The statmath package*

Sebastian Ankargren
sebastian.ankargren@statistics.uu.se

March 8, 2018

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
\bfB
\bfC
\bfD
\bfE
\bfF
\bfG
\bfH
\bfI
\bfJ
\bfK
\bfL
\bfM
\bfN
\bfO
\bfP
\bfQ
\bfR
\bfS
\bfT
\bfU
\bfV
\bfW
\bfX
\bfY
\bfZ

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
\bfb
\bfc
\bfd
\bfe
\bff
\bfg
\bfh
\bfi
\bfj
\bfk
\bfl
\bfm
\bfn
\bfo
\bfp
\bfq
\bfr
\bfs
\bft
\bfu
\bfv
\bfw
\bfx
\bfy
\bfz

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

```
46 \newcommand{\bfa}{\abcbf a}
47 \newcommand{\bfb}{\abcbf b}
48 \newcommand{\bfc}{\abcbf c}
49 \newcommand{\bfd}{\abcbf d}
50 \newcommand{\bfe}{\abcbf e}
51 \newcommand{\bff}{\abcbf f}
52 \newcommand{\bfg}{\abcbf g}
53 \newcommand{\bfh}{\abcbf h}
54 \newcommand{\bfi}{\abcbf i}
55 \newcommand{\bfj}{\abcbf j}
56 \newcommand{\bfk}{\abcbf k}
57 \newcommand{\bfl}{\abcbf l}
58 \newcommand{\bfm}{\abcbf m}
59 \newcommand{\bfn}{\abcbf n}
60 \newcommand{\bfo}{\abcbf o}
61 \newcommand{\bfp}{\abcbf p}
62 \newcommand{\bfq}{\abcbf q}
63 \newcommand{\bfr}{\abcbf r}
64 \newcommand{\bfs}{\abcbf s}
65 \newcommand{\bft}{\abcbf t}
66 \newcommand{\bfu}{\abcbf u}
67 \newcommand{\bfv}{\abcbf v}
68 \newcommand{\bfw}{\abcbf w}
69 \newcommand{\bfx}{\abcbf x}
70 \newcommand{\bfy}{\abcbf y}
71 \newcommand{\bfz}{\abcbf z}
```

\bfalpha
\bfbeta
\bfdelta
\bfepsilon
\bfvarepsilon
\bfzeta
\bfeta
\bftheta
\bfvartheta
\bfgamma
\bfkappa
\bflambda
\bfmu
\bfnu
\bfxi
\bfpi
\bfvarpi
\bfrho
\bfvarrho
\bfsigma
\bfvarsigma
\bftau
\bfupsilon
\bfphi
\bfvarphi
\bfchi
\bfpsi
\bfomega
\bfiota

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
\bfDelta
\bfTheta
\bfLambda
\bfXi
\bfPi
\bfSigma
\bfUpsilon
\bfPhi
\bfPsi
\bfOmega

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
  \E
  \V
\DeclareMathOperator{\cov}{Cov}
\DeclareMathOperator{\E}{E}
\DeclareMathOperator{\V}{V}

\inas
\inprob
\indist
\plim
\newcommand{\inas}{\overset{a.s.}{\to}}
\newcommand{\indist}{\overset{d}{\to}}
\newcommand{\inprob}{\overset{p}{\to}}
\DeclareMathOperator{\plim}{plim}
```

3.3 Matrix and mathematical operators

```
\tr
\vc
\vcs
\vch
\diag
\DeclareMathOperator{\tr}{tr}
\DeclareMathOperator{\vc}{vec}
\DeclareMathOperator{\vcs}{vecs}
\DeclareMathOperator{\vch}{vech}
\DeclareMathOperator{\diag}{diag}

\argmin
\argmax
\DeclareMathOperator{\argmin}{arg\,min}
\DeclareMathOperator{\argmax}{arg\,max}
```