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pst-poly allows to draw easily various kinds of regular or non regular polygons, using the unique macro \PstPolygon, with various customization parameters. It is also a good example of the great power and flexibility of PSTricks, as in fact it is a very short program (it body is only 100 lines long) but nevertheless really powerful. And last, it is also a good pedagogical example of how to design and program high level graphic objects above PSTricks own ones.
1 Introduction

\(\text{pst-poly}\) offers a unique macro (plus some aliases to define some often used polygons) with few parameters to interact on it. But we can also use all the relevant \text{PSTricks} parameters to change the size, the characteristics of lines, to add filling, etc. The polygons are always drawn counter clockwise. The syntax is simply:

\[
\begin{align*}
\PstPolygon \ast & \text{ [Options]} \\
\PstTriangle & \text{ [Options]} \\
\PstSquare & \text{ [Options]} \\
\PstTriangle & \text{ [Options]} \\
\PstPentagon & \text{ [Options]} \\
\PstHexagon & \text{ [Options]} \\
\PstHeptagon & \text{ [Options]} \\
\PstOctagon & \text{ [Options]} \\
\PstHeptagon & \text{ [Options]} \\
\PstNonagon & \text{ [Options]} \\
\PstDecagon & \text{ [Options]} \\
\PstDodecagon & \text{ [Options]} \\
\PstStarFiveLines & \text{ [Options]} \\
\PstStarFive & \text{ [Options]} \\
\pspolygonbox & \text{ [Options]} \\
\end{align*}
\]

As for \text{PSTricks} closed objects, the \(*\) version uses a solid style to fill the polygon, use the line color for fill color and set the linewidth to 0.

By default the polygons are set with a radius of 1 unit for the outer circle.

![Diagram of a polygon with radius 1 unit](image)

\[
\begin{align*}
\text{\texttt{begin pspicture}} & \text{[showgrid=true]}(\texttt{-1,-1})(1,1) \\
\PstPolygon & \text{[PstPicture=false]} \\
\pscircle & \text{[linestyle=dashed]}(1) \\
\text{\texttt{end pspicture}} \\
\end{align*}
\]

There is no special optional argument for this radius, the polygon can be scaled by using the key unit. With unit=1.5, the outer radius will be of 1.5cm when the current unit is set to 1cm.

2 Optional arguments

There are eight specific optional arguments defined to change the way the polygons are defined:

\textit{PstPicture} (boolean): to define or not a \texttt{pspicture} environment for the polygon. We have to define this parameter to false if we want to mix the polygon with other \text{PSTricks} objects — see examples later (Default: \texttt{true} — which is not the case for basic \text{PSTricks} objects). With \texttt{PstPicture=false} the image doesn’t reserve any space, it overwrites the text. The resulting box has a width and a height of 0pt.
2 Optional arguments

```
foo\PstPolygon bar\hfill foo\PstPolygon[PstPicture=false] bar
```

*PolyRotation* (real): rotation angle applied to the polygon *(Default: 0 — no rotation).*

```
\PstPolygon\hfill
\PstPolygon[PolyRotation=18]\hfill
\PstPolygon[PolyRotation=36]\hfill
\PstPolygon[PolyRotation=45]
```

*PolyNbSides* (integer): number of sides of the polygon *(Default: 5).*

```
\PstPolygon\hfill
\PstPolygon[PolyNbSides=3]\hfill
\PstPolygon[PolyNbSides=4]\hfill
\PstPolygon[PolyNbSides=5]\hfill
\PstPolygon[PolyNbSides=8]\hfill
\PstPolygon[PolyNbSides=50]
```

*PolyOffset* (integer): number of nodes to bypass to obtain each time the next one *(Default: 1 — no node bypassed).*

```
\PstPolygon
\PstPolygon[PolyOffset=2]
\PstPolygon[PolyOffset=3]
\PstPolygon[PolyNbSides=7,PolyOffset=2]
\PstPolygon[PolyNbSides=9,PolyOffset=4]
\PstPolygon[PolyNbSides=17,PolyOffset=6]
```

*PolyIntermediatePoint* (real): position of the intermediate point used to join each time the next node *(Default: empty — not used).*
2 Optional arguments

\begin{verbatim}
\PstPolygon
\PstPolygon[PolyIntermPoint=0.38]
\PstPolygon[PolyIntermPoint=0.2]
\PstPolygon[PolyIntermPoint=1.2]
\PstPolygon[PolyNbSides=7,PolyOff=2, PolyIntermPoint=0.38]
\PstPolygon[PolyNbSides=7,PolyIntermPoint=0.2, PolyOff=2]
\end{verbatim}

