The \texttt{amscd} package

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1 Introduction

The \texttt{amscd} package provides a \texttt{CD} environment that emulates the commutative diagram capabilities of \texttt{AMS-\LaTeX} version 2.x. This means that only simple rectangular diagrams are supported, with no diagonal arrows or more exotic features. Many users will be better served by one of the more powerful diagram packages such as \texttt{diagram}, \texttt{xypic}, or \texttt{kuvio}.

Example:

\[
\begin{CD}
S^\mathcal{W}_\Lambda \otimes T @>j>> T \\
@VVV @VV{\End P}V \\
(S \otimes T)/I @= (Z \otimes T)/J
\end{CD}
\]

(assuming \texttt{\End} is defined as an ‘operator name’).

Another example:

We will make liberal use of Cichon’s Diagram [C]:

\[
\begin{CD}
\cov(\mathcal{L}) @>>> \non(\mathcal{K}) @>>> \cf(\mathcal{K}) @>>> \cf(\mathcal{L}) \\
@VVV @AAA @AAA @VVV \\
add(\mathcal{L}) @>>> \add(\mathcal{K}) @>>> \cov(\mathcal{K}) @>>> \non(\mathcal{L})
\end{CD}
\]

(2)
\add(\mathcal{L}) @>>> \add(\mathcal{K}) @>>> \cov(\mathcal{K}) @>>> \non(\mathcal{L})
\end{CD}
\end{equation}

Standard package info.
\NeedsTeXFormat{LaTeX2e}% LaTeX 2.09 can't be used (nor non-LaTeX)
[1994/12/01]% LaTeX date must December 1994 or later
\ProvidesPackage{amscd}[2017/04/14 v2.1 AMS Commutative Diagrams]
\RequirePackage{amsgen}
Better not to redefine \texttt{\math@cr} if it is already defined, because for CD use only
we want to omit the part of the code related to \texttt{\dspbrk@lvl} (see \texttt{amsmath.sty}).

[mjd,1999/11/04] These definitions have gone somewhat obsolete; but we
had probably better leave them as they are for backward compatibility.

@ifundefined{math@cr}{%
def\math@cr{\ifnum0='}\fi
   \ifstar{\global\@eqpen\@M\math@cr@}{
   \global\@eqpen\interdisplaylinepenalty \math@cr@}}%
The following section merely duplicates some code from the \texttt{amsmath} package,
in case the \texttt{amscd} package is used by itself. For documentation of the code refer
to \texttt{amsmath.dtx}.
\def\math@cr@{\new@ifnextchar[\math@cr@@{\math@cr@@\[
   \noalign{\vskip\z@\relax}}
\def\restore@math@cr{\def\math@cr@@\[
   \cr}}{}
\restore@math@cr

[mjd,1999/11/04] These definitions too are somewhat obsolete; but we had prob-
ably better leave them as they are for backward compatibility.

@ifundefined{rightarrowfill@}{%
def\rightarrowfill@#1{\m@th\setboxz@h{$#1-$}\ht\z@\z@
   $#1\copy\z@\mkern-6mu\cleaders$
   \hbox{$#1\mkern-2mu\box\z@\mkern-2mu$}\hfill
   \mkern-6mu\mathord\rightarrow$}
def\leftarrowfill@#1{\m@th\setboxz@h{$#1-$}\ht\z@\z@
   $#1\mathord\leftarrow\mkern-6mu\cleaders$
   \hbox{$#1\mkern-2mu\copy\z@\mkern-2mu$}\hfill
   \mkern-6mu\box\z@$}
def\leftrightarrowfill@#1{\m@th\setboxz@h{$#1-$}\ht\z@\z@
   $#1\mathord\leftarrow\mkern-6mu\cleaders$
   \hbox{$#1\mkern-2mu\copy\z@\mkern-2mu$}\hfill
   \mkern-6mu\mathord\rightarrow$}}%
\atdef@\Iat
\ifundefined{Iat}{%\DeclareRobustCommand{\Iat}{\FN@at}}{}}%
1. INTRODUCTION

\begin{group}
\catcode`@=\active

Define math \@ to replicate its mathcode-dictated behavior. This is in case \@ occurs outside of CD.

