediately after a word as the end of a sentence and leaves a larger-than-usual space; to prevent the larger-than-usual space after an abbreviation that finishes with a period, use `\ ` instead of a space, as in `Diff.\ Equations`.

- An unescaped % character signals the beginning of a comment; any characters following the % to the end of that line are ignored by LaTeX.

- To prevent a line break between two words, use a ˜ instead of a space between them, as in `MATH˜223`.

- To leave a smaller-than-usual space between two words, use `\,` instead of a space between them, as in `MATH\,223`.

- To prevent hyphenation of some word, use the word as the argument to an `\mbox` command, as in `\mbox{Robert}`.

Course Boxes and Text-Lines
`\halfcourse` *x,y*:{*course code*}{*course title*}{*timetable code*}
`\fullcourse` *x,y*:{*course code*}{*course title*}{*timetable code*}
`\reqhalfcourse` *x,y*:{*course code*}{*course title*}{*timetable code*}
`\reqfullcourse` *x,y*:{*course code*}{*course title*}{*timetable code*}
`\halfcoursec` *x,y* :{ *course code* }{ *course title* }{ *timetable code* } { *color* }
`\reqhalfcoursec` *x,y* :{ *course code* }{ *course title* }{ *timetable code* } { *color* }
`\fullcoursec` *x,y* :{ *course code* }{ *course title* }{ *timetable code* } { *color* }
`\reqfullcoursec` *x,y* :{ *course code* }{ *course title* }{ *timetable code* } { *color* }
`\mini` *x,y* :{*course code*}
`\text` *x,y* :{*line of text*}
Arrows
`\prereq` x_0,y_0,x_1,y_1: `\prereqc` $x_0,y_0,x_1,y_1; c$:
`\coreq` x_0,y_0,x_1,y_1: `\coreqc` $x_0,y_0,x_1,y_1; c$:
`\recomm` x_0,y_0,x_1,y_1: `\recommc` $x_0,y_0,x_1,y_1; c$:
Coordinate Grid
`\grid`
In-Line Instructions
`\solidarrow`
`\dottedarrow`
`\dashedarrow`
`\lightbox`
`\boldbox`

Table 1: Instructions for Program Charts

8.4   Configuration

The following LaTeX definitions are made in `prerex.sty` but may be re-defined by the user in the chart source file:

    \newcommand{\DefaultCurvature}{20}

where the argument should be in the range 0–100; 0 means no curvature.

    \newcommand{\CourseURL}[3]{#1.html}

where the arguments supplied at the call are the x and y coordinates of the box or mini, and the course code.

```
\newcommand{\background}{yellow!15}
```

```
\setlength{\unit}{5.7816pt}
```

which defines the absolute size of a coordinate unit; this results in exactly 10 pixels per coordinate unit if the chart is converted to an image at 125 dpi.

```
\newcommand{\dpi}{125}
```

```
\newcommand{\PixelsPerUnit}{10}
```

```
\setcounter{diagheight}{75}
```

which is the *y*-coordinate of the top of the diagram (reduced to 65 in landscape mode); the nominal diagram width is \textwidth ÷ \unit +10.

The following define the thicknesses of the three kinds of arrows and the thickness of bold boxes:

```
\setlength{\solidwidth}{0.5pt}
```

```
\setlength{\dottedwidth}{0.8pt}
```

```
\setlength{\dashedwidth}{0.8pt}
```

```
\setlength{\boldwidth}{1.0pt}
```

9 An Interactive Editor

The source code of prerex, an interactive program-chart editor, is available at CTAN repositories.[25] It should build on any UNIX-like system with suitable tools and libraries installed; for example, it can be compiled on GNU/Linux, Solaris, the Cygwin[26] platform on Windows, and the Fink[27] platform on OS X, if the GNU readline library is installed.

The prerex editor supports add, remove, cut-and-paste, edit, and shift operations on diagram elements (course boxes, arrows, minis). The effects of these operations may be observed in a PDF viewer, without exiting the editor. For making substantial changes to a PREREX chart, it is more convenient to use this program than to edit the source file directly. A graphical front-end vprerex to the prerex editor is also available.

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[25]http://www.ctan.org/tex-archive/graphics/prerex/
[26]http://www.cygwin.com/
[27]http://fink.sourceforge.net/

Bibliography

The following are three recommended books on LaTeX. Many other books and tutorial materials are available; check out the web sites referenced in Section 3.

[1] Helmut Kopka and Patrick W. Daly. *Guide to LaTeX*[28]. Addison Wesley Professional, 4th edition, 2003.

[2] Leslie Lamport. *LaTeX: A Document Preparation System*[29]. Addison Wesley Professional, 2nd edition, 1994.

[3] Frank Mittelbach, Michel Goossens, Johannes Braams, David Carlisle, and Chris Rowley. *The LaTeX Companion*[30]. Addison Wesley Professional, 2nd edition, 2004.

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[28] http://www.awprofessional.com/titles/0321173856
[29] http://www.awprofessional.com/titles/0201529831
[30] http://www.awprofessional.com/titles/0201362996