

Using the Bard Macros Style File for Homework with Proofs

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1 Introduction

This manual explains how to use the style file “bardmacros.sty.” This style file is designed for homework assignments in upper level mathematics classes, such as Proofs and Fundamentals, Abstract Algebra, Real Analysis and Topology. It takes care of a number of formatting issues such as exercises, definitions and the like, and has specific macros for various upper level classes. It is assumed that you already know the basics of LaTeX. Only the specific macros defined in this style file are discussed here.

1.1 *Obtaining the Bard Macros Style File*

The file bardmacros.sty, as well as the associated template bardmacros_template.tex, can be downloaded from the website

`http://math.bard.edu/bloch/tex.shtml`.

If you find any errors in bardmacros.sty, or you have any suggestions for improvements, please send an email to `bloch@bard.edu`.

1.2 *Read this Whole Manual*

Though it may seem obvious, please read through this entire manual before starting to write your project. Familiarizing yourself with what has already been defined in the Bard macros style file will save you the effort of figuring out how to do those things yourself.

1.3 *Read the Writing Guidelines for Homework with Proofs*

Knowing the proper LaTeX commands for the Bard macros style file is very helpful for writing a project, but even more important is to follow good writing practices for mathematics. For help with mathematical writing, please read the Writing Guidelines for Homework with Proofs. The Writing Guidelines can be downloaded from the same place as the Bard macros style file.

2 Document Formatting

The first two topics regarding document formatting listed below include commands that are specific to the Bard macros style file; the remaining topic uses standard \LaTeX commands.

2.1 *Name, Course Name and Date*

At the start of your document insert

```
\hwinfo{[Your name]}{[Course name]}{[Date of assignment]}
```

into your text immediately after

```
\begin{document}
```

Make sure you put in your own name, your course name, and the date the assignment is due, and remove the [] symbols (which are meant to imply that your own text needs to be inserted).

2.2 *Double-Spaced vs. Single-Spaced*

If you want to double-space your assignment, insert

```
\doublespace
```

into your text immediately after the homework information.

To undo double-spacing at any point, insert

```
\singlespace
```

into your text.

The default setting found in the template `bardmacros_template.tex` is single-spaced.

2.3 *Double-Sided vs. Single-Sided*

The default setting for Bard macros style is two-sided printing. If you want to print single-sided, you **MUST** change the default setting, which is done by adding “, oneside” (including the comma) right after `reqno` in the the `\documentclass` declaration in the very first line of the document.

3 Mathematical Formatting

The Bard macros style file has commands for exercises, theorems, proofs, and the like, as well as various specialized mathematical notation that is useful in proofs-based mathematics courses.

3.1 Exercises, Theorems, Proofs and the Like

The format for exercises, theorems, definitions, etc. are shown below, using the particular case of exercises as an example. The analogous commands for theorems, definitions, etc. are given in the tables on the following pages.

1.

Exercise 3.2.1. For this exercise, you given the number. ◇

```
\exero{3.2.1}
For this exercise, you given the number.
\eexero
```

2.

Exercise 3.2.1 Fred's Theorem. For this exercise, you give the number, and it also has a name. ◇

```
\exero{3.2.1}[Fred's Theorem]
For this exercise, you give the number, and it also has a name.
\eexero
```

3.

Exercise. This exercise does not have a number. ◇

```
\exern
This exercise does not have a number.
\eexern
```

4.

Exercise Theorem of Fred. This exercise does not have a number, and it also has a name. ◇

```
\exern[Theorem of Fred]
This exercise does not have a number, and it also has a name.
\eexern
```

5.

Exercise 1. This exercise is automatically numbered.

```
\exer\label{thmA}
This exercise is automatically numbered.
\exer
```

6.

Exercise 2 F. Smith's Theorem. This exercise is automatically numbered, and it also has a name.

```
\exer[F.\ Smith's Theorem]\label{pig}
This exercise is automatically numbered, and it also has a name.
\exer
```

7.