*PolyCurves* (boolean): boolean value to choose between straight line and curve to join each time the next node (*Default: false* — straight lines).

\begin{verbatim}
\psset{PolyCurves=true}
\PstPolygon[PolyOff=2]
\PstPolygon[PolyOff=72]
\end{verbatim}

*PolyEpicycloid* (boolean): boolean value to choose between polygon and epicycloid (*Default: false* — polygon).

\begin{verbatim}
\psset{linewidth=0.001,PolyNbSides=72,PolyEpicycloid=true}
% Epicycloid of factor 1 is cardioid and of factor 2 nephroid
\multido{\i=2+1}{4}{\PstPolygon[PolyOff=\i]\hfill}
\PstPolygon[PolyOff=72]\hfill% Epicycloid of factor 71
\PstPolygon[PolyOff=73] % Epicycloid of factor 72
\end{verbatim}

*PolyName* (string): name of the polygon, useful to have different names for the nodes of different polygons (*Default: empty* — no name).

The center of the polygon has name *PolyName0* and the nodes (vertices) have names *PolyName1* to *PolyNameN*. With this parameter, we can connect as we want nodes of different polygons:
3 Pre-defined polygons

It is also a way (limited in fact...) to define three dimensional objects in perspective:

Of course, we can mix specific parameters of \texttt{pst-poly} with relevant PSTricks ones and combine it with other generic macros (for repetitions, projection in the 3d space, etc.)

\begin{verbatim}
\psset{unit=0.8}
\begin{pspicture}(3,2.5)
% \PstSquare is described later
\rput[lb](0,0){\PstSquare[PolyName=A]}
\rput[lb](2.5,2){\PstSquare[unit=0.5,PolyName=B]}
\multido{i=1+1}{4}{\ncline{A\text{the\multidocount}}{B\text{i}}}
\end{pspicture}
\end{verbatim}

3 Pre-defined polygons

Some often used polygons and other related geometric objects are pre-defined, for immediate usage:
4 Non regular polygons

Until now, we have described only the so-called regular polygons, which are from far the most useful ones (all of them have equal edges and angles). Nevertheless, it is not so difficult to extend these polygon to non regular ones, using a different value for horizontal and vertical units (nevertheless, the code is more tricky, as we must do all the trigonometry explicitly...)

5 Nodes (vertices)

And another powerful possibility is to define a command \texttt{\textbackslash PstPolygonNode} which will be executed at each node (Default: empty — nothing executed). The counter name for nodes is \texttt{INode}, starting from 0. The \texttt{\multidocount} counter, from the \texttt{\multido} command, start itself from 1.

\begin{verbatim}
\PstTriangle
\PstSquare
\PstPentagon[unit=0.5,linestyle=dotted]
\PstHexagon[fillstyle=hlines,hatchangle=90]
\PstHeptagon[fillstyle=vlines]
\PstOctagon*[unit=0.8,linestyle=red]
\PstNonagon[unit=0.5]
\PstDecagon
\PstDodecagon[linecolor=green] \par
\PstStarFiveLines
\PstStarFive
\end{verbatim}

\begin{verbatim}
\PstPentagon[xunit=0.5]\hfill
\PstHexagon[yunit=0.5]\hfill
\PstStarFive[xunit=0.5,yunit=1.5]\hfill
\PstPolygon[xunit=0.8,yunit=1.5,PolyNbSides=9,PolyOffset=2,
            PolyIntermediatePoint=0.1,PolyCurves=true]
\end{verbatim}
5 Nodes (vertices)

\providecommand{\PstPolygonNode}{% 
\psdots[dotsize=0.2,linestyle=cyan](1;INode)} \PstPentagon

\newcounter{Letter} \providecommand{\PstPolygonNode}{% 
\setcounter{Letter}{\the\multidocount} \rput{0}1\Node{\small\text{Alph}{\Letter}}} \PstHeptagon[PolyOffset=3]

\providecommand{\PstPolygonNode}{% 
\psdots[dotstyle=*,linestyle=0.2](1;INode) \psline[linestyle=red](0.9;INode)} \PstPolygon[PolyNbSides=8]

It is also a way to nest polygons:

\newbox{\Star} \savebox{\Star}{% \PstStarFive[unit=0.15,linestyle=red]} \providecommand{\PstPolygonNode}{% 
\rput{0}1\Node{\usebox{\Star}}} \shortstack{\PstNonagon[5mm]} \PstDodecagon[linestyle=none]
6 Polygonbox

The valid options with the predefined values are PolyNbSides=3 and PolyRotation=0

• There may be some problems with linearcs and rounding errors.
• To rotate the text inside the box, one can use the \rotatebox macro from the rotating package (see examples).

