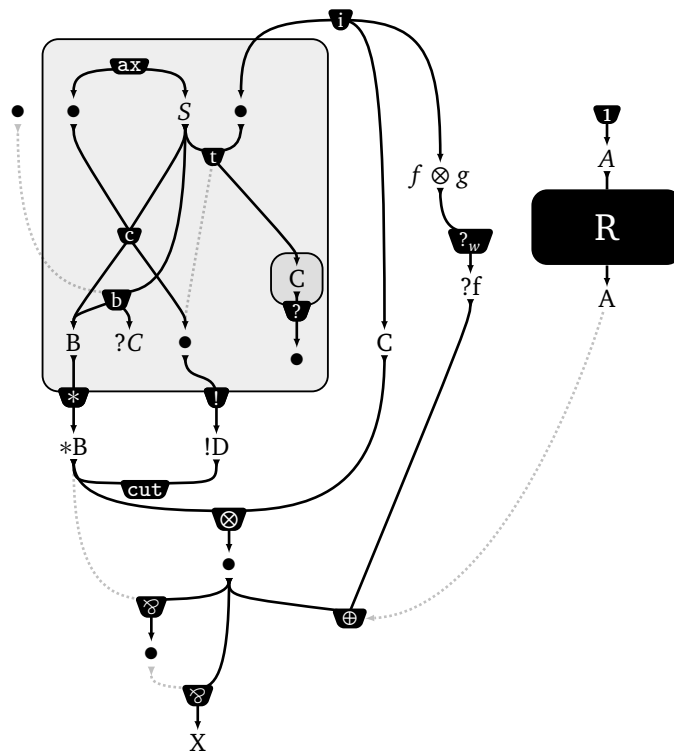


# pn.sty documentation

Drawing hypergraphs and proofnets in  $\text{\LaTeX}$

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```

\begin{proofnet}

  \pnformulae
  {
    \pnf[Z']{}~\pnf[Z]{}~\pnf[S]{$S$}~\pnf[A]{}\\
    ~~~~~\pnf[f]{$f\otimes g$}\\
    \\
    ~~~~~\pnf[G]{C}\\
    ~\pnf[B]{B}~\pnf[C]{$?C$}~\pnf[D]{}~~~~\pnf[F]{C}
  }

  \pnhyperlink{c}{Z,S}{B,D}
  \pnhyperlink{b}[r/]{Z',S}{b}{B,C}[0.9][0.2]
  \pnhyperlink{t}[r/]{A,S}{t}{G,D*}

  \pnaxiom{Z,S}

  \pnbox{G}[inner sep=5pt]
  \pnauxprom{G}{G}{}

  \pnbox[bigbox]{axiom,Z,A,B,C,G}
  \pnprom[bigbox.-80]{D}{!D}
  \pnport{$\ast$}[bigbox.down]{B}{$\ast B$}

  \pninitial{i}{A,f,F}[2.2]

  \pntensor{port,F}{tens}{}[1.4]
  \pnpar{*port,tens}{}
  \pnexp{w}{f}{?f}[1.3][0.4]

  \pncut{port,prom}[1.1]
  \pnterminal[plus]{$\oplus$}[s]{exp,tens}

  \pnsomenet{R}{2cm}{1cm}[at (5,0)]
  \pnoutfrom{somenet.south}{A}
  \pninto{somenet.north}{$A$}

  \pnone{into}
  \pnarrow[switchto]{outfrom}[20]{plus.east}[-50]
  \pnpar{par*,tens}{X}[1][0.1]

\end{proofnet}

```

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## 1 Introduction

`pn.sty` is a set of TikZ macros to draw to-down oriented hypergraphs in  $\text{\LaTeX}$ . The package also provides a set of macros for linear logic's proofnets, built on top of the hypergraph primitives.

It uses `xargs.sty`, `ifthen.sty` and `xstring.sty` to automatize treatment of inputs and define versatile functions.

The two commands to start writing a proofnet are

```
\pnet{...}
\begin{proofnet}... \end{proofnet}
```

The first one inlines the result in text, while the second renders it centered.

## 2 Generic commands

`pn.sty` defines very few primitives and gradually builds macros with them for a specific use. The main function is `\hyperlink` that creates a hyperedge from a set of sources to a set of targets.

**Remark.** *The package uses `xargs.sty` to define any number of optionnal arguments. Arguments between `{...}` are mandatory, arguments between `[...]` are optionnal. The parsing of inputs is the one of `xargs.sty`, read its documentation if you have trouble with it.*

### 2.1 Placing nodes

```
\pnformulae[label]{formulae matrix}[width][height][extra tikz options]
```

Creates a matrix in which nodes can be placed without specifying a position. The character for horizontal cells is `~` and the linebreaker is `\\`. `[width]` `[height]` can modify the horizontal and vertical space between cells (both default to 1).

