

Useful L^AT_EX Packages

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Outline

1 Figures

- eps Files
- jpeg Files
- Troubleshooting

2 Presentations

- Slides
- Presentation Packages

3 Xy – *pic*

- Preamble
- The Matrix Environment
 - Arrows in Diagrams
 - More Arrow Attributes
- The xy Environment
- Knot Pictures

4 References

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Preamble

If you would like to use eps files in a document, the preamble must include the following:

- `\usepackage{epsfig}`

If you would like to use jpeg files in a document, the preamble must include one of the following:

- `\usepackage[pdftex]{graphicx}`
- `\usepackage{pgf,pgfarrows,pgfnodes,
pgfautomata,pgfheaps}`

When using jpeg's, you must use PDFTeX.

The Figure environment

```
\begin{figure}  
  .  
  .  
  .  
\end{figure}
```

An eps file can be placed into a figure environment in two ways:

- ```
\begin{figure} [h/t/b/p]
 \centerline{\hbox{ \epsfysize=size
 \epsffile{filename.eps} } }
\end{figure}
```
- ```
\begin{figure} [h/t/b/p]  
  \centerline{\includegraphics [height=size]  
  {filename.eps}}  
\end{figure}
```

Captions, Labels, and References

```
\begin{figure} [h/t/b/p]
    \centerline{\hbox{ \epsfysize=size
    \epsffile{name.eps} } }
    \caption{caption text}
    \label{label text}
\end{figure}
```

If you add a label to your figure, you can reference it later in your document:

```
\ref{label text}
```

Captions, Labels, and References

```
\begin{figure} [h/t/b/p]
    \centerline{\hbox{ \epsfysize=size
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    \label{label text}
\end{figure}
```

If you add a label to your figure, you can reference it later in your document:

```
\ref{label text}
```


jpgs in a Figure Environment

A jpg file can be placed into a figure environment by typing:

```
\begin{figure} [h/t/b/p]
  \centerline{\includegraphics [height=size]
    {filename.jpg}}
\end{figure}
```

Captions and Labels

```
\begin{figure}[h]
  \centerline{
    \includegraphics[height=1in]
      {extanglestate.jpg}}
  \caption{An example.}
  \label{example}
\end{figure}
```

will typeset Figure 1:

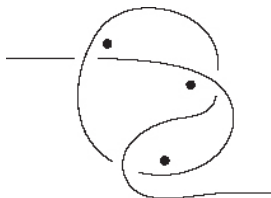


Figure: An example.

Spacing

You can use regular spacing commands like `\vspace{dim}` and `\hspace{dim}` within the figure environment. For example:

```
\begin{figure}[h]
\centerline{\hbox{\epsfysize=1in \epsffile{file1.eps}}
\hspace{1cm}\hbox{\epsfysize=1in \epsffile{file2.eps}}}
\caption{Two pictures next to each other}
\label{twopics}
\end{figure}
```

will typeset two files on the same line, 1cm apart.

Figures in a Line of Text

If you need to place a figure in a line of text you can use the following commands:

- `\vcenter{\hbox{\epsfig{file=filename.eps}}}`
- `$$\vcenter{\hbox{\includegraphics[height=1cm]{filename.jpg}}}`
- For example,

Consider the graph

```
$$\vcenter{\hbox{\includegraphics[height=1cm]{thetagraph.jpg}}}
```

with....

will typeset

Consider the graph  with....

Troubleshooting

- If you have trouble with eps files, you may consider changing the preamble to include:
 - ▶ `\usepackage[dvips]{epsfig,graphics}`
 - ▶ `\input{epsf}`
- If you get an error message indicating that the picture file is not found, make sure that the file is saved in the same folder as the .tex file.
- If you have trouble with the `\ref{}` command, try placing the first reference to a figure AFTER the occurrence of the figure, and try again.

For more help using figures you can try:

- \LaTeX User's guide and reference manual, by Lamport

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The Slides Class

To make transparency slides, use the slides class:

```
\documentclass{slides}
```

Create slides by enclosing text in a slide environment:

```
\begin{slide}  
  <text of the slide>  
\end{slide}
```

You can use both `.jpg` and `.eps` files with the slides class, but not the figure environment.

