The \LaTeX\ havannah package

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Abstract
The havannah package defines macros for typesetting diagrams of board positions in the games of Havannah and Hex.

A Havannah game between Maciej Celuch and Mirko Rahn played on http://www.littlegolem.net from 2009-07-05 to 2009-07-29

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1 Usage

Put \usepackage{havannah} in the preamble of your document. This package defines four environments, three commands, and several hooks that allow for the customization of its output.

The \texttt{HavannahBoard} environment typesets a Havannah board. It accepts the following keys:

- \texttt{board size}: an integer from 1 to 13, default: 10,
- \texttt{coordinate style}: little golem or classical, default: classical,
- \texttt{hex height}: a length, default: 17.5pt,
- \texttt{show coordinates}: a Boolean, default: true,
- \texttt{show hexes}: a Boolean, default: true.

Sample effects of setting these keys are shown below.

\begin{HavannahBoard}[\texttt{board size=2}] \end{HavannahBoard}
\begin{HavannahBoard}[\texttt{board size=3}] \end{HavannahBoard}
\begin{HavannahBoard}[\texttt{board size=4}] \end{HavannahBoard}
The \texttt{HexBoard} environment typesets a Hex board. It accepts the following keys:

- \texttt{board size}: an integer from 1 to 26, default: 11,
- \texttt{top left color}: either \texttt{white} or \texttt{black}, default: \texttt{black},
- \texttt{hex height}: a length, default: 17.5pt,
- \texttt{show coordinates}: a Boolean, default: \texttt{true},
• show hexes: a Boolean, default: true.

Sample effects of setting these keys are show below.

\begin{HexBoard}[board size=2]
\end{HexBoard}

\begin{HexBoard}[board size=3]
\end{HexBoard}

\begin{HexBoard}[board size=4]
\end{HexBoard}

\begin{HexBoard}[board size=3]
\HGame{a3,c2}
\end{HexBoard}

\begin{HexBoard}[board size=3, top left color=white]
\HGame{a3,c2}
\end{HexBoard}
InnerHavannahBoard  The *InnerHavannahBoard* environment typesets a Havannah board inside a
tikzpicture environment. It is useful for drawing multiple diagrams in one picture. In addition to the keys of HavannahBoard, it accepts the following keys:

- **prefix**: to be put before cell names.
- **x**: the x coordinate of the lower corner of the board.
- **y**: the y coordinate of the lower corner of the board.

An example of its use is shown below.

\begin{tikzpicture}
\begin{InnerHavannahBoard}[board size=4, prefix=A, x=0, y=0]
\end{InnerHavannahBoard}
\begin{InnerHavannahBoard}[board size=4, prefix=B, x=7cm, y=0]
\end{InnerHavannahBoard}
\draw (Ad4)..controls (Ae7) and (Bg5)..(Bd4);
\HStoneGroup[color=white]{Ad4, Bd4}
\end{tikzpicture}

The InnerHexBoard environment typesets a Hex board inside a tikzpicture environment. It accepts the same set of extra keys as InnerHavannahBoard: prefix, x, and y.

You can use \renewcommand to redefine three hooks that change the look and feel of HavannahBoard or HexBoard. They are:

- **\HLetterCoordinates**: a comma-separated list, default: \{a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u,v,w,x,y,z\},
- **\HCoordinateStyle**: a one-argument macro, default: \{\sffamily#1\},
- **\HDrawHex**: a tikz command, default: \{\shadedraw[shading=radial, inner color=gray!30, outer color=gray!70]\}. Note that the default shading is a heavy task for some printers so you might want to use a simpler command instead, for instance \draw[fill=gray!35].

