The proba package*

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1 Introduction

The `proba` package provides some shortcuts to mathematical symbols commonly used when writing articles about probability theory. You should be aware that some of those shortcuts may intersect with other package commands, or worse attempt to redefine commands defined elsewhere.

In fact, I have not tried to really look at the number of packages that already exist.

The shortcuts are defined with some default symbols associated to them, but can easily be customized. In fact, it happens quite often that one needs the same sort of symbol, just with a different letter, in the same document, and the shortcuts are defined in such a way to accomodate with this need.

2 Implementation

In this section we shall describe the syntax of the commands, as well as the implementation.

2.1 Sets

We define the set symbols as blackboard letters as provided by the `amsfonts` package. For those symbols as well as for others, the `amsfonts` package is therefore required.

```
\RequirePackage{amsfonts}
```

The usual syntax to obtain a set name is `\<Capital Letter>`. More precisely:

```
\DeclareRobustCommand{\A}[0]{\mathbb{A}}
\DeclareRobustCommand{\B}[0]{\mathbb{B}}
\DeclareRobustCommand{\C}[0]{\mathbb{C}}
\DeclareRobustCommand{\D}[0]{\mathbb{D}}
\DeclareRobustCommand{\E}[0]{\mathbb{E}}
\DeclareRobustCommand{\F}[0]{\mathbb{F}}
\DeclareRobustCommand{\G}[0]{\mathbb{G}}
\DeclareRobustCommand{\H}[0]{\mathbb{H}}
\DeclareRobustCommand{\I}[0]{\mathbb{I}}
\DeclareRobustCommand{\J}[0]{\mathbb{J}}
```

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```
\DeclareRobustCommand{\K}[0]{\mathbb{K}}
\DeclareRobustCommand{\L}[0]{\mathbb{L}}
\DeclareRobustCommand{\M}[0]{\mathbb{M}}
\DeclareRobustCommand{\N}[0]{\mathbb{N}}
\DeclareRobustCommand{\O}[0]{\mathbb{O}}
\DeclareRobustCommand{\P}[0]{\mathbb{P}}
\DeclareRobustCommand{\Q}[0]{\mathbb{Q}}
\DeclareRobustCommand{\R}[0]{\mathbb{R}}
\DeclareRobustCommand{\S}[0]{\mathbb{S}}
\DeclareRobustCommand{\T}[0]{\mathbb{T}}
\DeclareRobustCommand{\U}[0]{\mathbb{U}}
\DeclareRobustCommand{\V}[0]{\mathbb{V}}
\DeclareRobustCommand{\W}[0]{\mathbb{W}}
\DeclareRobustCommand{\X}[0]{\mathbb{X}}
\DeclareRobustCommand{\Y}[0]{\mathbb{Y}}
\DeclareRobustCommand{\Z}[0]{\mathbb{Z}}
```

Note that the `\mathbb` command ensures that those shortcuts to sets can be used in math mode only.

2.2 σ-fields and filtrations

In probability, the σ-fields and filtrations are commonly designated by letters in calligraphic style. Since such symbols are often needed in a probability-related document, we provide shortcuts to them. The usual syntax in this case is `\cal<Capital Letter>`.

```
\DeclareRobustCommand{\calA}[0]{{\mathcal A}}
\DeclareRobustCommand{\calB}[0]{{\mathcal B}}
\DeclareRobustCommand{\calC}[0]{{\mathcal C}}
\DeclareRobustCommand{\calD}[0]{{\mathcal D}}
\DeclareRobustCommand{\calE}[0]{{\mathcal E}}
\DeclareRobustCommand{\calF}[0]{{\mathcal F}}
\DeclareRobustCommand{\calG}[0]{{\mathcal G}}
\DeclareRobustCommand{\calH}[0]{{\mathcal H}}
\DeclareRobustCommand{\calI}[0]{{\mathcal I}}
\DeclareRobustCommand{\calJ}[0]{{\mathcal J}}
\DeclareRobustCommand{\calK}[0]{{\mathcal K}}
\DeclareRobustCommand{\calL}[0]{{\mathcal L}}
\DeclareRobustCommand{\calM}[0]{{\mathcal M}}
\DeclareRobustCommand{\calN}[0]{{\mathcal N}}
\DeclareRobustCommand{\calO}[0]{{\mathcal O}}
\DeclareRobustCommand{\calP}[0]{{\mathcal P}}
\DeclareRobustCommand{\calQ}[0]{{\mathcal Q}}
\DeclareRobustCommand{\calR}[0]{{\mathcal R}}
\DeclareRobustCommand{\calS}[0]{{\mathcal S}}
\DeclareRobustCommand{\calT}[0]{{\mathcal T}}
\DeclareRobustCommand{\calU}[0]{{\mathcal U}}
\DeclareRobustCommand{\calV}[0]{{\mathcal V}}
\DeclareRobustCommand{\calW}[0]{{\mathcal W}}
\DeclareRobustCommand{\calX}[0]{{\mathcal X}}
\DeclareRobustCommand{\calY}[0]{{\mathcal Y}}
\DeclareRobustCommand{\calZ}[0]{{\mathcal Z}}
```

2.3 Probability symbols

Now we deal with symbols more directly related to probability. Probability laws and expectations are often denoted by blackboard letters. Although shortcuts to such letters have already been defined in the set shortcuts, new ones are introduced that also handle any delimiters needed.

2.3.1 Elementary probability

First some shortcuts to symbols that are used at all levels of probability theory.

`\prob` First we define a simple `\prob` shortcut that simply produces a blackboard capital P by default, but whose optional argument makes it easy to switch to a different letter.