\csname if\string @compatibility\endcsname
\else \fam=mathcode`\@
\xdef \@{mathchar\number\fam\space }
\fi
\gdef\CDat{\let @=\Iat}
\endgroup
\mathcode`@="8000 % make \@ pseudo-active in math
\def\at@{\let\next@\at@@
\ifcat\noexpand\next a\else
\ifcat\noexpand\next0\else
\ifcat\noexpand\next\relax\else
\let\next@\at@@@i\fi\fi\next@}
\def\at@@#1{\expandafter
\ifx\csname\space @\string#1\endcsname\relax
\DN@{\at@@@#1}%
\else
\DN@{\csname\space @\string#1\endcsname}%
\fi\next@}%

The following items should be defined only if they are not already defined, either

to leave the package name untouched (in the case of PackageError) or to avoid
redundant allocation of token or dimen registers.

\@ifundefined{default@tag}{\def\default@tag{\PackageError{amscd}{\protect\tag space not allowed here}\eha}}{}
\@ifundefined{at@@@}{\def\at@@@{\PackageError{amscd}{\Invalid@@ @}{\the\athelp@}\char64\relax}}{}
\@ifundefined{athelp@}{\csname newhelp\endcsname\athelp@{Only certain combinations beginning with \@ make sense to me.^^J I'll assume you wanted \@ for a printed \@.}}{}
\@ifundefined{minaw@}{\newdimen\minaw@}{
\minaw@11.111pt
\newdimen\minCDarrowwidth
\minCDarrowwidth2.5pc
\newif\ifCD@
\let\ampersand@\relax
\restore@math@cr\default@tag
\default@tag
\PackageError{amscd}{\protect\tag space not allowed here}\eha
}
\@ifundefined{at@@@}{\def\at@@@{\PackageError{amscd}{\Invalid@@ @}{\the\athelp@}\char64\relax}}{}
\@ifundefined{athelp@}{\csname newhelp\endcsname\athelp@{Only certain combinations beginning with \@ make sense to me.^^J I'll assume you wanted \@ for a printed \@.}}{}
\@ifundefined{minaw@}{\newdimen\minaw@}{
\minaw@11.111pt
\newdimen\minCDarrowwidth
\minCDarrowwidth2.5pc
\newif\ifCD@
\let\ampersand@\relax
\restore@math@cr\default@tag
\default@tag
\PackageError{amscd}{\protect\tag space not allowed here}\eha
}
\@ifundefined{at@@@}{\def\at@@@{\PackageError{amscd}{\Invalid@@ @}{\the\athelp@}\char64\relax}}{}
\@ifundefined{athelp@}{\csname newhelp\endcsname\athelp@{Only certain combinations beginning with \@ make sense to me.^^J I'll assume you wanted \@ for a printed \@.}}{}
\@ifundefined{minaw@}{\newdimen\minaw@}{
\minaw@11.111pt
\newdimen\minCDarrowwidth
\minCDarrowwidth2.5pc
\newif\ifCD@
\let\ampersand@\relax
\restore@math@cr\default@tag
\default@tag
\PackageError{amscd}{\protect\tag space not allowed here}\eha
}
\@ifundefined{at@@@}{\def\at@@@{\PackageError{amscd}{\Invalid@@ @}{\the\athelp@}\char64\relax}}{}
\@ifundefined{athelp@}{\csname newhelp\endcsname\athelp@{Only certain combinations beginning with \@ make sense to me.^^J I'll assume you wanted \@ for a printed \@.}}{}
\@ifundefined{minaw@}{\newdimen\minaw@}{
\minaw@11.111pt
\newdimen\minCDarrowwidth
\minCDarrowwidth2.5pc
\newif\ifCD@
\let\ampersand@\relax
\restore@math@cr\default@tag
\default@tag
\PackageError{amscd}{\protect\tag space not allowed here}\eha
}
\@ifundefined{at@@@}{\def\at@@@{\PackageError{amscd}{\Invalid@@ @}{\the\athelp@}\char64\relax}}{}
\@ifundefined{athelp@}{\csname newhelp\endcsname\athelp@{Only certain combinations beginning with \@ make sense to me.^^J I'll assume you wanted \@ for a printed \@.}}{}
\@ifundefined{minaw@}{\newdimen\minaw@}{
\minaw@11.111pt
\newdimen\minCDarrowwidth
\minCDarrowwidth2.5pc
\newif\ifCD@
\let\ampersand@\relax
\restore@math@cr\default@tag
\default@tag
\PackageError{amscd}{\protect\tag space not allowed here}\eha
}
This check is used by all macros that must not appear outside the CD environment. The first argument is the symbol to be used after @, the second one the action to be performed.