InnerHexBoard

HLetterCoordinates

HCoordinateStyle

HDrawHex
Sample results of redefining them are shown below.

\begin{HavannahBoard}[board size=3,coordinate style=little golem]
\HGame{d3,c2}
\end{HavannahBoard}
\renewcommand\HLetterCoordinates{1,2,3,4,5}
\begin{HavannahBoard}[board size=3,coordinate style=little golem]
\HGame{4,3,2}
\end{HavannahBoard}

\begin{HavannahBoard}[board size=3,coordinate style=little golem]
\end{HavannahBoard}
\renewcommand\HCoordinateStyle[1]{\Large\bfseries#1}
\begin{HavannahBoard}[board size=3,coordinate style=little golem]
\end{HavannahBoard}

\begin{HavannahBoard}[board size=3,coordinate style=little golem]
\end{HavannahBoard}
\renewcommand\HCoordinateStyle[1]{\Large\bfseries#1}
\begin{HavannahBoard}[board size=3,coordinate style=little golem]
\end{HavannahBoard}
The \HGame macro can only be used inside a HavannahBoard or HexBoard environment. It accepts the following keys:

- **first move label**: a text, default: 1,
- **first player**: either white or black, default: white inside HavannahBoard and black inside HexBoard.
- **numbered moves**: a Boolean, default: true,
- **relative stone size**: a number, default: 0.75.

Their effects are shown below.

\begin{HavannahBoard}[board size=3,coordinate style=little golem]
\HGame{c3,e1,e3,c2,a1,d3,c5,d4,c4,b2,a3,d2,b4}
\end{HavannahBoard}

\begin{HavannahBoard}[board size=3,coordinate style=little golem]
\HGame[first move label=S]{c3,e1,e3,c2,a1,d3,c5,d4,c4,b2,a3,d2,b4}
\end{HavannahBoard}
The \HStoneGroup macro can only be used inside a \HavannahBoard or \HexBoard environment. It puts a group of stones of the same color on the board. It accepts the following keys:

- **color**: white, black, or transparent, there is no default – the value must be specified,
- **label**: a text, default: empty string,
- **relative stone size**: a number, default: 0.75.
The effects of color and label are shown below. The effect of relative stone size is the same as for \HGame and will not be shown.

\begin{HavannahBoard}[board size=6,coordinate style=little golem]
\HStoneGroup[color=black,label=$\mathcal F$]{{a5,b5,c5,d6,d7,d8,c8,e8,f8,g8,h7,i7,j7}}
\HStoneGroup[color=white,label=$\mathcal B$]{{a1,b2,c3,d3,e3,e2,f2,f1}}
\HStoneGroup[color=transparent,label=$\mathcal R$]{{h6,g6,g5,g4,h3,i2,j2,j3,j4,i5}}
\end{HavannahBoard}

There are five hooks that can be redefined via \renewcommand to change the appearance of \HGame and \HStoneGroup. They are:

- \HMoveNumberStyle: a one-argument macro, influences \HGame, default: \{\sffamily#1\},
- \HWhiteStone: a tikz command, influences \HGame and \HStoneGroup, default:
  \{\node[circle,draw,inner sep=0.6pt,fill=white,minimum size=\HStoneDiameter]\},
- \HBlackStone: a tikz command, influences \HGame and \HStoneGroup, default:
  \{\node[circle,draw,inner sep=0.6pt,fill=black,text=white,minimum size=\HStoneDiameter]\},
- \HTransparentStone: a tikz command, influences \HStoneGroup, default:
  \{\node[circle,draw,inner sep=0.6pt,minimum size=\HStoneDiameter]\},
minimum size=\HStoneDiameter],

- \HBeforeOddMove, \BeforeEvenMove: macros expanded before placing stones, for example \pause when animating games in beamer, influence \HGame, default: {};

- \HBeforeStone: a macro expanded before placing stones, influences \HStoneGroup, default: {}.