```
\pnf[label]{text}[position][extra tikz options]
\pnformula[label]{text}[position][extra tikz options]
```

Create a new node labeled by `label` (defaults to `formula`) with text `text` (if empty the text is set to `•`) at optionnal position.

**Remark.** None of the labels can use the \* character. It is reserved to mark the switched ports of links, see below.

X • C



```
\begin{proofnet}
  \pnformulae
  {
    \pnf [X]{X}~\pnf{}~\pnformula{C}\\
    ~~~\pnf [X']{X}[] [fill=gray]\\
    ~~~\pnf [X'']{}[at +(0.2,0)]
  }
\end{proofnet}
```

## 2.2 Hyperlinks

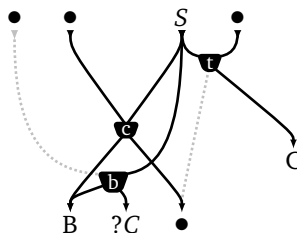
This is the main command defined by the package. As most further commands are defined from it, it has many customization options and might not be very handy to use. You might want to define your own macros with it.

---

```
\pnhyperlink[link label]{symbol}[prem style/concl style]{prem list}
[placement: c, b, t]{concl list}[height][x-offset]
```

---

- [label] is the TikZ name of the link node that can be reused later to draw arrows and such, defaults to hyperlink;
- {symbol} is the symbol of the hyperedge;
- [prem style/concl style] is the styles of source/target arrows, the default style gives straight arrows, options are r (for rounded) or a (for angle), they must be separated by a /. Defaults to “/”;
- {prem list} is a ,-separated list of source nodes, if a \* character is added in the end, the arrows are rendered in the switch style;
- [placement] is the placement option of the link with respect to its sources and targets. It can be c, t, b (for center, bottom, top). Defaults to c;
- {concl list} is a ,-separated list of target nodes, if a \* character is added in the end, they are rendered in the switch style;
- [height] is a height modifier for the link, bigger value means: lower in c and t modes, higher in b mode. Defaults to 1;
- [x-offset] is an horizontal offset for the link, defaults to 0.



```

\begin{proofnet}
  \pnformulae
  {
    \pnf [Z'] {} ~ \pnf [Z] {} ~ \pnf [S] { $$ } ~ \pnf [A] {} \\\
    \\\
    \\\
    ~ ~ ~ ~ \pnf [G] { C } \\\
    ~ \pnf [B] { B } ~ \pnf [C] { $ ? C $ } ~ \pnf [D] { }
  }
  \pnhyperlink { c } { Z, S } { B, D }
  \pnhyperlink { b } [ r / ] { Z' * , S } [ b ] { B, C } [ 0.9 ] [ 0.2 ]
  \pnhyperlink { t } [ r / ] { A, S } [ t ] { G, D * }
\end{proofnet}

```

---

```

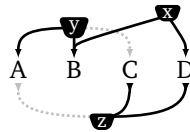
\pninitial [ link label ] { symbol } [ arrow style ] { concl list } [ height ] [ x - offset ]
\pnterminal [ link label ] { symbol } [ arrow style ] { prem list } [ height ] [ x - offset ]

```

---

Draw initial (with no source) and terminal (with no target) hyperedges, using `arrow style` (default to `r`). `link label` defaults respectively to `initial`, `terminal`.

**Remark.** *Unless otherwise specified, the label optional argument always default to the name of the command minus the “pn”.*



```

\begin{proofnet}
  \pnformulae { \pnf [ 1 ] { A } ~ \pnf [ 2 ] { B } ~ \pnf [ 3 ] { C } ~ \pnf [ 4 ] { D } }
  \pninitial { y } { 1, 2, 3 * }
  \pninitial { x } [ s ] { 2, 4 } [ 1.3 ] [ 0.5 ]
  \pnterminal { z } { 1 * , 3, 4 }
\end{proofnet}

```

---

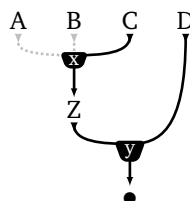
```

\pnary [ label ] { symbol } [ arrow style ] { prem list } [ label concl ] { text concl }
[ height ] [ x - offset ]

```

---

Creates a new node named `label concl` (defaults to `nary`) and text `text concl` (if empty, draws a  $\bullet$ ), then draws a hyperlink (labelled by `label`, defaults to `nary link`) from the `prem list` to this new node. Rounded style by default.



