האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

# Graphic Facilities Available in TEX and in LATEX

in shum and noga (unix machines)

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# Contents

# 1 What does plain LaTeX provide graphic-wise?

LaTeX has a picture environment. This environment can be used to draw pictures composed of text, straight lines, arrows, and circles. It is described in the LaTeX user's guide, section 5.5 and in Appendix C.13

Advantage: LaTeX graphics are made rapidly and take up a small space in memory.

Limitations: limited possibilities; only a limited number of possible slopes for lines and vectors, limited possibilities for drawing circles, only two line thicknesses.

Here is an example of a plot done via LaTeX ' picture environment. The input file is:

```
\documentstyle{article}
\begin{document}
\begin{figure}
%
\begin{picture}(500, 200)(-95,0)
%
\multiput(0, 0)(0, 20){11}{\line(20,0){200}}
\multiput(0, 0)(20, 0){11}{\line(0,20){200}}
\put(90,90){\circle*{15}}
\put(90,130){\circle{15}}
\put (87,126){1}
\put(70,110){\circle{15}}
\put (67,106){2}
\put(170,30){\circle{15}}
\put (167,26){3}
\put(30,50){\circle{15}}
\put (27,46){4}
\end{picture}
\caption{A LateX example - courtesy Ran Levy.}
%
\end{figure}
%
\end{document}
```

The output is in figure 1 on next page.

# 2 What does plain TeX provide graphic-wise?

The macros available in LaTeX 's picture environment can also be used in TeX. To use them, you have to include in the TeX document the following two lines:

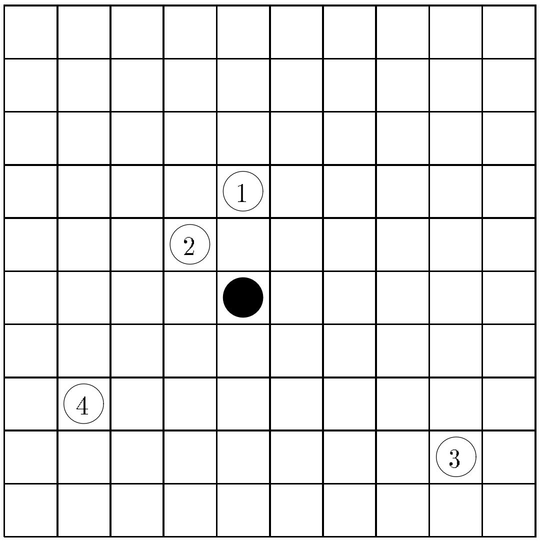


Figure 1: A LateX example - courtesy Ran Levy.

```
\input pictex
\input latexpicobjs
```

The file pictex includes also all macros which pertain to PICTEX, described below. Here is an example of a tex file using this facility:

```
\input pictex
\input latexpicobjs
This is just a line.
\setbox0=\hbox{ \raise 4pt \hbox{\circle{15} }} % This is the circle.
% 15 is the diameter.
\copy0       % Writing the circle ...
\kern-21pt   % Moving backward ...
2            % Writing the number inside.
More text.
\copy0       % Writing the circle ...
\kern-21pt   % Moving backward ...
2            % Writing the number inside.
\kern 4pt    % Moving forward a bit ....
And more text.
\end
```

Here is the output created:

This is just a line. 2
More text. 2 And more text.

# 3 PICTEX

PICTEX is a collection of TEX macros which makes it possible for the TEX user to use TEX commands in order to typeset pictures within the TEX or LATEX document.

It's advantages: PiCTeX makes it possible for the user to draw nice pictures, especially mathematical figures. The pictures become an integral part of the document. All TEX and LATEX capabilities are available for annotating the figures,as well as the fonts used in the original document. PICTEX' portability is achieved by using TEX arithmetic to do all plotting calculations, and by drawing the figure using the period character as a 'brush'. PiCTeX macros are, thus, machine independent.

The PiCTeX documentation is available from the TeX Users Group for $30.