You can create a title slide, for example:

```
\title{My Title}
\author{K. Luse \\ \vspace{.5in}
{\small{George Washington University}}\
{\small{kmcginn@gwu.edu}}}}
\date{Feb. 23, 2007\\ \vspace{1in}
\small{Joint work with F. Jasso}}
\maketitle
```


My Title

K. Luse

George Washington University
kmcginn@gwu.edu

Feb. 23, 2007

Joint work with F. Jasso

A typical frame could be typeset by:

```
\begin{slide}
```

This is a slide, with two types of eps figures:

```
\centerline{\hbox{ \epsfysize=1in  
                \epsffile{state010.eps} } }
```

and here I have

```
$G=\vcenter{\hbox{\epsfig{file=state011.eps}}}$  
in the middle of this sentence.
```

```
\\
```

```
\\
```

The text is vertically centered,
and in a large sized font.

```
\end{slide}
```

This is a slide, with two types of eps figures:



and here I have $G = \infty$ in the middle of this sentence.

The text is vertically centered, and in a large sized font.

Using Overlays in the Slides Class

You can make overlays using the slide class, as follows: First, make sure you add `\usepackage{color}` to your preamble

```
\begin{slide}
  \begin{itemize}
    \item this is the first bullet
  {\color{white}
    \item this is the hidden second bullet}
  \end{itemize}
\end{slide}

\begin{overlay}
  \begin{itemize}
    \item this is the first bullet
  {\color{black}
    \item this is the hidden second bullet}
  \end{itemize}
\end{overlay}
```

Landscape Slides

If you would like to use the slide class to create a PDF slideshow, (or just landscape transparencies) you can use:

- ```
\documentclass[landscape]{slides}
\usepackage[pdftex]{graphicx}
\AtBeginDocument{%
 \pdfpageheight = \paperheight
 \pdfpagewidth = \paperwidth}
```

```
\begin{document}
```

```
. . .
```

```
\end{document}
```

- ```
\begin{slide}
```

The text on this slide is still centered.

```
\vspace{2in}
```

You can use any commands from the slides class, but you must use PDF TeX.

```
\end{slide}
```

The text on this slide is still vertically centered.

You can use any commands from the slides class, but you must use PDF \TeX .

1

Beamer

To use Beamer, make sure you have the following packages:

- `beamer`
- `pgf`
- `xcolor`

You can find these packages online and download them into the appropriate location in your computer, or if you are using MikTeX, you can use the MikTeX Package Manager.

Beamer

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The Preamble

```
\documentclass{beamer}

\usetheme{City Name}
\usecolortheme{Flying Bird Name}

\title{Example Presentation}
\author{Name}
\date{\today}
```

Some Example Themes

There are many themes, color themes, and font themes.

1 `\usepackage{beamerthemesplit}`

2 `\usetheme{Antibes}`
`\usecolortheme{wolverine}`

3 `\usetheme{Marburg}`
`\usecolortheme{albatross}`

4 `\usetheme{PaloAlto}`
`\usecolortheme{sidebar tab}`

You can only change the overall theme in the preamble

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Outline
Introduction Overview of the Beamer Class

Features of the Beamer Class

- ▶ Normal LaTeX class.
- ▶ Easy overlays.
- ▶ No external programs needed.

Till Tantau Example Presentation Created with the Beamer Package

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Example Presentation Created with the Beamer Package

Till Tantau

Outline
Introduction Overview of the Beamer Class

Starting the Document

```
\title{Title}
\author[Short Name]{Name}
\institute[Short Name]{Name}
\date{\today}

\maketitle
\part{Main Part}
\frame{\frametitle{Outline}\tableofcontents[part=1]}
\AtBeginSection[]{\frame{\frametitle{Outline}
    \tableofcontents[current]}}

\section{Section Name}
\subsection{Subsection Name}
```


Frames

Instead of slides, we use a frame environment:

```
\begin{frame}\frametitle{Title of Frame}  
  <text>  
\end{frame}
```

The frame environments supports \LaTeX environments, for example:

- This list with over-
- lays is created by
- the code on the right

```
\begin{itemize}[<+--|alert@+>]  
  \item This list with over-  
  \item lays is created by  
  \item the code on the right  
\end{itemize}
```

