The statmath package*

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Abstract

Applied and theoretical papers in statistics usually contain a number of notational conventions which are currently lacking in the popular `amsmath` package. This package provides commands for such standard statistical-mathematical language, including bold Roman and Greek letters, convergence symbols, matrix operations.

1 Introduction

Applied and theoretical papers in statistics usually contain a number of notational conventions which are currently lacking in the popular `amsmath` package. The seasoned LaTeX user will see that the provided commands are simple, almost trivial, but will hopefully offer less cluttered preambles as well as a welcome help for novice users.

2 Usage

`\bfA`	Capital Roman letter: $\mathbf{A}$
`\bfa`	Lower-case Roman letter: $\mathbf{a}$
`\bfGamma`	Capital Greek letter: $\mathbf{\Gamma}$
`\bfalpha`	Lower-case Greek letter: $\boldsymbol{\alpha}$
`\bfzero`	Bold zero: $\mathbf{0}$
`\cov`	Covariance: $\mathrm{Cov}(X, Y)$
`\E`	Expectation: $\mathrm{E}(X)$
`\V`	Variance: $\mathrm{V}(X)$
`\inas`	Convergence almost surely: $X_n \xrightarrow{a.s.} X$
`\inprob`	Convergence in probability: $X_n \xrightarrow{p} X$
`\indist`	Convergence in distribution: $X_n \xrightarrow{d} X$
`\plim`	Probability limit: $\operatorname{plim} X_n = X$
`\tr`	Trace of matrix: $\mathrm{tr}(\mathbf{A})$
`\vc`	Vectorization of matrix: $\mathrm{vec}(\mathbf{A})$

*This document corresponds to statmath v0.1, dated 2018/03/08.

`\vcs` Strict half-vectorization of matrix: vecs($\mathbf{A}$)
`\vch` Half-vectorization of matrix: vech($\mathbf{A}$)
`\diag` Diagonal of matrix: diag($\mathbf{A}$)
`\argmin` Minimize argument: $\hat{\theta} = \arg\min_{\theta \in \Theta} f(\theta)$
`\argmax` Maximize argument: $\hat{\theta} = \arg\max_{\theta \in \Theta} f(\theta)$

3 Implementation

The default is to use `\mathbf` for Roman letters and `\boldsymbol` for Greek letters. Both can be changed (individually) to `\bm`.

```
\RequirePackage{amsmath}
\RequirePackage{bm}%

\DeclareOption{abcbm}{%
   \let\abcbf\bm%
}
\DeclareOption{greekbm}{%
   \let\greekbf\bm%
}
\DeclareOption{abcbf}{%
 \let\abcbf\mathbf%
}
\DeclareOption{greekbs}{%
 \let\greekbf\boldsymbol%
}

\ExecuteOptions{abcbf,greekbs}

\ProcessOptions\relax
```

3.1 Bold letters and symbols

`\bfA` Capital letters are obtained by `\bfA`, `\bfB`, etc. The command `\abcbf` is either `\textbf` or `\bm`, depending on options `abcbf` or `abcbm`.

```
\newcommand{\bfA}{\abcbf A}
\newcommand{\bfB}{\abcbf B}
\newcommand{\bfC}{\abcbf C}
\newcommand{\bfD}{\abcbf D}
\newcommand{\bfE}{\abcbf E}
\newcommand{\bfF}{\abcbf F}
\newcommand{\bfG}{\abcbf G}
\newcommand{\bfH}{\abcbf H}
\newcommand{\bfI}{\abcbf I}
\newcommand{\bfJ}{\abcbf J}
\newcommand{\bfK}{\abcbf K}
\newcommand{\bfL}{\abcbf L}
```

```
\newcommand{\bfM}{\abcbf M}
\newcommand{\bfN}{\abcbf N}
\newcommand{\bfO}{\abcbf O}
\newcommand{\bfP}{\abcbf P}
\newcommand{\bfQ}{\abcbf Q}
\newcommand{\bfR}{\abcbf R}
\newcommand{\bfS}{\abcbf S}
\newcommand{\bfT}{\abcbf T}
\newcommand{\bfU}{\abcbf U}
\newcommand{\bfV}{\abcbf V}
\newcommand{\bfW}{\abcbf W}
\newcommand{\bfX}{\abcbf X}
\newcommand{\bfY}{\abcbf Y}
\newcommand{\bfZ}{\abcbf Z}
```