This is Theorem 1; it is automatically numbered, so you use `\ref` with the internal label.

```
This is Theorem~\ref{thmA}; it is automatically numbered,
so you use \verb@\ref@ with the internal label.
```

8.

This is Theorem 3.2.1; it is not automatically numbered, so you write the number directly.

```
This is Theorem~3.2.1; it is not automatically numbered,
so you write the number directly.
```

9.

Proof. How could this theorem not be true? □

```
\demo
How could this theorem not be true?
\edemo
```

10.

Proof of Theorem 3.2.1. Obviously, this theorem is true. □

```
\demoname{Proof of Theorem~3.2.1}
Obviously, this theorem is true.
\edemoname
```

You Write the Number

Symbol	Command
Definition	<code>\defno ... \edefno</code>
Exercise	<code>\exero ... \eexero</code>
Problem	<code>\probo ... \eprobo</code>
Theorem	<code>\thmo ... \ethmo</code>
Lemma	<code>\lemo ... \elemo</code>
Corollary	<code>\coroo ... \ecoroo</code>
Proposition	<code>\propo ... \epropo</code>
Conjecture	<code>\conjo ... \econjo</code>
Claim	<code>\clmo ... \eclmo</code>
Example	<code>\explo ... \eexplo</code>
Remark	<code>\remko ... \eremko</code>
Algorithm	<code>\algo ... \ealgo</code>

No Number

Symbol	Command
Definition	<code>\defnn ... \edefnn</code>
Exercise	<code>\exern ... \eexern</code>
Problem	<code>\probn ... \eprobn</code>
Theorem	<code>\thmn ... \ethmn</code>
Lemma	<code>\lemn ... \elemn</code>
Corollary	<code>\coron ... \ecoron</code>
Proposition	<code>\propn ... \epropn</code>
Conjecture	<code>\conjn ... \econjn</code>
Claim	<code>\clmn ... \eclmn</code>
Example	<code>\expln ... \eexpln</code>
Remark	<code>\remkn ... \eremkn</code>
Algorithm	<code>\algn ... \ealgn</code>

Automatic Number

Symbol	Command
Definition	<code>\defn\label{<Label>} ... \edefn</code>
Exercise	<code>\exer\label{<Label>} ... \eexer</code>
Problem	<code>\prob\label{<Label>} ... \eprob</code>
Theorem	<code>\thm\label{<Label>} ... \ethm</code>
Lemma	<code>\lem\label{<Label>} ... \elem</code>
Corollary	<code>\coro\label{<Label>} ... \ecoro</code>
Proposition	<code>\prop\label{<Label>} ... \eprop</code>
Conjecture	<code>\conj\label{<Label>} ... \econj</code>
Claim	<code>\clm\label{<Label>} ... \eclm</code>
Example	<code>\expl\label{<Label>} ... \eexpl</code>
Remark	<code>\remk\label{<Label>} ... \eremk</code>
Algorithm	<code>\alg\label{<Label>} ... \ealg</code>

3.2 General Mathematical Commands

Symbol	Command
$\{x \in X \mid \text{blah}\}$	<code>\{x \in X \mid \text{blah}\}</code>
\mathbb{N}	<code>\nn</code>
\mathbb{Z}	<code>\zz</code>
\mathbb{Q}	<code>\qqq</code>
\mathbb{R}	<code>\rr</code>
\mathbb{R}^n	<code>\rrr{n}</code>
$A \subseteq B$	<code>A \subseteq B</code>
$A \subsetneq B$	<code>A \subsetneqq B</code>
$f: A \rightarrow B$	<code>\func fAB</code>
$g \circ f$	<code>g \circ f</code>
$\bigcup_{i \in I} A_i$	<code>\bigcup_{i \in I} A_i</code>
$\bigcap_{i \in I} A_i$	<code>\bigcap_{i \in I} A_i</code>
$\prod_{i=1}^n A_i$	<code>\prod_{i=1}^n A_i</code>
$x < y$	<code>x \prec y</code>
$x \leq y$	<code>x \preceq y</code>
$x \not< y$	<code>x \nprec y</code>
$x \not\leq y$	<code>x \npreceq y</code>
\mathcal{B}	<code>\mathcal{B}</code>
\mathbf{B}	<code>\mathbf{B}</code>
$\ker f$	<code>\ker f</code>
$\operatorname{im} f$	<code>\im f</code>
1_A	<code>\idmap A</code>