Frames

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```
\begin{frame}\frametitle{Title of Frame}  
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```

The frame environments supports \LaTeX environments, for example:

- This list with over-
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```
\begin{itemize}[<+-|alert@+>]  
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\end{itemize}
```

Frames

Instead of slides, we use a frame environment:

```
\begin{frame}\frametitle{Title of Frame}  
  <text>  
\end{frame}
```

The frame environments supports L^AT_EX environments, for example:

- This list with over-
- lays is created by
- the code on the right

```
\begin{itemize}[<+--|alert@+>]  
  \item This list with over-  
  \item lays is created by  
  \item the code on the right  
\end{itemize}
```

Environment Formats

Beamer will automatically format environments:

Theorem (Theorem Title)

Our Big Result

Example (First Example)

We could consider two cases:

- 1 first part
- 2 second part

Environment Formats in Other Themes

The environments look different in different themes:

Environment Formats

Beamer will automatically format environments:

Theorem (Theorem Title)

Our Big Result

Example (First Example)

We could consider two cases:

- 1 first part
- 2 second part

Other Features

- The overlays in the earlier slides were created by putting a `\pause` command between blocks of text.
- The `\setbeamercovered{dynamic}` command in the preamble creates the 'shadow' effect
- Adding `\usepackage{multicols}` to the preamble makes inserting columns easy.
- You can use figure environment, and labels, and captions, but Beamer will not number the figures.

Some nice references:

- 1 User's Guide to the Beamer Class
- 2 Tutorial for Beamer, available at:
<http://heather.cs.ucdavis.edu/matloff/beamer.html>
- 3 A much longer demo, available at:
us.share.geocities.com/kijoo2000/beamer.html

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To use X_Y – pic, you need to install the package:

- xypic

In the preamble, include the line:

- `\usepackage[all,knot,arc,poly]{xy}`

What is it?

- A package specialized on producing graphs and diagrams using the T_EX (L^AT_EX and AmS – LaTeX) systems.
- Uses an “object” oriented graphic language, the objects have “methods,” describing how they typeset, stretch, etc.
- Includes “matrix” features that are easier to handle than the matrix code in T_EX.

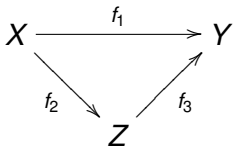
Example:

A *B* *C*
 ↘
D *E* *F*
 ↘
G *H* *I*

```
$$ \xymatrix {  
A \ar [drdr] & B & C \\ D & E & F \\ G & H & I \\ }$$
```

When dealing with the `\xymatrix`, one can specify the arrow's position as:

- Tail of the arrow: `\ar` in the cell.
- Head of the arrow: [**position**], specified by using d's or u's and l's or r's to indicate the head's cell.
- Example:



```


$$\begin{array}{ccc}
 X & \xrightarrow{f_1} & Y \\
 & \searrow_{f_2} & \\
 & & Z \\
 & & \nearrow_{f_3} \\
 & & Y
 \end{array}$$


```

```


$$\begin{array}{ccc}
 X & \xrightarrow{f_1} & Y \\
 & \searrow_{f_2} & \\
 & & Z \\
 & & \nearrow_{f_3} \\
 & & Y
 \end{array}$$


```

```


$$\begin{array}{ccc}
 X & \xrightarrow{f_1} & Y \\
 & \searrow_{f_2} & \\
 & & Z \\
 & & \nearrow_{f_3} \\
 & & Y
 \end{array}$$


```

```

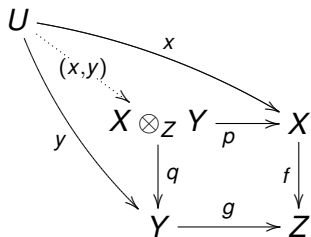

$$\begin{array}{ccc}
 X & \xrightarrow{f_1} & Y \\
 & \searrow_{f_2} & \\
 & & Z \\
 & & \nearrow_{f_3} \\
 & & Y
 \end{array}$$


```

NOTE: We require cells to point at.

Labels for the arrows are specified by using `_` and `^`.

Example



