Drawing histogram bars inside the LaTeX picture–environment*

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Abstract

This article describes an enhancement of the LaTeX picture–environment to draw histogram bars.

1 User interface

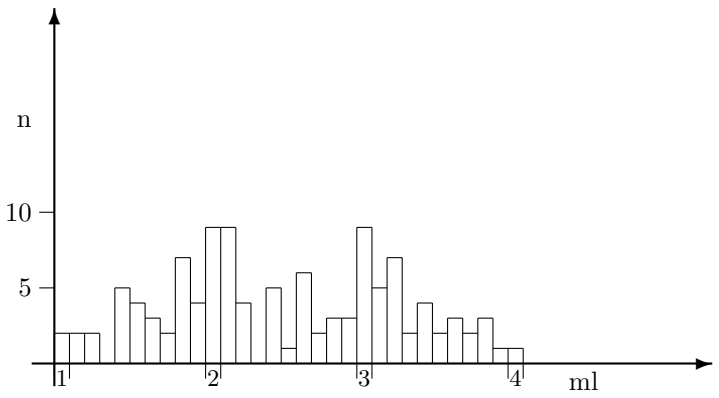
`\histogram` This is a macro collection to draw histogram bars inside a picture–environment. Use is as follows:

`\histogram`$(x_0,y_0)(x_1,y_1)...(x_n,y_n)$

The coordinate pairs specify the upper left corner of the histogram bars, i.e. this will draw a horizontal line from (x_i, y_i) to (x_{i+1}, y_i), then a vertical line from `\noverticallines` (x_{i+1}, y_i) to (x_{i+1}, y_{i+1}) if `\noverticallines` was specified, else from (x_{i+1}, y_0) `\verticallines` to $(x_{i+1}, \max(y_i, y_{i+1}))$.

Default is `\verticallines`. y_0 should be less or equal the minimum of all the y_i (i.e. other cases have not been tested).

Let's start with an example: to get the following picture:



Behandler 1

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I used these LaTeX commands:

```
\setlength{\unitlength}{1mm}
\begin {picture}(100,65)(-10,-15)

\thicklines
\put(0,-3){\vector(0,1){50}}
\put(-3,0){\vector(1,0){90}}
\thinlines

\put(0,0){\line(0,-1){2}}
\put(2,0){\line(0,-1){2}}
\put(20,0){\line(0,-1){2}}
\put(22,0){\line(0,-1){2}}
\put(40,0){\line(0,-1){2}}
\put(42,0){\line(0,-1){2}}
\put(60,0){\line(0,-1){2}}
\put(62,0){\line(0,-1){2}}

\put(0,-1){\makebox(2,0)[t]{\small 1}}
\put(20,-1){\makebox(2,0)[t]{\small 2}}
\put(40,-1){\makebox(2,0)[t]{\small 3}}
\put(60,-1){\makebox(2,0)[t]{\small 4}}
\put(70,-1){\makebox(0,0)[t]{ml}}

\put(0,10){\line(-1,0){2}}
\put(0,20){\line(-1,0){2}}

\put(-3,8){\makebox(0,4)[r]{5}}
\put(-3,18){\makebox(0,4)[r]{10}}
\put(-3,30){\makebox(0,4)[r]{n}}

\put(15,-10){Behandler 1}

\histogram(0,0)(0,4)(2,4)(4,4)(6,0)(8,10)(10,8)(12,6)(14,4)
          (16,14)(18,8)(20,18)(22,18)(24,8)(26,0)(28,10)(30,2)
          (32,12)(34,4)(36,6)(38,6)(40,18)(42,10)(44,14)(46,4)
          (48,8)(50,4)(52,6)(54,4)(56,6)(58,2)(60,2)(62,0)
\end{picture}
```