Sample effects of redefining some of them are shown below.

\begin{HavannahBoard}[board size=3,coordinate style=little golem]
  \HGame{c3,e1,e3,c2,a1,d3,c5,d4,c4,b2,a3,d2,b4}
\end{HavannahBoard}

\renewcommand\HMoveNumberStyle[1]{\footnotesize\romannumeral#1}
\begin{HavannahBoard}[board size=3,coordinate style=little golem]
  \HGame{c3,e1,e3,c2,a1,d3,c5,d4,c4,b2,a3,d2,b4}
\end{HavannahBoard}
The \texttt{\HHexGroup} macro can only be used inside a \texttt{HavannahBoard} or \texttt{HexBoard} environment. It puts a group of hexes on the board, which presumably is typeset with \texttt{show hexes=false}. It is recommended to use it inside the \texttt{HexBoard} environment due to the simplicity of its coordinate system. It accepts the following keys:

- \texttt{label}: a text, default: empty string.

An example of its use is shown below.
2 Implementation

\begin{HHexGroup}
\{a1,b1,c1,d1,e1,f1,g1,h1,a2,b2,c2,e2,f2,g2,a3,b3,c3,d3,e3,f3,b4,c4,d4\}
\end{HHexGroup}

\begin{HexBoard}
 \begin{HStoneGroup}\textcolor{black}\{a,b,c,d,e,f,g,h,i,c4\}\end{HStoneGroup}
\end{HexBoard}

The naming schema used in the havannah package is \texttt{\textbackslash HFooBar} for redefinable hooks, and \texttt{\textbackslash h@foo@bar} for internal macros.

Start with defining default expansions for the hooks.
\begin{verbatim}
\newcommand\HLetterCoordinates{a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u,v,w,x,y,z}
\newcommand\HCoordinateStyle[1]{\sffamily#1}
\newcommand\HMoveNumberStyle[1]{\sffamily#1}
\newcommand\HDrawHex{\shadedraw[shading=radial,inner color=gray!30,outer color=gray!70]}
\end{verbatim}
\newcommand\HWhiteStone{\node[
circle,draw=black,inner sep=0.6pt,fill=white,
minimum size=\HStoneDiameter]}
\newcommand\HBlackStone{\node[
circle,draw=black,inner sep=0.6pt,fill=black,text=white,
minimum size=\HStoneDiameter]}
\newcommand\HTransparentStone{\node[
circle,draw=black,inner sep=0.6pt,
minimum size=\HStoneDiameter]}
\newcommand\HBeforeOddMove{}
\newcommand\HBeforeEvenMove{}
\newcommand\HBeforeStone{}

The \h@draw@hex macro draws a hexagonal cell. The cell is 3\h@one@third@hex@wd
wide and 2\h@half@hex@ht high. It has two horizontal and four slanted edges.
The \h@draw@hex macro takes one argument: the coordinates of the center of the
cell. It uses the \HDrawHex hook to style the cell.
\newcommand{\h@draw@hex}[1]{%
\HDrawHex (#1){%
++(-2\h@one@third@hex@wd,0)--
++(\h@one@third@hex@wd,-\h@half@hex@ht)--
++(2\h@one@third@hex@wd,0)--
++(\h@one@third@hex@wd,\h@half@hex@ht)--
++(-\h@one@third@hex@wd,\h@half@hex@ht)--
++(-2\h@one@third@hex@wd,0)--
cycle;
}