3.3 Groups and Rings Commands

Symbol	Command
$a \equiv b \pmod{n}$	<code>\eqmod abn</code>
$a \not\equiv b \pmod{n}$	<code>\neqmod abn</code>
$[a]$	<code>\relclass a</code>
\mathbb{Z}_n	<code>\zs n</code>
\cong	<code>\isomg</code>
\leq	<code>\subgrp</code>
$\not\leq$	<code>\notsubgrp</code>
$\langle a \rangle$	<code>\grp gen a</code>
$ a $	<code>\eltord a</code>
$ G $	<code>\grpord G</code>
S_n	<code>\permgrp n</code>
A_n	<code>\altgrp n</code>
C_n	<code>\cygrp n</code>
D_n	<code>\digrp n</code>
$H \times K$	<code>H \times K</code>
$(G:H)$	<code>\indexgh GH</code>
$H \triangleleft G$	<code>H \nsubgrp G</code>
$H \not\triangleleft G$	<code>H \notnsubgrp G</code>
$R[x]$	<code>\polrngrx Rx</code>

3.4 Vector Space Commands

Symbol	Command
0	<code>\zsc</code>
0	<code>\zv</code>
$\mathcal{F}(S, F)$	<code>\funcspce SF</code>
$\text{span}(S)$	<code>\spn (S)</code>
$\dim(V)$	<code>\dim (V)</code>
\mathcal{F}	<code>\mathcal{F}</code>
$a_n x^n + \cdots + a_1 x + a_0$	<code>\polyaxn axn</code>
$a_1 x_1 + \cdots + a_n x_n$	<code>\lincombaxn axn</code>
$M_{m \times n}(F)$	<code>\matspce mnF</code>
$V \oplus W$	<code>V \oplus W</code>
E_λ	<code>\espce \lambda</code>
$\langle x, y \rangle$	<code>\ip xy</code>
$\ x\ $	<code>\norm x</code>
$[x]_\beta$	<code>\coordv x{\beta}</code>
$[f]_\beta^\gamma$	<code>\matrep f{\beta}{\gamma}</code>
$[f]_\beta$	<code>\matrepo {f}{\beta}</code>

3.5 Matrix and Linear Map Commands

Symbol	Command
$\ker f$	<code>\ker f</code>
$\operatorname{im} f$	<code>\im f</code>
$\operatorname{nullity}(f)$	<code>\nll (f)</code>
$\operatorname{rank}(f)$	<code>\rk (f)</code>
$g \circ f$	<code>g \rc f</code>
$\mathcal{L}(V, W)$	<code>\linspce VW</code>
$\mathbf{0}$	<code>\zm</code>
f	<code>\mathsf{f}</code>
$\operatorname{tr} A$	<code>\tr A</code>
L_A	<code>\mmap A</code>
$M_{m \times n}(F)$	<code>\matspce mnF</code>
$\operatorname{columnrank} A$	<code>\crk A</code>
$\operatorname{rowrank} A$	<code>\rrk A</code>
$\det A$	<code>\det A</code>
A^\perp	<code>A^\perp</code>
$\operatorname{cof} A$	<code>\cof A</code>