\multido{\nA=3+1}{8}{{%
\pspolygonbox[PolyNbSides=\nA,framesep=3mm]{Text}--}
\multido{\nA=3+1}{8}\{\pspolygonbox{PolyNbSides=\nA,framesep=2mm,doubleline=true}{Text}\}

\psset{PolyNbSides=4}
\multido{\nA=0+60}{8}\{\pspolygonbox{PolyRotation=\nA,framesep=2mm,doubleline=true,linecolor=red,doublecolor=blue}{magenta Text}\}

\multido{\nA=0+60,\nB=45+60}{8}\{\pspolygonbox{PolyRotation=\nA,framesep=2mm,doubleline=true,linecolor=red,doublecolor=blue,linearc=0.4}\\rotatebox{\nB}{blue Text}\\1cm\}

\multido{\nA=3+1}{8}\{\pspolygonbox{PolyNbSides=\nA,rot=60,framesep=2pt,doubleline=true,linearc=0.2}{Text}\}

\multido{\nA=3+1}{8}\{\pspolygonbox{PolyNbSides=\nA,framesep=10pt,fillstyle=solid,fillcolor=cyan,linearc=0.2}{Text}\}
7 Some more examples

\multido{\nA=-5+5}{8}\{\pspolygonbox[framesep=\nA pt,\%}
PolyRotation=90\}\{\Huge\textcolor{red}{T}\}~}

\multido{\nA=-5+5}{7}\{\pspolygonbox[framesep=\nA pt,\%
PolyRotation=90,boxsep=false]\{\Huge\textcolor{red}{T}\}~}\par
\rule{0pt}{1cm}

7 Some more examples

\multido{\i=3+1}{6}\{%
\PstPolygon[PolyNbSides=\i]\hspace{5mm}}

\multido{\i=3+2}{6}\{%
\PstPolygon[PolyOffset=2, PolyNbSides=\i]\hspace{5mm}}

\multido{\i=3+1}{10}\{%
\PstPolygon[PolyOffset=3, PolyNbSides=\i]\hspace{5mm}}
Some more examples

\multido{\i=5+1}{10}{{\PstPolygon[ PolyOffset=4, PolyNbSides=\i ] hspace{5mm} }}

\multido{\i=5+2}{10}{{\PstPolygon[ PolyOffset=5, PolyNbSides=\i ] hspace{5mm} }}

\multido{\i=5+2}{10}{{\PstPolygon[ PolyOffset=7, PolyNbSides=\i ] hspace{5mm} }}

\multido{\i=5+2}{10}{{\PstPolygon[ PolyOffset=8, PolyNbSides=\i ] hspace{5mm} }}
\multido{\i=1+1}{10}\%
PstPolygon[PolyOffset=\i,PolyNbSides=5]\hspace{5mm}

\multido{\i=1+1}{10}\%
PstPolygon[PolyOffset=\i,PolyNbSides=7]\hspace{5mm}

\multido{\i=5+1}{10}\%
PstPolygon[PolyCurves,PolyIntermediatePoint=0.1,PolyNbSides=\i]
\hspace{5mm}

\multido{\i=5+1}{10}\%
PstPolygon[PolyCurves,PolyIntermediatePoint=0.2,
PolyOffset=2,PolyNbSides=\i]\hspace{5mm}
\textbf{7 Some more examples}

\begin{verbatim}
\multido\{i=5+2\}{10}{{}
  \PstPolygon\[PolyCurves, PolyIntermediatePoint=0.1, PolyOffset=3, PolyNbSides=i\hspace{5mm}\]}

\multido\{n=-1.4+0.5\}{10}{{}
  \PstPolygon\[PolyNbSides=3, PolyOffset=2, PolyIntermediatePoint=n\] \hspace{5mm}}par \vspace{0pt}\{2cm\}

\multido\{n=-1.4+0.5\}{6}{{}
  \PstPolygon\[PolyNbSides=5, PolyOffset=2, PolyIntermediatePoint=n\] \hspace{5mm}}

\multido\{n=-1.4+0.5\}{6}{{}
  \PstPolygon\[PolyNbSides=13, PolyOffset=2, PolyIntermediatePoint=n\] \hspace{5mm}}
\end{verbatim}
\multido{\n=-1.4+0.5}{6}{% 
\PstPolygon[PolyNbSides=21,PolyOffset=2,PolyIntermediatePoint=\n] 
\hspace{5mm}}