Define pgfkeys paths.
\newif\h@numbered@moves
\newif\h@show@coordinates
\newif\h@show@hexes
\pgfkeys{%
/h@havannah@board/.cd,
board size/.store in=\hv@board@size,
coordinate style/.is choice,
coordinate style/classical/.code={%
  \def\h@draw@board{\h@draw@classical@board}},
coordinate style/little golem/.code={%
  \def\h@draw@board{\h@draw@little@golem@board}},
hex height/.store in=\h@hex@height,
prefix/.store in=\h@prefix,
show coordinates/.is if=\h@show@coordinates,
show hexes/.is if=\h@show@hexes,
x/.store in=\h@xx,
y/.store in=\h@yy,
board size=10,
coordinate style=classical,
hex height=17.5pt,
prefix=, show coordinates=true,
show hexes=true, x=0, y=0, 
%
/h@hex@board/.cd, top left color/.is choice, top left color/white/.code={\def\h@top@left@color{\HWhiteStone}\def\h@bottom@left@color{\HBlackStone}},
}, top left color/black/.code={\def\h@top@left@color{\HBlackStone}\def\h@bottom@left@color{\HWhiteStone}},
board size/.store in=\hx@board@size, hex height/.store in=\h@hex@height, prefix/.store in=\h@prefix, relative stone size/.store in=\h@relative@stone@size, show coordinates/.is if=h@show@coordinates, show hexes/.is if=h@show@hexes, x/.store in=\h@xx, y/.store in=\h@yy, top left color=black, board size=11, hex height=17.5pt, relative stone size=0.75, show coordinates=true, show hexes=true, 
%
/h@game/.cd, first move label/.store in=\h@first@move@label, first player/.is choice, first player/white/.code={\def\h@odd@player{\HWhiteStone}\def\h@even@player{\HBlackStone}},
}, first player/black/.code={\def\h@odd@player{\HBlackStone}\def\h@even@player{\HWhiteStone}},
}, numbered moves/.is if=h@numbered@moves, relative stone size/.store in=\h@relative@stone@size, first move label=1, numbered moves=true, relative stone size=0.75, 
%
/h@stone@group/.cd, color/.is choice, color/white/.code={\def\h@player{\HWhiteStone}}, color/black/.code={\def\h@player{\HBlackStone}},

The \texttt{InnerHavannahBoard} environment first sets the values of \h@board@size, \h@draw@board, \h@hex@height, and \h@show@coordinatestrue or \h@show@coordinatesfalse. Then it computes \h@half@hex@ht, \h@one@third@hex@wd, and \h@board@diagonal, and executes \h@draw@board.

There is nothing to be done at the end of \texttt{InnerHavannahBoard}.

The \texttt{HavannahBoard} environment just wraps \texttt{InnerHavannahBoard} inside a \texttt{tikzpicture}.

Finally, \texttt{HavannahBoard} closes the \texttt{InnerHavannahBoard} and \texttt{tikzpicture} environments.

The \texttt{\h@draw@classical@board} and \texttt{\h@draw@little@golem@board} macros differ enough that a common routine would be of little help. They both draw a rhombus of hexes with two corners cut. The edges of adjacent hexes are drawn twice.

The following counters are shared by both macros.
The `\h@draw@classical@board` macro is a bit simpler than the other one.