```

\begin{proofnet}
  \pnformulae{\pnf [1]{A}~\pnf [2]{B}~\pnf [3]{C}~\pnf [4]{D}}
  \pnary{x}{1*,2*,3}[5]{Z}
  \pnary{y}{5,4}{}
\end{proofnet}

```

## 2.3 Boxes

---

```

\pnbox[label]{node list}[extra tikz options]

```

---

Draws a box containing the nodes in `node list` (non empty, -separated list of nodes), labelled by `label` (defaults to `box`) and passing `extra tikz options` (for instance `inner sep=...` to modify the space left around nodes by the box).

---

```

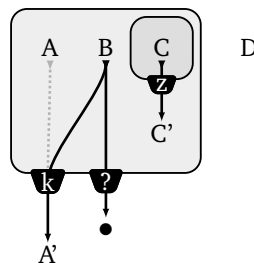
\pnport[link label]{symbol}[box.position]{prem list}
[label concl]{text concl}[height]

```

---

Attaches a port (TikZ label: `link label`, defaults to `port link`) at `box.position` (defaults to `box.down`) with the text `symbol`. Draws arrows from the `prem list` nodes to the port, in the `switch style` if the label of the node is followed by a `*`. Then creates a node below the port (`height` modified by `height`), with label `label concl` (defaults to `port`) and text `text concl`, again switches to `•` if empty.

`box.position` can either be an angle or the value `down`, that draws the port just below the source node.



```

\begin{proofnet}
  \pnformulae{\pnf [1]{A}~\pnf [2]{B}~\pnf [3]{C}~\pnf [4]{D}}
  \pnbox[box1]{3}
  \pnport{z}[box1.down]{3}{C'}
  \pnbox{1,2,3,port}[inner sep=10pt]
  \pnport{k}[box.-125]{1*,2}{A'}[1.5]
  \pnport{?}[2]{}
\end{proofnet}

```

## 2.4 Drawing unspecified graphs

---

```

\pnsomenet[label]{text}[position]{width}{height}[extra tikz options]

```

---

Draws a black rounded corners rectangle with white text `text` labelled `label` (defaults to `somenet`) at position `position` with minimum width and height defined by `width` and `height`.

---

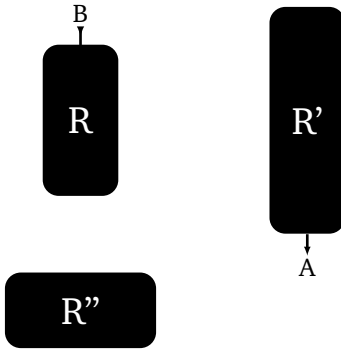
```

\pnoutfrom{somenet.angle}[label]{text}[height]
\pninto{somenet.angle}[label]{text}[height]

```

---

Creates nodes labelled by `label` (defaults to `outfrom` or `into`) with a link coming out/to an unspecified hypergraph.



```
\begin{proofnet}
\pnsomenet[R1]{R}{1cm}{2cm}
\pnsomenet[R2]{R'}{1cm}{3cm}[at (3,0)]
\pnsomenet{R''}{2cm}{1cm}[] [below=of R1]
\pnoutfrom{R2.south}{A}
\pninto{R1.north}{B}[1.8]
\end{proofnet}
```

## 2.5 Arrows

---

```
\pnarrow[style]{source:out angle}{target:in angle}[looseness*]
```

---

Draws an arrow with style `style` (defaults to `linkto`) from `source` to `target` with angles modified by the `out angle` and `in angle`. The arrow will bend more or less according to `looseness` (defaults to 1).



```
\begin{proofnet}
\pnformulae{\pnf[A]{A}~~\pnf[B]{B}}
\pnarrow{A.east:0}{B.west:0}
\pnarrow{B.north west:-40}{A.north east:40}[1.9]
\pnarrow[switchto]{B.south west:30}{A.south east:-30}
\end{proofnet}
```

## 2.6 Inlining edges

---