```
$$ \xymatrix{
U \ar@/_/[ddr]_y
\ar@/^/[drr]^x
\ar@{.>}[dr]|-{(x,y)} \\
& X \otimes Z & Y \xrightarrow{p} X \\
& \downarrow q & \downarrow f \\
& Y \xrightarrow{g} Z & }
$$
```

- $\ar@/_/$ makes a concave down arrow,
 $\ar@/^/$ makes it concave up.
- To specify the curvature use $\ar/^1pc/$
- $\ar@{.>}$ makes a dotted arrow.

More arrow attributes

- To break an arrow use the character |:

$$A \xrightarrow{f} B \quad \$\xymatrix@1{A\ar[r]|f&B} \$.$$

- One can insert empty breaks using: `\hole`

$$C \xrightarrow{\quad} D \quad \$\xymatrix@1{C\ar[r]|\hole & D } \$$$

- To place a label in between cells, brake an invisible arrow:

$$\begin{array}{ccc} A & \rightsquigarrow & B \\ & \searrow & \downarrow \\ D & \longrightarrow & C \end{array}$$

```
 $\xymatrix{
A \ar@{.>} [dr]
\ar @{} [d] | {\wr \parallel}
\ar@{~>} [r] & B \ar[d] \ \\
D \ar[r] & C
} $
```

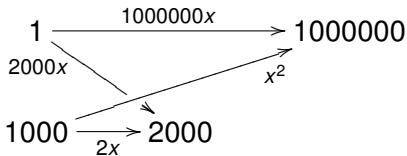
- One can do loops using @ (in, out)
- Where in and out can be:
u, ur, r, dr, d, dl, l, ul.

Example:



```
\xymatrix@1{
x \ar@(ul,dl) [] | {id} }$
```

- One can also specify the place of the labels for the arrows
- and specify the place of intersection for two arrows using
!{t_1 , t_2}



```
1 \ar[rr] ^-{\!1000000x}
\ar[dr] _{.2}{2000x}
|!{[d];[rr]}\hole
&& 1000000 \\\
1000 \ar[r] _{2x}
\ar[urr] _>>>{x^2} & 2000
```

Positions and Directions



```
\[
\xy
(0,0)*{}="A"; (10,0)*{}="B"; (0,10)*{}="C";
"A"; "B" **\dir{-};
"B"; "C" **\dir{-};
"C"; "A" **\dir{-};
\endxy
\]
```



```
$$ \xy
\POS (0,10) *{\bullet}*\cir<1pt>{} ="e",
(0,0) *{\bullet}*\cir<1pt>{} ="f",
(10,10) *{\bullet}*\cir<1pt>{} ="a",
(10,0) *{\bullet}*\cir<1pt>{} ="b",
(20,10) *{\bullet}*\cir<1pt>{} ="c",
(20,0) *{\bullet}*\cir<1pt>{} ="d"
\POS"e" \ar@{} @/l10ex/ "f"
\POS"a" \ar@{} @/l2ex/ "b"
\POS"a" \ar@{} @/r2ex/ "b"
\POS"c" \ar@{} @/r0ex/ "d"
\POS"c" \ar@{} @/l2ex/ "d"
\POS"c" \ar@{} @/r2ex/ "d"
\endxy$$
```

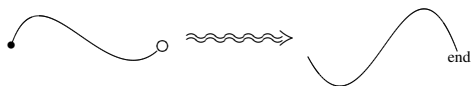
Nesting diagrams

```
\[
\xy
(0,0)*{\xy (diagram) \endxy};
(2,0)*{\xy (some other diagram) \endxy};
\endxy
\]
```