\newcommand{\h@draw@classical@board}{%
  \h@l=0
  \h@b@corner=\hv@board@size
  \foreach \h@letter in \HLetterCoordinates {%
    \global\advance\h@l by 1
    \ifnum \h@l > \h@board@diagonal
      \breakforeach
    \else
      \global\advance\h@b@corner by 1
      \h@a@corner=\hv@board@size
      \foreach \h@n in {1,...,\h@board@diagonal} {%
        \global\advance\h@a@corner by 1
        \ifnum \h@l < \h@a@corner
          \ifnum \h@n < \h@b@corner
            \coordinate (\h@prefix\h@letter\h@n) at
              (\h@xx+3*\h@n\h@one@third@hex@wd,\h@yy+\h@n\h@half@hex@ht+\h@l\h@half@hex@ht);
          \fi
        \fi
      \}
      \ifh@show@hexes
        \h@draw@hex{\h@prefix\h@letter\h@n}%
      \fi
    \fi
  \}
  \ifh@show@coordinates
    \ifnum \h@l < \hv@board@size
      \node at (\h@xx-3*\h@l\h@one@third@hex@wd,\h@yy+\h@l\h@half@hex@ht) {\HCoordinateStyle{\h@letter}};
    \else
      \node at (\h@xx+3*\hv@board@size\h@one@third@hex@wd,\h@yy+\h@l\h@half@hex@ht-\hv@board@size\h@half@hex@ht) {\HCoordinateStyle{\h@letter}};
    \fi
  \fi
  \fi
%
\ifh@show@coordinates
  \foreach \h@n in {1,...,\h@board@diagonal} {%
    \ifnum \h@n < \hv@board@size
      \node at (\h@xx+3*\h@n\h@one@third@hex@wd,\h@yy+\h@n\h@half@hex@ht-\hv@board@size\h@half@hex@ht) {\HCoordinateStyle{\h@n}};
    \else
      \node at (\h@xx+3*\hv@board@size\h@one@third@hex@wd,\h@yy+2*\h@n\h@half@hex@ht-\hv@board@size\h@half@hex@ht)
        {\HCoordinateStyle{\h@n}};
    \fi
  \}
\fi
%
\ifh@show@coordinates
  \foreach \h@n in {1,...,\h@board@diagonal} {%
    \ifnum \h@n < \hv@board@size
      \node at (\h@xx+3*\h@n\h@one@third@hex@wd,\h@yy+\h@n\h@half@hex@ht) {\HCoordinateStyle{\h@n}};
    \else
      \node at (\h@xx+3*\hv@board@size\h@one@third@hex@wd,\h@yy+2*\h@n\h@half@hex@ht-\hv@board@size\h@half@hex@ht)
        {\HCoordinateStyle{\h@n}};
    \fi
  \}
\fi
%
\end{verbatim}

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The \h@draw@little@golem@board macro is more complicated since the numbered rows in Little Golem change direction in the middle.

\newcommand\h@draw@little@golem@board{% 
\h@a@corner=\hv@board@size 
\h@b@corner=\hv@board@size 
\multiply\h@b@corner by 3 
\h@l=0 
\foreach \h@letter in \HLetterCoordinates {% 
\global\advance\h@l by 1 
\ifnum \h@l > \h@board@diagonal 
\breakforeach 
\else 
\global\advance\h@a@corner by 1 
\global\advance\h@b@corner by -1 
\foreach \h@n in {1,...,\h@board@diagonal} {% 
\ifnum \h@n < \h@a@corner 
\ifnum \h@n < \h@b@corner 
\ifnum \h@l < \hv@board@size 
\coordinate (\h@prefix\h@letter\h@n) at 
(\h@xx+3*\h@l\h@one@third@hex@wd, 
\h@yy+2*\hv@board@size\h@half@hex@ht+
2*\h@n\h@half@hex@ht-\h@l\h@half@hex@ht); 
\h@show@hexes 
\h@draw@hex{\h@prefix\h@letter\h@n}% 
\fi 
\else 
\coordinate (\h@prefix\h@letter\h@n) at 
(\h@xx+3*\h@l\h@one@third@hex@wd, 
\h@yy+2*\h@n\h@half@hex@ht+\h@l\h@half@hex@ht); 
\h@show@hexes 
\h@draw@hex{\h@prefix\h@letter\h@n}% 
\fi 
\fi 
\fi 
\if\h@show@coordinates 
\ifnum \h@l < \hv@board@size 
\node at 
(\h@xx+3*\h@l\h@one@third@hex@wd, 
\h@yy+2*\hv@board@size\h@half@hex@ht-\h@l\h@half@hex@ht) 
{\HCoordinateStyle{\h@letter}}; 
\else 
\node at 
}
The \texttt{InnerHexBoard} environment is similar to \texttt{InnerHavannahBoard} but simpler, as it typesets an entire cross-product of coordinates, without cutting the corners.