You can get it from:

```
P.O. Box 9506
Providence, RI 02940
Phone: 401-751-7760
E-mail: TUG@math.ams.com
```

It's limitations: PICTEX is slow and requires a large internal TEX memory. The scope of graphics is limited. No 'free' sketches are possible. There are no 3D pictures. making curves takes some minutes and a lot of computer memory.

## 3.1 How to use PiCTeX with TEX ?

Include in your input file to TEX the line

```
\input pictex
```

If you also want to use (in your TEX file) the LATEX graphic macros, include in your TEX file the following line also:

```
\input latexpicobjs
```

Then you can use all the commands described in the PiCTeX manual.

## 3.2 How to use PiCTeX with LaTeX ?

Include in your LaTeX document the lines

```
\input prepictex
\input pictex
\input postpictex
```

The order of the lines is important. Then you can use all the commands described in the PiCTeX manual.

More information about PiCTeX and its relation to TeX and to LaTeX is contained in the PiCTeX manual.

# 4 GNUPLOT

GNUPLOT is a graphic program. It has many keywords; its syntax is described in the GNUPLOT manual, obtainable by typing

latex gnuplot_manual

The program plots any number of functions, built up of C operators, C library functions, and some things C doesn't have like **, sgn(), etc. It also supports plotting data files, to compare actual data to theoretical curves.

When used interactively, it has a good "help" facility.

## 4.1 How to use GNUPLOT with LaTeX ?

GNUPLOT 2.0 includes a LaTeX driver which outputs GNUPLOT commands in a file having LaTeX format. This file can later be included in a LaTeX document in a figure environment.

For example, you create a file called gnu.input, containing the lines

```
set terminal latex
set output 'example.tex'
set samples 50
set title "The Title"
plot [-10:10] sin(x),atan(x),cos(atan(x))
set xlabel "x label"
set ylabel "y label"
```

You process this file by typing gnuplot gnu.input and get the output file example.tex .

You use this file in the LaTeX documnt by specifying

```
\begin{figure}
\begin{center}
\input example
```

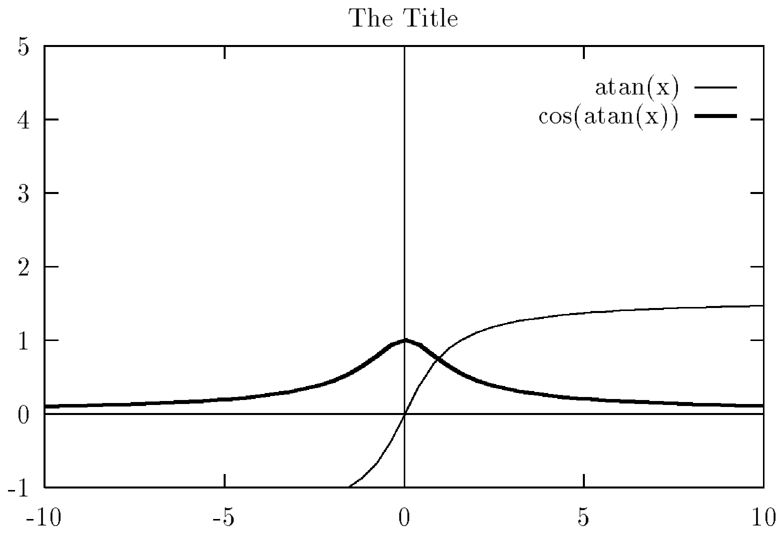



Figure 2: A GNUPLOT example.

```
\end{center}
\end{figure}
```

The result in shown in figure 2.

As mentioned, there is a GNUPLOT manual. The manual describes the package, and is obtainable by typing

latex gnuplot_manual

Another guide is provided which explains usage of GNUPLOT by LaTeX users, and it can be obtained by running

latex gnuplot_guide

GNUPLOT graphics within LaTeX might need an enlarged version of TeX . The ordinary version may suffice if the plots are not very complicated.

### 4.2 How to use GNUPLOT with TeX ?

TeX can also utilize the GNUPLOT package (using the files pictex and latexpicobjs mentioned before). In this case you can include the plot within the TeX document via the keywords

```
\topinsert .....\endinsert
\midinsert .....\endinsert
\pageinsert ....\endinsert
```

See page 116 in the TeX book.