```
\[
\xy (0,0)+++{\xy (0,0)*{\bullet}="A";
(20,0)*{\cir<2pt>{}}="B";
"A"; "B"*\crv{(4,12) & (13,-8)};
\endxy }="x";
(40,0)+++{\xy (0,0)*{}="A";
(20,0)*{\textrm{end}}="B";
"A"; "B"*\crv~pC{(8,-15) & (13,20)};
\endxy }="y";
{\ar@2{~>} "x";"y";}
\endxy
\]
```

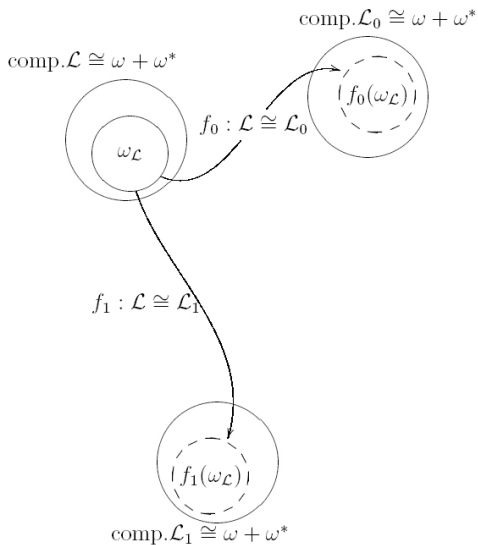
×

×

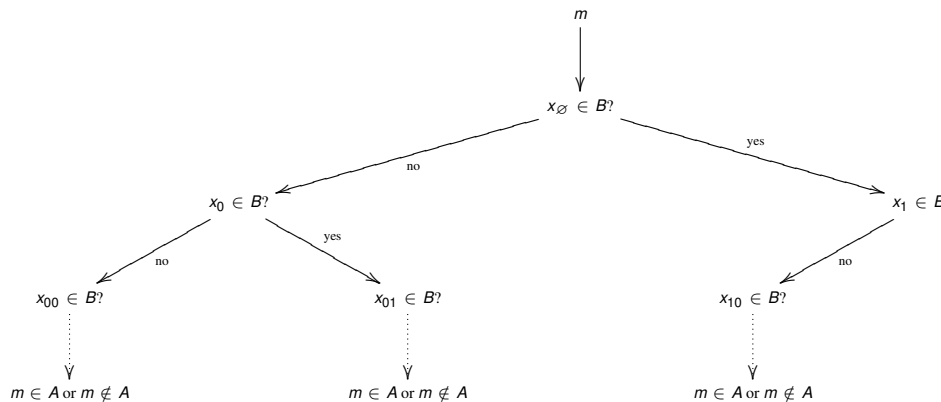


Another Example

```
\[
\xy
(-35,40)*{\xy \cir<360pt>{} \endxy};
(0,15)*{\xy *{o}=<40pt>{\omega_{\mathcal{L}}}"o"*\frm{o}, +<5em,-5em>@+,
(46,11)*{o}=<40pt>{f_0(\omega_{\mathcal{L}})}="s"*\frm{-o}, -<5em,-5em>@+,
(15,-60)*{o}=<40pt>{f_1(\omega_{\mathcal{L}})}="p"*\frm{-o},
"o";"s"
**{}?*+{f_0:\mathcal{L}\cong\mathcal{L}_0}="b",
"o";"s"."b"
**\crvs{-},
"o"."b";"s"
**\crvs{-} ?>*\dir{>},
"o";"p"
**\crv{(0,-20) & (30,-35)} ?>*\dir{>}
\endxy};
(-20,10)*{f_1:\mathcal{L}\cong\mathcal{L}_1};
(10,48)*{\xy \cir<180pt>{} \endxy};
(-18,-20)*{\xy \cir<240pt>{} \endxy};
(-30,55)*{\hbox{comp.} \mathcal{L}\cong\omega+\omega^*};
(25,63)*{\hbox{comp.} \mathcal{L}_0\cong\omega+\omega^*};
(-10,-33)*{\hbox{comp.} \mathcal{L}_1\cong\omega+\omega^*};
\endxy
\]
```



Trees

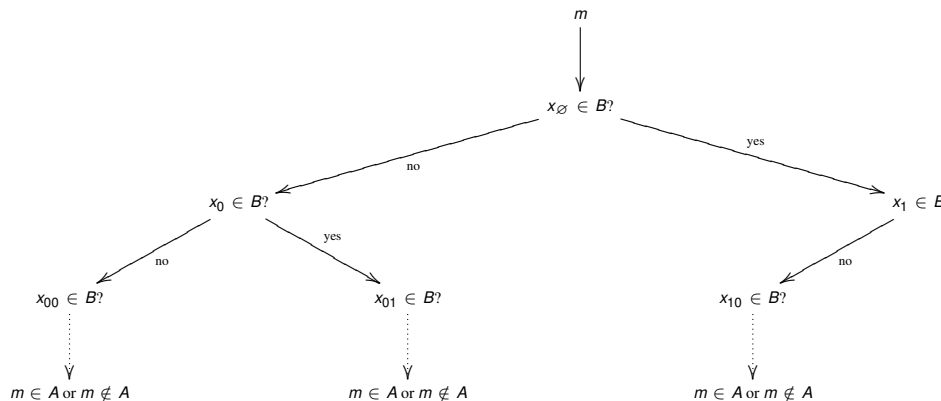


was typeset in a matrix environment:

