The `amsfonts` package

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1 Introduction

The package `amsfonts` makes some of the math fonts from the AMSFonts package usable within LaTeX. For wholesale substitution of Euler math, see Frank Jensen's `euler` package.

Provide package info.

```
\NeedsTeXFormat{LaTeX2e}% LaTeX 2.09 can't be used (nor non-LaTeX)
[1994/12/01]% LaTeX date must be December 1994 or later
\ProvidesPackage{amsfonts}[2001/10/25 v2.2f]
```

2 Package options

2.1 The `psamsfonts` option

The `psamsfonts` option is intended to mean that the Y&Y/Blue Sky Research PostScript versions of the AMSFonts should be used. In that font set, the only `.tfm` files provided below size 10 are 5 and 7, rather than 5,6,7,8,9. This means that if the standard `.fd` files are used, any attempt to use 6,8,9 point math will result in error messages about missing `.tfm` files. In order to ensure that the proper `.fd` files are used for the PS case, we load them immediately. Otherwise the `.fd` files would be auto-loaded when LaTeX encounters the first math formula in a document, and the standard auto-loading mechanisms don't provide a way [that I know of—mjd, 7-Oct-1994] to choose the '57' varieties of the `.fd` files.

```
\DeclareOption{psamsfonts}{%
  \ifnum\cmex@opt=7 \def\cmex@opt{10}%
  \else \def\cmex@opt{0}\fi
  \DeclareFontFamily{U}{msa}{}%
  \DeclareFontShape{U}{msa}{m}{n}{<-6>msam5<6-8>msam7<8->msam10}{}%
  \DeclareFontFamily{U}{msb}{}%
  \DeclareFontShape{U}{msb}{m}{n}{<-6>msbm5<6-8>msbm7<8->msbm10}{}%
  \DeclareFontFamily{U}{euf}{}%
  \DeclareFontShape{U}{euf}{m}{n}{<-6>eufm5<6-8>eufm7<8->eufm10}{}%
  \DeclareFontShape{U}{euf}{b}{n}{<-6>eufb5<6-8>eufb7<8->eufb10}{}%
}
```

2.2 Font definitions for cmex

The AMSFonts distribution provides some extra sizes of the `cmex` font; these will not be used by LaTeX unless we change the font definition that refers to `cmex`. However, when the Y&Y/Blue Sky Research PostScript versions of the AMSFonts are used, there is only `cmex10`, and no smaller sizes. Because of complications in the order of option processing, we use a flag that will be set to '0' by the `psamsfonts` option, and initialize it to '1'. This means that sizes 7–9 of `cmex` will be used, unless the `psamsfonts` option is in effect. There's probably a better way to do this (please submit your suggestions to `tech-support@ams.org`) but I don't see anything obvious at the moment [mjd, 1995/01/31]. If the flag is already defined, then we assume that it was set by an earlier load of `amsmath`, and we don't override its value.

```
\@ifundefined{cmex@opt}{\def\cmex@opt{1}}{}
```

Process the options for this package.

```
\ProcessOptions\relax
```

Processing the `cmex7` and `cmex10` options is a little tricky because of different possible loading orders for `amsmath` and `amsfonts`. The package `amsmath` sets the `\cmex@opt` flag to 7 or 10, and the package `amsfonts` sets the flag to 1 or 0.

```
\ifnum\cmex@opt=1 \relax
  \DeclareFontShape{OMX}{cmex}{m}{n}{<-8>cmex7<8>cmex8<9>cmex9%
    <10><10.95><12><14.4><17.28><20.74><24.88>cmex10}{}%
  \expandafter\let\csname OMX/cmex/m/n/10\endcsname\relax
\else
  \ifnum\cmex@opt=10 % need to override cmex7 fontdef from amsmath
```

Force reloading of the OMX/cmex font definition file.

```
    \begingroup
    \expandafter\let\csname OMX+cmex\endcsname\relax
    \fontencoding{OMX}\fontfamily{cmex}%
    \try@load@fontshape
    \endgroup
```