# 5 PLOT10 → GNUPLOT

PLOT10 is a graphic package written in Fortran. It contains nine subroutines which are quite easy to use for Fortran programmers.

Those are:

```
Axis     -  Plot axis
Factor   -  Scale size
Line     -  Draw a vector of points
Logax    -  Plot log axis
Namplt   -  Initiate plot
Number   -  Draw numbers
Plot     -  Move pen
Scale    -  Scale a vector
Symbol   -  Draw text and symbols
```

A manual is available by typing

tex plot10_manual

A new library, plot10_s.a has been created which includes the PLOT10 subroutines, changed so that instead of creating a plot, it creates an input file for GNUPLOT; this file, when processed by GNUPLOT creates a latex file which can be included in a LaTeX document, as described earlier. Good results are obtained by suppressing the automatic scaling done by GNUPLOT; see example below.

## 5.1 How to use PLOT10 with LaTeX ?

Let's say you have the following Fortran program, containing calls to Plot10 routines, In a file called twoplot.f

```
program twoplot
call namplt
call plot(0.0,0.0,3)
call plot(5.0,5.0,2)
call plot(7.0,3.0,2)
call axis(0.0,0.0,1hx,-1,8.0,0.0,0.0,1.0,0)
call newpag
call symbol(2.0,2.0,0.20,4hkuku,0.0,4)
call plot(0.0,0.0,555)
end
```

You type

f77 twoplot.f plot10_s.a
and then
a.out
As a result, the following files are created:

- A file called gnu.input, containing instructions for GNUPLOT. Here's the file's content:

```
set term latex
set nokey
set output "gnu.tex"
set samples 100000
plot "gnu.data.11" with lines
plot "gnu.data.12" with lines
```

  The file name "gnu.input" is written within plot10 routines.

- Two data files will be created (because the program twoplot.f creates two plots, one initiated by "call namplt" and the other by "call newpag") called gnu.data.11 and gnu.data.12

You use GNUPLOT by typing
gnuplot gnu.input
and get the LaTeX file gnu.tex, which is to be included in a LaTeX document, as described earlier in section 4.1.

Here's an example of a latex file which will plot twoplot.

```
\documentstyle{article}
\begin{document}
\begin{figure}
\begin{center}
\input gnu.tex
\end{center}
\end{figure}
\end{document}
```

The output appears in figure 3.

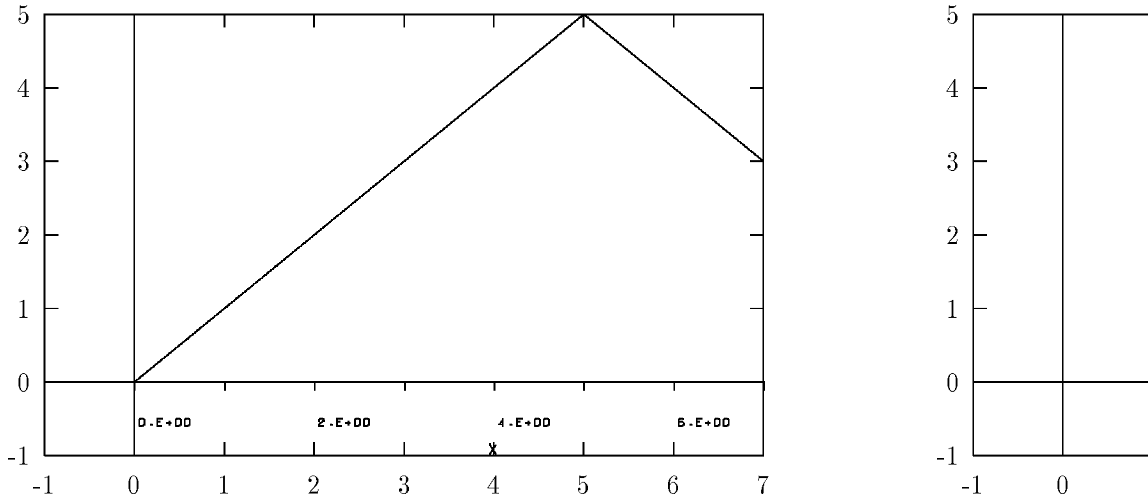



Figure 3: A PLOT10→GNUPLOT→LATEX example : Courtesy Uri Feldman

## Note!

In order to get better results using PLOT10 + GNUPLOT, it is advisable to scale the resulting GNUPLOT plots.