```
\[
  \xymatrix {
    <matrix commands>
  }
\]
```

```
\[
  \xymatrix@{} {
    <matrix commands>
  }
\]
```

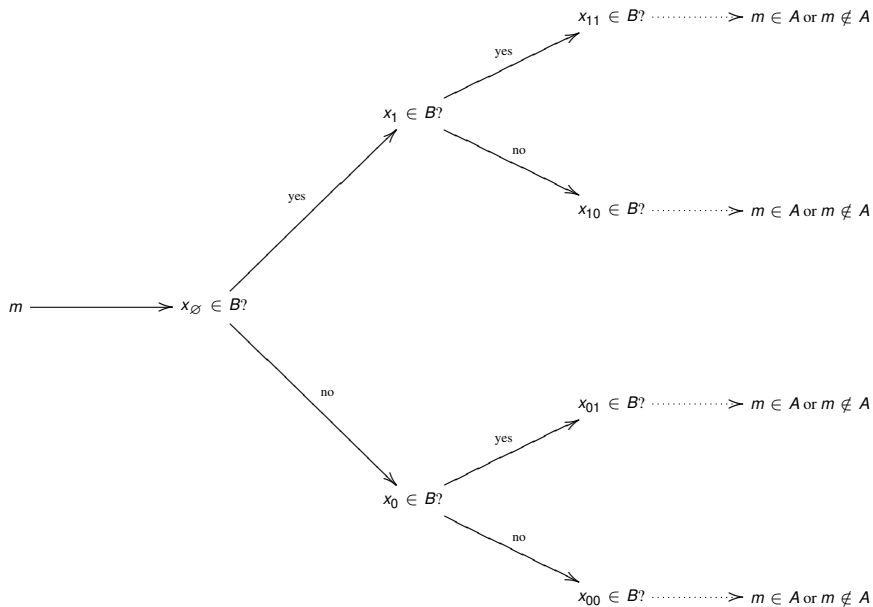

Trees



was typeset in a matrix environment:

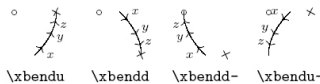
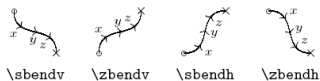
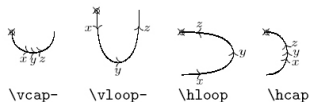
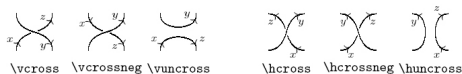
```
\[
  \xymatrix {
    <matrix commands>
  }
\]
```

```
\[
  \xymatrix@{} {
    <matrix commands>
  }
\]
```

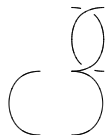


Knot Pieces

Knots and links can be created by piecing together “crossings” and “joins,” like:



Example

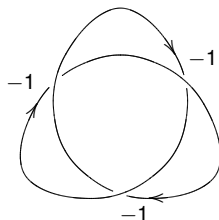
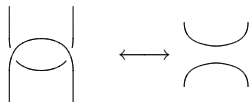


```
\xygraph{
  !{0;/r1.0pc/:}
  !{\vunder}
  !{\vunder-}
  !{\hcap[2]}
  [1]!\hcap[-2]}
}
```