The `cmex10` font gets special preload handling in the building of the LaTeX format file; we need an extra bit here to work around that.

```
    \expandafter\let\csname OMX/cmex/m/n/10\endcsname\relax
    \def\cmex@opt{0}%
  \fi
\fi
```

3 Miscellaneous

In case the `amsfonts` package is used apart from the `amsmath` package, we need to define the following functions.

```
\providecommand*{\@mathmeasure}[3]{%
  \setbox#1\hbox{\frozen@everymath\@emptytoks\m@th$#2#3$}}
```

`\newtoks` was still outer in early releases of LaTeX 2_ε, so we need to take a little extra care here.

```
\@ifundefined{@emptytoks}{\csname newtoks\endcsname\@emptytoks}{}
```

4 Preparing to use the extra math fonts

We declare the encoding schemes for two AMS math symbol fonts. `U` encoding with `\noaccents@` for math is already provided in base NFSS.

The AMS symbol fonts will be assigned via `\DeclareSymbolFont` since most of their characters are accessed with the `\mathchardef` primitive. This means that these fonts are loaded for the particular size whenever a size or version switch is requested by the user. At the present time bold forms of these fonts don't exist. So there are no overriding `\SetSymbolFont` commands for math-version 'bold'.

```
\DeclareSymbolFont{AMSa}{U}{msa}{m}{n}
\DeclareSymbolFont{AMSb}{U}{msb}{m}{n}
```

The next constructs are symbols that work the same in text or math. They are built the hard way using `\hexnumber@\sym....` We can't use `\DeclareTextSymbol` since it only specifies the font by its encoding, which, being `U` for both `msam` `msbm`, is ambiguous.

```
\@ifundefined{yen}{%
  \edef\yen{\noexpand\mathhexbox{\hexnumber@\symAMSa}55}
}{}
\@ifundefined{checkmark}{%
  \edef\checkmark{\noexpand\mathhexbox{\hexnumber@\symAMSa}58}
}{}
\@ifundefined{circledR}{%
  \edef\circledR{\noexpand\mathhexbox{\hexnumber@\symAMSa}72}
}{}
\@ifundefined{maltese}{%
  \edef\maltese{\noexpand\mathhexbox{\hexnumber@\symAMSa}7A}
}{}
```

We now define a few symbols which reside in the `msam` and `msbm` fonts. The `\catcode` change is to ensure that the double-quote character is not active (which at one time was a problem when something like `german.sty` was used).

```
\begingroup \catcode`\"=12
\DeclareMathDelimiter{\ulcorner}{\mathopen} {AMSa}{"70}{AMSa}{"70}
\DeclareMathDelimiter{\urcorner}{\mathclose}{AMSa}{"71}{AMSa}{"71}
\DeclareMathDelimiter{\llcorner}{\mathopen} {AMSa}{"78}{AMSa}{"78}
\DeclareMathDelimiter{\lrcorner}{\mathclose}{AMSa}{"79}{AMSa}{"79}
```

The next two definitions redefine the `\widehat` and `\widetilde` command to use a special accent if their argument is suitably wide. (In plain TEX these commands can produce three different accents depending on the size of the argument.) The current implementation will tend to give wrong results (tilde or hat symbol too wide) if these accents are used in script or scriptscript math style. But making that part work properly is too much effort given the limitations of TEX 3.x.

```
\xdef\widehat#1{\noexpand\@mathmeasure\z@\textstyle{#1}%
  \noexpand\ifdim\noexpand\wd\z@>\tw@ em%
  \mathaccent"0\hexnumber@\symAMSb 5B{#1}%
  \noexpand\else\mathaccent"0362{#1}\noexpand\fi}
```

```
%
\xdef\widetilde#1{\noexpand\@mathmeasure\z@\textstyle{#1}%
  \noexpand\ifdim\noexpand\wd\z@>\tw@ em%
  \mathaccent"0\hexnumber@\symAMSb 5D{#1}%
  \noexpand\else\mathaccent"0365{#1}\noexpand\fi}
```