The current example has been scaled by using a pre-defined file called .gnuplot, which resides in the user's home directory, and which contains the following GNUPLOT commands:

```
set noautoscale
set size .968,.968
set xrange [-1:7]
set yrange [-1:5]
```

# 6 EPIC

EPIC is a LATEX 's document style option. It improves the drawing capabilities of LATEX , by providing simpler and more powerful macros. Those macros reduce the amount of manual calculation required to specify the layout of objects. It introduces new commands for drawing more line types and new environments suitable for drawing graphs.

Usage:

```
\documentstyle[epic]{.....}
```

EPIC contains various macros, which are fully explained in a guide available to LaTeX users via the command
latex epic_guide
The guide explains all the available new commands and contains elaborate examples.

## 7 EEPIC

EEPIC is, like EPIC, a LaTeX document style option. It extends LaTeX and EPIC capabilities. It draws lines in any slope, draws circles and filled circles in any radii, draws dotted and dash lines much faster and with less memory, and more. It draws elipses, arcs, splines and more.
Usage:

```
\documentstyle[epic,eepic]{.....}
```

A guide is available to LaTeX users, via
latex eepic_guide
The guide explains EEPIC's extensions to both LaTeX and to EPIC. It uses the same examples which appear in the epic_guide and tries to convince you that EEPIC gives better results. You can see two examples copied from the eepic_guide in figure 4 and in figure 5.

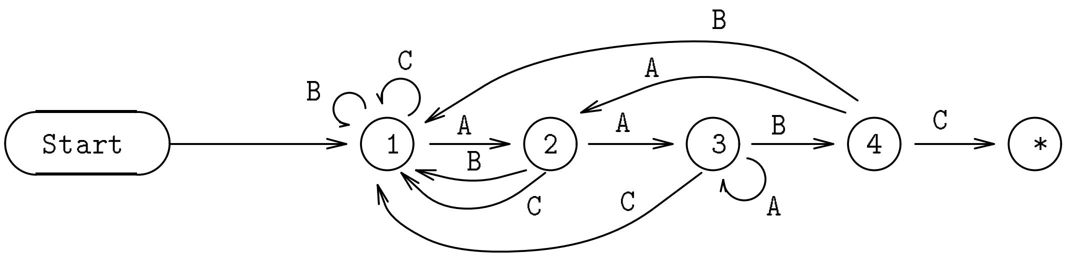



Figure 4: Example 3 from EEPIC_guide.

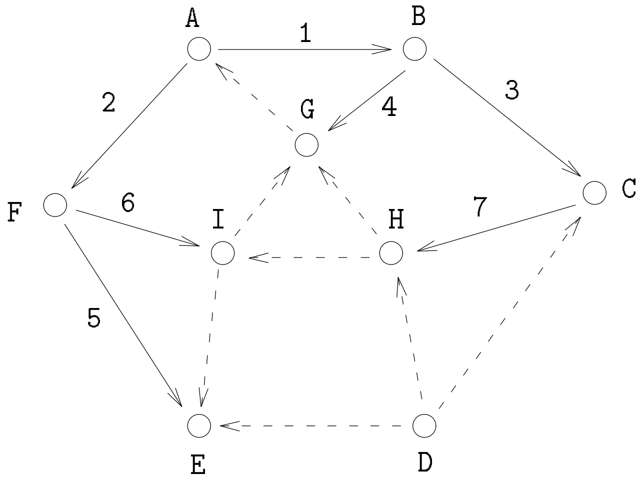



Figure 5: Example 4 from EEPIC_guide.