```
\pntextlink{symbol}
```

---

Inlines in text a link with no sources or target, with symbol `symbol`. For instance `\pntextlink{h}` gives **h**. a link with no sources or target, with symbol a link with no sources or target, with symbol a link with no sources or target, with symbol a link with no sources or target, with symbol a link with no sources or target, with symbol a link with no sources or target, with symbol a link with no sources or target, with symbol a link with no sources or target, with symbol a link with no sources or target, with symbol a link with no sources or target, with symbol

### 3 Linear logical macros

On top of this first set of functions, `pn.sty` defines some macros for drawing linear logic proofnets.

#### 3.1 Initial links and cuts

---

`\pnaxiom[label]{concl1,concl2}[height][x-offset]`

---

Places an axiom link above two nodes.

---

`\pndaimon[label]{concl list}[height][x-offset]`

---

Places a *daimon* link above a list of nodes.

---

`\pnone[label]{concl}[height][x-offset]`

---

Places a *one* link above a node.

---

`\pncut[label]{prem1,prem2}[height][x-offset]`

---

Places a *cut* link below two nodes.

#### 3.2 Connectives

---

`\pntensor[label]{prem1,prem2}[label concl]{text concl}[height][x-offset]`

`\pnpar[label]{prem1,prem2}[label concl]{text concl}[height][x-offset]`

---

Create a node named `(label concl)` (defaults to the command name: `tensor`, `par`) with label `{text concl}`, then draws a link from `(prem1)` and `(prem2)` to `(label concl)`.

---

`\pnexp[subscript][label]{prem list}[label concl]{text concl}[height][x-offset]`

---

Is a `\pnary` command with `{symbol}` set to `$_{subscript}$`.

#### 3.3 Exponential boxes

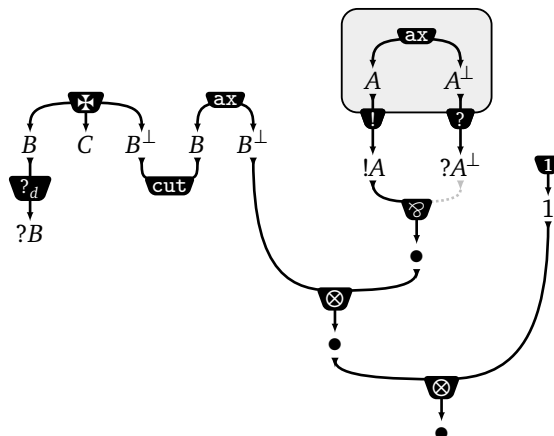
---

`\pnprom[box.position]{prem}[label concl]{text concl}[height]`

`\pnauxprom[box.position]{prem}[label concl]{text concl}[height]`

---

Are `\pnport` commands with `{symbol}` respectively set to `!$` and `?$`.





```

\begin{proofnet}
  \pnformulae
  {
    ~~~~~~\pnf [A] {$A$}~\pnf [nA] {$A^\bot$}\
    \pnf [B1] {$B$}~\pnf [C] {$C$}~\pnf [nB1] {$B^\bot$}~
      \pnf [B2] {$B$}~\pnf [nB2] {$B^\bot$}\
    ~~~~~~\pnf [1]{1}
  }
  \pndaimon{B1,C,nB1}
  \pnaxiom{B2,nB2}
  \pnone{1}
  \pnexp{d}{B1}{?$B$}
  \pncut{nB1,B2}
  \pnaxiom{A,nA}
  \pnbox{A,nA,axiom}
  \pnprom{A}{!A$}
  \pnauxprom{nA}{?A^\bot$}
  \pnpar{prom,auxprom*}{}
  \pntensor{par,nB2}{}
  \pntensor{1,tensor}{}
\end{proofnet}

```

## 4 Customization

Some customization can be achieved by redefining the basic TikZ styles defined by `pn.sty`, which are by default:

---

```
\tikzstyle{linkfrom}=[  
  draw opacity=0,latex reversed-, line width=0.3pt,  
  postaction={draw, opacity=1,-, line width=1pt, shorten <=1pt}  
]
```

---

Is the style of arrows from sources to links.

---

```
\tikzstyle{linkto}=[  
  draw opacity=0,-latex, line width=0.2pt,  
  postaction={draw, opacity=1,-, line width=1pt, shorten >=3pt}  
]
```

---

Is the style of arrows from links to targets.

---

```
\tikzstyle{switchfrom}=[  
  draw opacity=0, fill opacity=0.25, latex reversed-, line width=0.3pt,  
  postaction=  
    {draw,opacity=0.25,-, densely dotted, line width=1pt, shorten <=3.5pt}  
]
```

```
\tikzstyle{switchto}=[  
  draw opacity=0, fill opacity=0.25, -latex, line width=0.2pt,  
  postaction=  
    {draw,opacity=0.25,-, densely dotted, line width=1pt, shorten >=3.5pt}  
]
```

---

Are the styles of switched edges.

---

```
\tikzstyle{linkstyle}=[  
  trapezium,trapezium angle=110,rounded corners=2pt,  
  inner sep=1.2pt,fill=black  
]
```

---

Is the style of links.

---

```
\tikzstyle{box}=[  
  inner sep=7pt, rounded corners=6pt, fill opacity=.07,  
  fill=black, draw= black, line width=0.7pt  
]
```

---

Is the style of boxes.

Moreover, the text for empty nodes given by the command `\PNemptynodetext` that can also be redefined to another default text.