```
\xygraph{
  !{0;/r1.0pc/:}
  !{\vunder}
  !{\vunder-}
  [uur]!\hcap[2]}
  [1]!\hcap[-2]}
}
```

More Examples



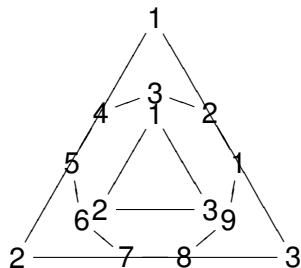
```
$$\xygraph{
!{0;/r1.0pc/:}
[u(1.5)]!{\xcapv@{0}}
!{\hover}!{\hunder-}
[dll]!{\xcapv@{0}}
[rru]!{\xcapv@{0}}
[uuu]!{\xcapv@{0}} \,
\longleftarrow \,
\xygraph{!{0;/r1.0pc/:}
[u(1)]!{\vuncross[2]}$$
```

```
\xygraph{
!{0;/r2.0pc/:}
!P3"a"{}~>{}
!P9"b"{}~:{{(1.3288,0):}~>{}
!P3"c"{}~:{{(2.5,0):}~>{}
!{\vunder~{"b2"}{"b1"}{"a1"}{"a3"}<{-1}}
!{\vcap~{"c1"}{"c1"}{"b4"}{"b2"}=<
!{\vunder~{"b5"}{"b4"}{"a2"}{"a1"}<{-1}}
!{\vcap~{"c2"}{"c2"}{"b7"}{"b5"}=<
!{\vunder~{"b8"}{"b7"}{"a3"}{"a2"}<{-1}}
!{\vcap~{"c3"}{"c3"}{"b1"}{"b8"}=<
}
```

The Polygon Option

The trefoil on the previous slide is made using the polygon option. This means that the knot pieces are placed between edges of polygons.

To get the polygons to appear:



```
\xygraph{
  !{0;/r2.0pc/:}
  !P3"a"~*{\xypolynode}>{}}
  !P9"b"~: {(1.3288,0):}
  ~*{\xypolynode}>{}}
  !P3"c"~: {(2.5,0):}
  ~*{\xypolynode}>{}}
}
```

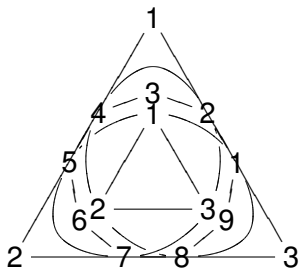


Figure: The knot pieces are placed within the polygons

Outline

1 Figures

- eps Files
- jpeg Files
- Troubleshooting

2 Presentations

- Slides
- Presentation Packages

3 Xy – *pic*

- Preamble
- The Matrix Environment
 - Arrows in Diagrams
 - More Arrow Attributes
- The xy Environment
- Knot Pictures

4 References

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- Oetiker, Tobias et al. *The Not So Short Introduction to $\LaTeX 2_{\epsilon}$*
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- Kim, Ki-Joo. *Beamer v3.0 Guide*
http://us.share.geocities.com/kijoo2000/beamer_guide.pdf
- Matloff, Norm. *Quick Tutorial on the Beamer Package for Slide Making in \LaTeX*
<http://heather.cs.ucdavis.edu/~matloff/beamer.html>
- Tantau, Till. *User's Guide to the Beamer Class, Version 3.01*
<http://latex-beamer.sourceforge.net>

References $Xy-pic$:

- Fischer, Lars. *Drawing knot pictures using L^AT_EX with Xy-pic -An introduction and tutorial*
<http://www.lars.fischer.de.vu>
- Lauda, Aaron *Xy-pic Tutorial: Strings, Cobordisms, Braids and Lots More*
<http://www.dpmms.cam.ac.uk/~al366/xyintroduction/>
- T_EX User's Group. *Xy-pic - Typesetting graphs and diagrams in T_EX*
<http://tug.org/applications/Xy-pic/>
It contains the following:
 - Rose, Kristoffer. *Xy-pic User's guide*
 - Rose, Kristoffer and Moore, Ross. *Xy-pic Reference Manual*

Answer to the exercise:

$$\begin{array}{ccc} A & \xrightarrow{f} & B \\ f \downarrow & \circlearrowright & \downarrow g \\ B & \xrightarrow{g} & C \end{array}$$

```
$$\xymatrix{
  A \ar[d]_f
  \ar[r]^f
  & B \ar @{}[d]{} |
  {\circlearrowright}
  \ar[d]^g \\
  B \ar[r]_g & C }$$
```