\psset{unit=1.4,linewidth=0.001,PolyNbSides=72,PolyEpicycloid}
\multido{\i=2+1}{4}{% 
\PstPolygon[PolyOffset=\i]\hspace{5mm}}

% Epicycloid of factor 10
\PstPolygon[unit=2,linewidth=0.003, 
PolyEpicycloid,PolyNbSides=72,PolyOffset=11]

% Epicycloid of factor 22
\PstPolygon[unit=2,linewidth=0.003, 
PolyEpicycloid,PolyNbSides=72,PolyOffset=23]
Some more examples

\begin{verbatim}
\psset{unit=1.9,linewidth=0.001,\PolyNbSides=72,\PolyEpicycloid}
\multido\{i=71+1\}{3}\{%
\PstPolygon[\PolyOffset=i]\hspace{5mm}\}
\end{verbatim}

% Epicycloid of factor 100
\begin{verbatim}
\PstPolygon[unit=2,\linewidth=0.003,\PolyEpicycloid,\PolyNbSides=72,\PolyOffset=101]
\end{verbatim}

% Epicycloid of factor 153
\begin{verbatim}
\PstPolygon[unit=2,\linewidth=0.003,\PolyEpicycloid,\PolyNbSides=72,\PolyOffset=154]
\end{verbatim}

\providecommand{\PstPolygonNode}{% 
\psdots[\dotsize=0.2,\linecolor=cyan](1;\INode)}
\PstPentagon[unit=2]

\providecommand{\PstPolygonNode}{% 
\rput{0}(1.2;\INode){\small\the\multidocount}}
\PstPolygon[unit=2,\PolyNbSides=7,\PolyOffset=2]
Some more examples

\providecommand{\PstPolygonNode}{% 
\rput+{0}(1;\INode){\small\the\multidocount}} \PstHeptagon[unit=2,PolyOffset=2]

% \newcounter{Letter} 
\providecommand{\PstPolygonNode}{% 
\setcounter{Letter}{\the\multidocount} \rput+{0}(1;\INode){\small\Alph{Letter}}} \PstHeptagon[unit=2,PolyOffset=3]

\providecommand{\PstPolygonNode}{% 
\SpecialCoor \degrees[3] \rput{0.5}(0.5;\INode){% 
\pspolygon*(0.5;0.5)(0.5;1.5)(0.5;2.5)}} \PstTriangle

\providecommand{\PstPolygonNode}{% 
\psdots[dotstyle=o,dotsize=0.2](1;\INode) \psline[linecolor=red]{-}<>(0.9;\INode)} \PstPolygon[unit=2,PolyNbSides=8]

\providecommand{\PstPolygonNode}{% 
\psline[linewidth=0.1mm,doubleline=true, linecolor=green]{-}<>(0;0)(1;\INode)} \PstHexagon[unit=2]
\newbox{\Star}
\savebox{\Star}{% 
\PstStarFive*[unit=0.15,linestyle=red]}
\providecommand{\PstPolygonNode}{% 
\rput{+0}(1;INode){\usebox{\Star}}} 
\shortstack{% 
\PstNonagon\[5mm\] 
\PstDodecagon[linestyle=none]}

\newcounter{Letter} \ifnotdefined 
\setcounter{Letter}{the\multidocount} 
\begin{pspicture}(-2.5,-2.5)(2.5,2.5) 
\PstPolygon[PolyName=A,fillstyle=solid,fillcolor=lightgray,linewidth=2pt, 
PolyNbSides=5,unit=0.5, 
PstPicture=false] 
\PstPolygon[PolyName=B,PolyNbSides=5,linewidth=2pt, 
PstPicture=false,unit=2.5] 
\multido{iA=1+1,iB=2+1}{5}{% 
\setcounter{Letter}{the\multidocount} 
\ncline{A\iA}{B\iA} \ncput*{\bf alph\{Letter\}}% 
\ifnum\iB>5 \def\iB{1}\fi% 
\pcline[linestyle=none](B\iA)(B\iB) \ncput*{\bf \iA} 
\end{pspicture}
8 List of all optional arguments for \texttt{pst-poly}

<table>
<thead>
<tr>
<th>Key</th>
<th>Type</th>
<th>Default</th>
</tr>
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<tbody>
<tr>
<td>\texttt{PstPicture}</td>
<td>boolean</td>
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<tr>
<td>\texttt{PolyRotation}</td>
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<td>\texttt{PolyName}</td>
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</tr>
<tr>
<td>\texttt{PolyEpicycloid}</td>
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<td>true</td>
</tr>
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