2 Implementation

1 ⟨∗package⟩

`\hist@x` `\hist@y` `\hist@ystart`

Here's how it is implemented: first we allocate three counters that are needed later on. `\hist@x` and `\hist@y` are the x and y coordinate of the *current point*, i.e. the point that serves as a start for the next box of the histogram. `\hist@ystart` holds the y coordinate of the first point, i.e. y_0.

```
2 \newcount\hist@x
3 \newcount\hist@y
4 \newcount\hist@ystart
```

`\noverticallines` `\verticallines`

We need a switch to decide if the vertical lines of the histogram boxes are to be drawn from y_i to y_{i+1} or from y_0 to $\max(y_i, y_{i+1})$. Default is the latter.

```
\newif\ifhist@vert

\let\verticallines\hist@verttrue
\let\noverticallines\hist@vertfalse

\hist@verttrue
```

`\histogram` The `\histogram` command takes the starting point as argument and initializes the counters. `\hist@x`, `\hist@y` and `\hist@ystart` are set to x_0, y_0 and y_0, respectively.

```
\def\histogram(#1,#2){\hist@x #1 \hist@y #2 \hist@ystart\hist@y
```

Then the macro `\hist@next` is used.

```
  \hist@next}
```

`\hist@next` `\hist@next` looks at the next token to see if there is another open parentheses. If this is the case it calls `\hist@box`, otherwise `\hist@end`.

```
\def\hist@next{\@ifnextchar ({\hist@box}{\hist@end}}
```

`\hist@box` The macro `\hist@box` does nearly all the work. The first thing to do is to set the temporary counter `\@tempcnta` to $x_{i+1} - x_i$. Remember that `\hist@x` is the x coordinate of the last point (i.e. x_i) whereas the macros first argument is x_{i+1}. So we write

```
\def\hist@box(#1,#2){\@tempcnta -\hist@x
   \advance\@tempcnta #1
```

The next step is easy: draw the horizontal part of the histogram box. The line starts at (x_i, y_i) and has length `\@tempcnta\unitlength`.

```
   \ifnum \@tempcnta >\z@
        \put(\hist@x,\hist@y){\line(1,0){\@tempcnta}}\else
        \put(\hist@x,\hist@y){\line(-1,0){-\@tempcnta}}\fi
```

Now set `\hist@x` to x_{i+1}:

```
   \hist@x #1
```

If `\verticallines` was set we first set `\@tempcnta` to $\max(y_i, y_{i+1})$:

```
   \ifhist@vert
      \ifnum \hist@y >#2 \@tempcnta\hist@y
        \else \@tempcnta #2 \fi
```

then we set `\@tempcntb` to the same value and `\@tempcnta` to the length of the line to draw.

```
      \@tempcntb\@tempcnta
      \advance\@tempcnta -\hist@ystart
```

We draw the line

```
      \put(\hist@x,\@tempcntb){\line(0,-1){\@tempcnta}}%
```

which finishes this case.

```
   \else
```

In the other case (i.e. if `\noverticallines` was set) we have to draw a line from y_i to y_{i+1}. We set `\@tempcnta` to $y_{i+1} - y_i$

```
      \@tempcnta -\hist@y
      \advance\@tempcnta #2
```

and draw the line.

```
29      \ifnum \@tempcnta >\z@
30         \put(\hist@x,\hist@y){\line(0,1){\@tempcnta}}\else
31         \put(\hist@x,\hist@y){\line(0,-1){-\@tempcnta}}\fi
```

Thus endeth the drawing.

```
32    \fi
```

Finally we set `\hist@y` to y_{i+1} and call `\hist@next` to look for the next coordinate pair.

```
33    \hist@y #2\hist@next}
```

`hist@end` There is only one thing we left out: what if there is no more open parenthesis? That's the easy part: do nothing.

```
34 \def\hist@end{}
```

Frank Mittelbach suggested that the x–coordinate should specify the midpoint of the histogram bar, not the upper left corner. However, I don't see how this will work if the bars have different widths. What do you think about it?

Well, that's all. Use it and enjoy.