```
\DeclareRobustCommand{\prob}[1][P]{\ensuremath {\mathbb{#1}}}
```

`\probX` Our next command defines a proability and takes as an argument the event in the probability. Again, P is the default probability symbol, but any letter can override it as an optional argument.

```
\DeclareRobustCommand{\probX}[2][{\mathbb{P}}]{\ensuremath{ {#1}\left[ {#2} \right]}}
```

`\cprobX` `\cprobX` offers a shortcut to type conditional probability. It takes 3 arguments: the first one is the symbol to be used as the probability, the second one is the event and the last one is the conditioning.

```
\DeclareRobustCommand{\probCX}[3][{\mathbb{P}}]{\ensuremath{ {#1}\left[ {#2} \big| {#3} \right
```

`\EX` Now are defined the expectation related symbols. We begin by a simple expectation that takes care of delimiters.

```
\DeclareRobustCommand{\EX}[2][{\mathbb{E}}]{\ensuremath {#1}\left[ {#2} \right]}
```

`\cEX` Just like for probabilities, a conditional version of the expectation is provided.

```
\DeclareRobustCommand{\cEX}[3][{\mathbb{E}}]{\ensuremath {#1}\left[ {#2} \big| {#3} \right]}
```

`\Var` Also a math operator is defined for the variance. This simple version has just an optional argument that goes as a subscript to "Var".

```
\DeclareRobustCommand{\Var}[1][]{\ensuremath{\mathrm{Var[#1]}}}
```

`\VarX` Now we take care of delimiters for what is inside the variance.

```
\DeclareRobustCommand{\VarX}[2][]{\ensuremath{\mathrm{Var}_{#1}\left[ {#2} \right]}}
```

`\cVarX` A conditional variance command is also provided, although less often used.

```
\DeclareRobustCommand{\cVarX}[3][]{\ensuremath \mathrm{Var}_{#1}\left[ {#2} \big| {#3} \right]
```

`\eqlaw` A shortcut for equality in law is provided.

```
\DeclareRobustCommand{\eqlaw}[0]{\mathop{\stackrel{(d)}{=}}}
```

`\tolaw` `\tolaw` is a shortcut to a symbol for convergence in law.

```
\DeclareRobustCommand{\tolaw}[0]{\mathop{\stackrel{(d)}{\longrightarrow}}}
```

2.3.2 Stochastic processes

Some notation is customary when dealing with stochastic processes. Note that the same notation is sometimes used also in other parts of mathematics.

\qvar The quadratic variation of two processes arises quite often. The command \qvargives the right bracket of two processes.

```
64 \DeclareRobustCommand{\qvar}[2]{\ensuremath{\left[ {#1},{#2} \right]}}
```

\cqvar Obviously, a shortcut for the conditional quadratic variation, or oblique bracket is also provided.

```
65 \DeclareRobustCommand{\cqvar}[2]{\ensuremath{\langle {#1},\,{#2} \rangle}}
```

2.4 Miscellany

Some miscellaneous symbols or functions defined here.

\1 First, an indicator function, that prints a bold 1 and puts curly braces.

```
66 \DeclareRobustCommand{\1}[1]{\ensuremath \mathbf{1}_{\{#1\}}}
```