

# The `statmath` package\*

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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 L<sup>A</sup>T<sub>E</sub>X 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

<code>\bfA</code>	Capital Roman letter: <b>A</b>
<code>\bfa</code>	Lower-case Roman letter: <b>a</b>
<code>\bfGamma</code>	Capital Greek letter: <b>Γ</b>
<code>\bfalpha</code>	Lower-case Greek letter: <b>α</b> Bold zero: <b>0</b>
<code>\bfzero</code>	Covariance: $\text{Cov}(X, Y)$
<code>\cov</code>	Expectation: $E(X)$
<code>\E</code>	Variance: $V(X)$
<code>\V</code>	Convergence almost surely: $X_n \xrightarrow{a.s.} X$
<code>\inas</code>	Convergence in probability: $X_n \xrightarrow{p} X$
<code>\inprob</code>	Convergence in distribution: $X_n \xrightarrow{d} X$
<code>\indist</code>	Probability limit: $\text{plim } X_n = X$
<code>\plim</code>	Trace of matrix: $\text{tr}(\mathbf{A})$
<code>\tr</code>	Vectorization of matrix: $\text{vec}(\mathbf{A})$
<code>\vc</code>	Strict half-vectorization of matrix: $\text{vecs}(\mathbf{A})$
<code>\vcs</code>	

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

<code>\vch</code>	Half-vectorization of matrix: $\text{vech}(\mathbf{A})$
<code>\diag</code>	Diagonal of matrix: $\text{diag}(\mathbf{A})$
<code>\argmin</code>	Minimize argument: $\hat{\theta} = \arg \min_{\theta \in \Theta} f(\theta)$
<code>\argmax</code>	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`.

```

1 \RequirePackage{amsmath}
2 \RequirePackage{bm}%
3
4 \DeclareOption{abcbm}{%
5   \let\abcbf\bm%
6 }
7 \DeclareOption{greekbm}{%
8   \let\greekbf\bm%
9 }
10 \DeclareOption{abcbf}{%
11   \let\abcbf\mathbf%
12 }
13 \DeclareOption{greekbs}{%
14   \let\greekbf\boldsymbol%
15 }
16
17 \ExecuteOptions{abcbf,greekbs}
18
19 \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`.

```

20 \newcommand{\bfA}{\abcbf A}
21 \newcommand{\bfB}{\abcbf B}
22 \newcommand{\bfC}{\abcbf C}
23 \newcommand{\bfD}{\abcbf D}
24 \newcommand{\bfE}{\abcbf E}
25 \newcommand{\bfF}{\abcbf F}
26 \newcommand{\bfG}{\abcbf G}
27 \newcommand{\bfH}{\abcbf H}
28 \newcommand{\bfI}{\abcbf I}
29 \newcommand{\bfJ}{\abcbf J}
30 \newcommand{\bfK}{\abcbf K}
31 \newcommand{\bfL}{\abcbf L}
32 \newcommand{\bfM}{\abcbf M}

```

```

33 \newcommand{\bfN}{\abcbf N}
34 \newcommand{\bfO}{\abcbf O}
35 \newcommand{\bfP}{\abcbf P}
36 \newcommand{\bfQ}{\abcbf Q}
37 \newcommand{\bfR}{\abcbf R}
38 \newcommand{\bfS}{\abcbf S}
39 \newcommand{\bfT}{\abcbf T}
40 \newcommand{\bfU}{\abcbf U}
41 \newcommand{\bfV}{\abcbf V}
42 \newcommand{\bfW}{\abcbf W}
43 \newcommand{\bfX}{\abcbf X}
44 \newcommand{\bfY}{\abcbf Y}
45 \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`.

```

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

```

72 \newcommand{\bfalpha}{\greekbf \alpha}
73 \newcommand{\bfbeta}{\greekbf \beta}
74 \newcommand{\bfdelta}{\greekbf \delta}

```

```

75 \newcommand{\bfepsilon}{\greekbf \epsilon}
76 \newcommand{\bfvarepsilon}{\greekbf \varepsilon}
77 \newcommand{\bfzeta}{\greekbf \zeta}
78 \newcommand{\bfeta}{\greekbf \eta}
79 \newcommand{\bftheta}{\greekbf \theta}
80 \newcommand{\bfvartheta}{\greekbf \vartheta}
81 \newcommand{\bfgamma}{\greekbf \gamma}
82 \newcommand{\bfkappa}{\greekbf \kappa}
83 \newcommand{\bflambda}{\greekbf \lambda}
84 \newcommand{\bfmu}{\greekbf \mu}
85 \newcommand{\bfnu}{\greekbf \nu}
86 \newcommand{\bfxi}{\greekbf \xi}
87 \newcommand{\bfpi}{\greekbf \pi}
88 \newcommand{\bfvarpi}{\greekbf \varpi}
89 \newcommand{\bfrho}{\greekbf \rho}
90 \newcommand{\bfvarrho}{\greekbf \varrho}
91 \newcommand{\bfsigma}{\greekbf \sigma}
92 \newcommand{\bfvarsigma}{\greekbf \varsigma}
93 \newcommand{\bftau}{\greekbf \tau}
94 \newcommand{\bfupsilon}{\greekbf \upsilon}
95 \newcommand{\bfphi}{\greekbf \phi}
96 \newcommand{\bfvarphi}{\greekbf \varphi}
97 \newcommand{\bfchi}{\greekbf \chi}
98 \newcommand{\bfpsi}{\greekbf \psi}
99 \newcommand{\bfomega}{\greekbf \omega}
100 \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**.

```

101 \newcommand{\bfGamma}{\greekbf \Gamma}
102 \newcommand{\bfDelta}{\greekbf \Delta}
103 \newcommand{\bfTheta}{\greekbf \Theta}
104 \newcommand{\bfLambda}{\greekbf \Lambda}
105 \newcommand{\bfXi}{\greekbf \Xi}
106 \newcommand{\bfPi}{\greekbf \Pi}
107 \newcommand{\bfSigma}{\greekbf \Sigma}
108 \newcommand{\bfUpsilon}{\greekbf \Upsilon}
109 \newcommand{\bfPhi}{\greekbf \Phi}
110 \newcommand{\bfPsi}{\greekbf \Psi}
111 \newcommand{\bfOmega}{\greekbf \Omega}

```

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

```

112 \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}

```