# 8 POSTSCRIPT

PostScript, sometimes referred to as PS, is a powerful graphic language which is gaining acceptance as a standard. In an environment where DVI files are transtaled into PS before being printed, it is possible to insert a seperately prepared PostScript file into a TEX or a LATEX document, using the TEX \special command. The resulting output can only be previewed using a PS previewer, (like 'ghost' in UNIX) and has to be printed on a PS printer, such as the Apple LaserWriter. In shum, as well as in DOS PC, users of dvips (a program which translated a .DVI file into a .PS file) can include a previously prepared PS file in their TEX or LATEX document by specifying (within the document)

```
\special{psfile=filename.ps}
```

This will download the file so that the current point will be the origin of the Postcript coordinate system. It is also possible to specify transformations on the PostScript, using the syntax

```
\special{psfile=filename.ps [key=value ......]}
```

Possible keys are hoffset, hsize, hscale, angle, voffset etc. You can also use the \special command like in

```
\special{ps:ps_command}
```

in order to include PostScript commands in the document.

Possible uses of the \special command with dvips is explained in the dvips guide, obtainable by running in shum

tex dvips_guide

### 8.1 \special

\special is a TEX command which is not processed by TEX but remains as it is in the .dvi file. The \special command is processed by dvips, and is meant to include PostScript commands and/or a PostScript file in the output. See the usage of \special in the section about FIG.

The \special command can be used for plotting the Hebrew University header on documents. You type

```
\special{psfile=HU.ps}
```

See the header on top of the title page of this guide.

## 9 FIG, XFIG

Those are interactive graphic editors, in the style of Macintosh' MacDraw. Fig runs under Suntools/SunView, and Xfig can also work under X11 windowing systems. Xfig is a version of Fig which goes with the X Windowing System. These graphic editors produce files which can be translated to a variety of graphic languages, including PostScript and picTeX , and then included in a TEX or LATEX document. shum has xfig for those users who can use the X windowing system.

xfig is a menu driven interactive utility. Using the 'mouse', you choose some of many optional drawing types and styles, including font selection. You can save the figure, and a file having the extension .fig is created.

### 9.1 f2ps

f2ps is a utility which inputs a .fig file and creats a .ps file, that is, a PostScript file which can be included in a TEX or LATEX document.

### 9.2 Including an XFIG plot in TEX

Here is an example of using xfig with f2ps.

Having an X terminal, you type

xfig

and you draw a picture, then you save it within xfig. Let's say called girl.fig has been created.

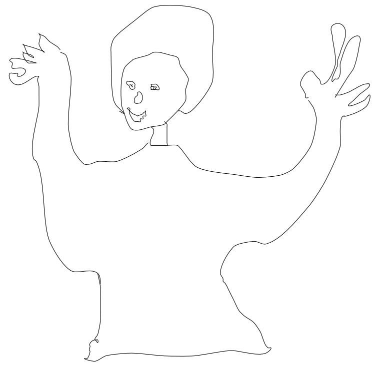
Then the command f2ps is utilized, thus:

f2ps girl.fig > girl.ps

The file girl.ps is to be included in a TEX text. Here is how it can be done:

```
%  We insert the figure after moving(=translating) scaling and rotating it.
%
\special{ps:gsave}                     % Saving the current environment.
\special{ps: 0 500  translate -90 rotate 2 -2 scale}
\special{ps: plotfile girl.ps}        % Here we call the figure file.
\special{ps:grestore }                 % Restoring the previous environment.
\end
```

Here's the girl:



The PostScript commands translate, rotate and/or scale appear in the .ps file to be included. They can be customized in the .ps file (this might be easier - of course you have to know SOME PostScript to do it right), and then you can include the customized file in you text by

```
\special{psfile=girl.ps}
```

# 10 XDVI, GHOST

Those are utilities which can be used by a user who has access to the X windows system. XDVI is a screen previewer for the X window system. It takes a dvi file and displays its content on screen.

See man xdvi

ghost is a utility which displays a PostScript on screen.

Usage is xdvi filename where 'filename' has the .dvi extension.
ghost filename.ps