Now we define two special arrows which are built with special characters from the first symbol font.

```
\DeclareMathSymbol{\dabar@}{\mathord}{AMSa}{"39}
\xdef\dashrightarrow{\mathrel{\dabar@\dabar@
                              \mathchar"0\hexnumber@\symAMSa 4B}}%
\xdef\dashleftarrow{\mathrel{\mathchar"0\hexnumber@\symAMSa 4C\dabar@
                              \dabar@}}%
%
\global\let\dasharrow\dashrightarrow
```

To avoid using too many control sequence names by defining all new symbols provided with the two fonts, we defined so far only symbols which are not assigned via `\mathchardef`. The majority however will be defined only if the user loads the `amssymb` package or explicitly defines symbols using the `\DeclareMathSymbol` macro.

Finally we test the `\DeclareMathSymbol` command by redefining the PLAIN TeX symbols which were made up from different characters (and thus could not change sizes properly) but are now available as real characters. Note that we have to make them undefined first, otherwise `\DeclareMathSymbol` will complain that they are already defined.

```
\global\let\rightleftharpoons\undefined
\DeclareMathSymbol{\rightleftharpoons}{\mathrel}{AMSa}{"0A}
\global\let\angle\undefined
\DeclareMathSymbol{\angle}            {\mathord}{AMSa}{"5C}
\global\let\hbar\undefined
\DeclareMathSymbol{\hbar}             {\mathord}{AMSb}{"7E}
```

Include a few common symbols which are both in `msam` or `msbm` and also in `lasy`, which might have been loaded already, so it is a good idea to make them undefined.

```
\global\let\sqsubset\undefined
\DeclareMathSymbol{\sqsubset}         {\mathrel}{AMSa}{"40}
\global\let\sqsupset\undefined
\DeclareMathSymbol{\sqsupset}         {\mathrel}{AMSa}{"41}
\global\let\mho\undefined
\DeclareMathSymbol{\mho}              {\mathord}{AMSb}{"66}
```

Now we close the group so that `"` will get its old `\catcode` back.

```
\endgroup
```

5 Defining ⟨*math alphabet identifiers*⟩

`\mathfrak` The Fraktur alphabet will be accessed by the command `\mathfrak` inside of math mode.

```
\DeclareMathAlphabet{\mathfrak}{U}{euf}{m}{n}
```

```
\SetMathAlphabet{\mathfrak}{bold}{U}{euf}{b}{n}
```

`\mathbb` The AMS symbol font B contains the blackboard bold math alphabet. There is only a single weight of this alphabet so it is used in all math versions.

```
\DeclareSymbolFontAlphabet{\mathbb}{AMSb}
```

5.1 Setting up the fonts for correct accents in math

There are a few ⟨*math alphabets*⟩ which don't have any or enough accents for math in the corresponding fonts. For example the `\mathbb` ⟨*math alphabet identifier*⟩ comes from a symbol font with none of the normal accents in the correct places. $\mathcal{A}\mathcal{M}\mathcal{S}$-TeX has a sophisticated solution for this problem: all math accents are defined in a way that the font where the accents are taken from depends on the current value of a macro called `\accentclass@`. To support this idea ⟨*math alphabet identfiers*⟩ which come with their own accents should set this macro to the number `7` (variable family in the terminology of the TeXbook); all others should set it to `0` so that the accents are taken from the ⟨*math group*⟩ zero in the current *math version*.

There is a `\DeclareFontEncodingDefaults` macro which declares such defaults. For the `amsfonts` package we set this default in the following way. This information will be ignored unless the `amsmath` package is also loaded.

```
\DeclareFontEncodingDefaults{\relax}{\def\accentclass@{7}}
```

6 Some backward compatibility definitions

The following commands are provided for compatibility with pre-1995 versions of the `amsfonts` package. If a `\documentclass` command is used the `\@obsolete` function will issue a warning saying that the command is obsolete.