Once again we use the trick of defining a temporary control sequence \next@ and calling it after the final fi. This is not absolutely necessary, but it ensures that the conditional text is processed in one and the same column of the enclosing alignment.

\def\CD@check#1#2{\ifCD@\DN@{#2}\else
\DN@{\PackageError{amscd}{@\protect#1 not allowed outside of the CD environment}\@eha}\fi\next@}

\atdef@>#1>#2>{\ampersand@
\ifCD@ \global\bigaw@\minCDarrowwidth \else \global\bigaw@\minaw@ \fi
\setboxz@h{$\m@th\scriptstyle\;{#1}\;\;$}\ifdim\wdz@>\bigaw@ \global\bigaw@\wdz@ \fi
\ifCD@\enskip\fi
\mathrel{\mathop{\hbox to\bigaw@{\rightarrowfill@\displaystyle}}\limits^{#1} \@ifnotempty{#2}{_{#2}}}\ifCD@\enskip\fi \ampersand@}

\atdef@<#1<#2<{\ampersand@
\ifCD@ \global\bigaw@\minCDarrowwidth \else \global\bigaw@\minaw@ \fi
\setboxz@h{$\m@th\scriptstyle\;{#1}\;$}\ifdim\wdz@>\bigaw@ \global\bigaw@\wdz@ \fi
\@ifnotempty{#2}{\setbox@ne\hbox{$\m@th\scriptstyle\;{#2}\;$}\ifdim\wd@ne>\bigaw@ \global\bigaw@\wd@ne \fi}
\ifCD@\enskip\fi
\mathrel{\mathop{\hbox to\bigaw@{\leftarrowfill@\displaystyle}}\limits^{#1} \@ifnotempty{#2}{_{#2}}}\ifCD@\enskip\fi \ampersand@}

Variants of the above two arrows, using ( and ) characters instead of < and > characters, are provided for those whose keyboards don’t have the latter.

\begingroup \catcode`\~=\active \lccode`\~=\@ \lowercase{\CDat
\begin{verbatim}
% \CD@check
\begingroup\relax\iffalse{fi\let\ampersand@&\iffalse}\fi
\CD@true\center\bbox\let\math@cr\restore@math@cr\default@tag
\tabskip\z@skip\baselineskip20\ex@
\lineskip3\ex@\lineskiplimit3\ex@\halign\bbox
&\hfill$\m@th##$\hfill
\crcr
\crcr\egroup\egroup\egroup
\end{verbatim}
\CD@check
\\endgroup
\end{flushleft}
The \pretend command has weird syntax that doesn’t fit well with standard \LaTeX syntax so we leave it undone, at least for now. [mjd,1994/10/27]
% \def\pretend#1\haswidth#2{\setboxz@h{$\m@th\scriptstyle{#2}$}\hbox to\wdz@{$\m@th\scriptstyle{#1}$}}
% to\wdz@{$\m@th\scriptstyle{#1}$}}\hfill}
% The usual \endinput to ensure that random garbage at the end of the file
% doesn’t get copied by docstrip.
\endinput