\begin{verbatim}
\newenvironment{InnerHexBoard}[1][]{% 
  \def\h@odd@player{\HBlackStone} 
  \def\h@even@player{\HWhiteStone} 
  \pgfqkeys{/h@hex@board}{#1} 
  \tracingcommands=1 
  \setlength\h@half@hex@ht{\h@hex@height} 
  \divide\h@half@hex@ht by 2 
  \setlength\h@one@third@hex@wd{0.577350269*\h@half@hex@ht} 
  \HStoneDiameter=\h@relative@stone@size*\h@half@hex@ht 
  \multiply\HStoneDiameter by 2 
  \h@l=0 
  \HCoordinateStyle{\h@letter}; 
  \fi
  \fi
  \fi
}\
If \h@show@coordinates
\foreach \h@n in {1,...,\h@board@diagonal} {%
  \ifnum \h@n < \hv@board@size
    \node at
      \h@xx,
      \h@yy+2*\h@n*\h@half@hex@ht+
      \h@board@diagonal*\h@half@hex@ht+\h@half@hex@ht)
    \HCoordinateStyle{\h@n};
    \node at
      \h@xx+3*\h@board@diagonal*\h@one@third@hex@wd+
      3*\h@one@third@hex@wd,
      \h@yy+2*\h@n*\h@half@hex@ht+
      \h@board@diagonal*\h@half@hex@ht+\h@half@hex@ht)
    \HCoordinateStyle{\h@n};
  \else
    \node at
      \h@xx+3*\h@n*\h@one@third@hex@wd-
      3*\hv@board@size*\h@one@third@hex@wd,
      \h@yy+\h@n*\h@half@hex@ht+3*\hv@board@size*\h@half@hex@ht)
    \HCoordinateStyle{\h@n};
  \fi
\else
  \node at
    \h@xx-3*\h@n*\h@one@third@hex@wd+
    9*\hv@board@size*\h@one@third@hex@wd,
    \h@yy+\h@n*\h@half@hex@ht+3*\hv@board@size*\h@half@hex@ht)
  \HCoordinateStyle{\h@n};
\fi
\fi
\} 
\end{verbatim}
The HexBoard environment just wraps \texttt{InnerHexBoard} inside a \texttt{tikzpicture}.

\begin{Verbatim}
\newenvironment{HexBoard}{\begin{tikzpicture}}{
\end{tikzpicture}}
\end{Verbatim}
Finally, HexBoard closes the InnerHexBoard and tikzpicture environments.

The \Game macro

\newcount\move@number
\newdimen\StoneDiameter
\newcommand\Game[2][]{%
\pgfqkeys{/game}{#1}{% \HGameDiameter=\relative@stone@size\half@hex@ht
\multiply\HGameDiameter by 2
\move@number=0
\if\numbered@moves
\let\label=
\edef\label{\MoveNumberStyle{\first@move@label} %
\global\let\label{\MoveNumberStyle{the\move@number}}}
\else
\def\label{}
\fi
\foreach \coord in {#2} {%
\global\advance\move@number by 1
\ifodd\move@number
\BeforeOddMove
\coord at \label
\else
\BeforeEvenMove
\coord at \label
\fi
}%
}%

The \StoneGroup macro

\newcommand\StoneGroup[2][]{%
\let\player=\empty
\let\label=\empty
\pgfqkeys{/stone@group}{#1}{% \HStoneDiameter=\relative@stone@size\half@hex@ht
\multiply\HStoneDiameter by 2
\foreach \coord in {#2} {%
\BeforeStone
\coord at \label
\fi
}%
}%

The \HexGroup macro

\newcommand\HexGroup[2][]{%
\let\label=\empty
\HStoneDiameter=\relative@stone@size\half@hex@ht
\multiply\HStoneDiameter by 2
\foreach \coord in {#2} {%
\BeforeStone
\coord at \label
}%
}%
\pgfqkeys{/h@hex@group}{#1}%
\foreach \h@coord in {#2} {%
  \node at (\h@coord) {\h@label};
  \h@draw@hex{\h@coord}%
}%
%
That's all, folks.
(/package)