`\bfa` Lower-case letters are obtained by `\bfa`, `\bfb`, etc. The command `\abcbf` is either `\textbf` or `\bm`, depending on options `abcbf` or `abcbm`.

```
\newcommand{\bfa}{\abcbf a}
\newcommand{\bfb}{\abcbf b}
\newcommand{\bfc}{\abcbf c}
\newcommand{\bfd}{\abcbf d}
\newcommand{\bfe}{\abcbf e}
\newcommand{\bff}{\abcbf f}
\newcommand{\bfg}{\abcbf g}
\newcommand{\bfh}{\abcbf h}
\newcommand{\bfi}{\abcbf i}
\newcommand{\bfj}{\abcbf j}
\newcommand{\bfk}{\abcbf k}
\newcommand{\bfl}{\abcbf l}
\newcommand{\bfm}{\abcbf m}
\newcommand{\bfn}{\abcbf n}
\newcommand{\bfo}{\abcbf o}
\newcommand{\bfp}{\abcbf p}
\newcommand{\bfq}{\abcbf q}
\newcommand{\bfr}{\abcbf r}
\newcommand{\bfs}{\abcbf s}
\newcommand{\bft}{\abcbf t}
\newcommand{\bfu}{\abcbf u}
\newcommand{\bfv}{\abcbf v}
\newcommand{\bfw}{\abcbf w}
\newcommand{\bfx}{\abcbf x}
\newcommand{\bfy}{\abcbf y}
\newcommand{\bfz}{\abcbf z}
```

`\bfalpha` Lower-case Greek letters are obtained by `\bfalpha`, `\bfbeta`, etc. The command `\greekbf` is either `\boldsymbol` or `\bm`, depending on options `greekbs` or `greekbm`.

```
\newcommand{\bfalpha}{\greekbf \alpha}
\newcommand{\bfbeta}{\greekbf \beta}
```

```
\newcommand{\bfdelta}{\greekbf \delta}
\newcommand{\bfepsilon}{\greekbf \epsilon}
\newcommand{\bfvarepsilon}{\greekbf \varepsilon}
\newcommand{\bfzeta}{\greekbf \zeta}
\newcommand{\bfeta}{\greekbf \eta}
\newcommand{\bftheta}{\greekbf \theta}
\newcommand{\bfvartheta}{\greekbf \vartheta}
\newcommand{\bfgamma}{\greekbf \gamma}
\newcommand{\bfkappa}{\greekbf \kappa}
\newcommand{\bflambda}{\greekbf \lambda}
\newcommand{\bfmu}{\greekbf \mu}
\newcommand{\bfnu}{\greekbf \nu}
\newcommand{\bfxi}{\greekbf \xi}
\newcommand{\bfpi}{\greekbf \pi}
\newcommand{\bfvarpi}{\greekbf \varpi}
\newcommand{\bfrho}{\greekbf \rho}
\newcommand{\bfvarrho}{\greekbf \varrho}
\newcommand{\bfsigma}{\greekbf \sigma}
\newcommand{\bfvarsigma}{\greekbf \varsigma}
\newcommand{\bftau}{\greekbf \tau}
\newcommand{\bfupsilon}{\greekbf \upsilon}
\newcommand{\bfphi}{\greekbf \phi}
\newcommand{\bfvarphi}{\greekbf \varphi}
\newcommand{\bfchi}{\greekbf \chi}
\newcommand{\bfpsi}{\greekbf \psi}
\newcommand{\bfomega}{\greekbf \omega}
\newcommand{\bfiota}{\greekbf \iota}
```

`\bfGamma` Capital Greek letters are obtained by `\bfGamma`, `\bfDelta`, etc. The command `\greekbf` is either `\boldsymbol` or `\bm`, depending on options `greekbs` or `greekbm`.

```
\newcommand{\bfGamma}{\greekbf \Gamma}
\newcommand{\bfDelta}{\greekbf \Delta}
\newcommand{\bfTheta}{\greekbf \Theta}
\newcommand{\bfLambda}{\greekbf \Lambda}
\newcommand{\bfXi}{\greekbf \Xi}
\newcommand{\bfPi}{\greekbf \Pi}
\newcommand{\bfSigma}{\greekbf \Sigma}
\newcommand{\bfUpsilon}{\greekbf \Upsilon}
\newcommand{\bfPhi}{\greekbf \Phi}
\newcommand{\bfPsi}{\greekbf \Psi}
\newcommand{\bfOmega}{\greekbf \Omega}
```

`\bfzero` Bold zero. The command `\greekbf` is either `\boldsymbol` or `\bm`, depending on options `greekbs` or `greekbm`.

```
\newcommand{\bfzero}{\greekbf 0}
```

3.2 Statistical operators and concepts

Statistical operators for covariance, expectation and variance.

```
   \cov
        113 \DeclareMathOperator{\cov}{Cov}
     \E
        114 \DeclareMathOperator{\E}{E}
     \V
        115 \DeclareMathOperator{\V}{V}
  \inas
        116 \newcommand{\inas}{\overset{a.s.}{\to}}
\inprob
        117 \newcommand{\indist}{\overset{d}{\to}}
\indist
        118 \newcommand{\inprob}{\overset{p}{\to}}
  \plim
        119 \DeclareMathOperator{\plim}{plim}
```

3.3 Matrix and mathematical operators

```
    \tr
        120 \DeclareMathOperator{\tr}{tr}
    \vc
        121 \DeclareMathOperator{\vc}{vec}
   \vcs
        122 \DeclareMathOperator{\vcs}{vecs}
   \vch
        123 \DeclareMathOperator{\vch}{vech}
  \diag
        124 \DeclareMathOperator{\diag}{diag}
\argmin
        125 \DeclareMathOperator{\argmin}{arg\,min}
\argmax
        126 \DeclareMathOperator{\argmax}{arg\,max}
```