Upgraded to robust commands. [bnb, 1996/09/29]

`\frak`
`\Bbb`
`\bold`

```
\DeclareRobustCommand{\frak}[1]{%
  {\@subst@obsolete{amsfonts}\frak\mathfrak{#1}}}
\DeclareRobustCommand{\Bbb}[1]{%
  {\@subst@obsolete{amsfonts}\Bbb\mathbb{#1}}}
\DeclareRobustCommand{\bold}[1]{%
  {\@subst@obsolete{amsfonts}\bold\mathbf{#1}}}
```

The `\newsymbol` command has different syntax than `\DeclareMathSymbol` so it cannot use the direct substitution function `\@subst@obsolete`.

```
\begingroup \catcode`\"=12 \relax
\gdef\newsymbol#1#2#3#4#5{%
  \@obsolete{amsfonts}\newsymbol\DeclareMathSymbol
  \@ifdefinable#1{%
     \edef\next@
       {\ifcase #2 \or
          \hexnumber@\symAMSa\or
          \hexnumber@\symAMSb\fi}%
     \ifx\next@\@empty
```

```
    \PackageError{amsfonts}{\Invalid@@\newsymbol}\@ehd%
  \else
   \global\mathchardef#1"#3\next@#4#5
  \fi}}
\endgroup
```

`\@obsolete` This command gives a warning on the first use that the command given as second argument is deprecated/obsolete, with the third argument recommended as a substitute. In compatibility mode we just continue silently.

```
\long\def\@gobblethree#1#2#3{}
\if@compatibility
  \let\@obsolete\@gobblethree
\else
  \def\@obsolete#1#2#3{\PackageWarning{#1}{%
    Obsolete command \protect#2; \protect#3 should be used instead}}%
\fi
```

`\@subst@obsolete` For obsolete commands that have a substitute command.

```
\def\@subst@obsolete#1#2#3{\@obsolete{#1}#2#3\gdef#2{#3}#2}
```

First we load the symbols under the official AMS names and then define the LaTeX names via `\let` unless they are already defined (which probably means that the `lasy` fonts are defined).

```
\begingroup \catcode`\"=12
\DeclareMathSymbol{\square}           {\mathord}{AMSa}{"03}
\DeclareMathSymbol{\lozenge}          {\mathord}{AMSa}{"06}
\DeclareMathSymbol{\vartriangleright} {\mathrel}{AMSa}{"42}
\DeclareMathSymbol{\vartriangleleft}  {\mathrel}{AMSa}{"43}
\DeclareMathSymbol{\trianglerighteq}  {\mathrel}{AMSa}{"44}
\DeclareMathSymbol{\trianglelefteq}   {\mathrel}{AMSa}{"45}
\DeclareMathSymbol{\rightsquigarrow}  {\mathrel}{AMSa}{"20}
```

Check if the `latexsym` package has already been loaded

```
\@ifpackageloaded{latexsym}{\@tempswafalse}{\@tempswatrue}
\if@tempswa
  \global\let\Box\square
  \global\let\Diamond\lozenge
  \global\let\leadsto\rightsquigarrow
```

`\lhd` and its relatives look like `\vartriangleleft` and its relatives, but the math atom types are different (according to the LaTeX book). So we need to issue different `\DeclareMathSymbol` statements.

```
  \global\let\lhd\@@undefined
  \global\let\unlhd\@@undefined
  \global\let\rhd\@@undefined
  \global\let\unrhd\@@undefined
  \DeclareMathSymbol{\lhd}     {\mathbin}{AMSa}{"43}
  \DeclareMathSymbol{\unlhd}   {\mathbin}{AMSa}{"45}
  \DeclareMathSymbol{\rhd}     {\mathbin}{AMSa}{"42}
  \DeclareMathSymbol{\unrhd}   {\mathbin}{AMSa}{"44}
```

No equivalent of the `\Join` symbol in `lasy` is available in `msam` or `msbm` so we make do with a composite of two characters.

```
\xdef\Join{\mathrel{\mathchar"0\hexnumber@\symAMSb 6F\mkern-13.8mu%
  \mathchar"0\hexnumber@\symAMSb 6E}}
\fi
\endgroup
```

The usual `\endinput` to ensure that random garbage at the end of the file doesn't get copied by `docstrip`.

```
\endinput
```