3.6 Column Vector Commands

Symbol	Command
$\begin{bmatrix} 1 \\ 2 \end{bmatrix}$	<code>\scolvecqtwo 12</code>
$\begin{bmatrix} 1 \\ 2 \end{bmatrix}$	<code>\colvecqtwo 12</code>
$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$	<code>\scolvecqthree 123</code>
$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$	<code>\colvecqthree 123</code>
$\begin{bmatrix} x_1 \\ \vdots \\ x_n \end{bmatrix}$	<code>\scolvecqxn xn</code>
$\begin{bmatrix} x_1 \\ \vdots \\ x_n \end{bmatrix}$	<code>\colvecqxn xn</code>
$\begin{bmatrix} a \\ \vdots \\ b \end{bmatrix}$	<code>\scolvecqd ab</code>
$\begin{bmatrix} a \\ \vdots \\ b \end{bmatrix}$	<code>\colvecqd ab</code>

3.7 Matrices Commands

Symbol	Command
$\begin{pmatrix} a & b \\ c & d \end{pmatrix}$	<code>\smtwo abcd</code>
$\begin{pmatrix} a & b \\ c & d \end{pmatrix}$	<code>\mtwo abcd</code>
$\begin{pmatrix} a & b & c \\ d & e & f \\ g & h & i \end{pmatrix}$	<code>\smthree abcdefghi</code>
$\begin{pmatrix} a & b & c \\ d & e & f \\ g & h & i \end{pmatrix}$	<code>\mthree abcdefghi</code>

3.8 Real Analysis Commands

Symbol	Command
$\text{lub } A$	<code>\lub A</code>
$\text{glb } A$	<code>\glb A</code>
$\lim_{x \rightarrow c}$	<code>\limd xc</code>
$\frac{dz}{dy}$	<code>\ddx zy</code>
$\ P\ $	<code>\norm P</code>
$S(f, P, T)$	<code>\rsumm fPT</code>
$\int_a^b f(x) dx$	<code>\intr abfx</code>
$\int_a^b [f + g](x) dx$	<code>\intrn ab{[f + g](x)}x</code>
$M_i(f)$	<code>\maxi fi</code>
$m_i(f)$	<code>\mini fi</code>
$U(f, P)$	<code>\usum fP</code>
$L(f, P)$	<code>\lsum fP</code>
$\overline{\int_a^b f(x) dx}$	<code>\intor abfx</code>
$\underline{\int_a^b f(x) dx}$	<code>\intur abfx</code>
$\big $	<code>\labs \text{\LARGE BIG} \rabs</code>
$\int f(x) dx$	<code>\intir fx</code>
$\int [f + g](x) dx$	<code>\intirn {[f + g](x)}x</code>

3.9 Sequences and Series Commands

Symbol	Command
$\{a_n\}_{n=1}^{\infty}$	<code>\seqa a</code>
$\{a_n\}_{n=0}^{\infty}$	<code>\seqao a</code>
$\{a_n\}_{n=p}^{\infty}$	<code>\seqai ap</code>
$\{a_n + b_n\}_{n=1}^{\infty}$	<code>\seqna {a_n + b_n}</code>
$\{a_n + b_n\}_{n=p}^{\infty}$	<code>\seqnai {a_n + b_n}p</code>
$\{a_w + b_w\}_{w=p}^{\infty}$	<code>\seqnaik {a_w + b_w}pw</code>
$\{a_{n_k}\}_{k=1}^{\infty}$	<code>\subseqa a</code>
$\{a_{n_w}\}_{w=1}^{\infty}$	<code>\subseqak aw</code>
$\sum_{n=1}^{\infty} a_n$	<code>\sera a</code>
$\sum_{n=0}^{\infty} a_n$	<code>\serao a</code>
$\sum_{n=p}^{\infty} a_n$	<code>\serai ap</code>
$\sum_{n=1}^{\infty} (a_n + b_n)$	<code>\serna {(a_n + b_n)}</code>
$\sum_{n=0}^{\infty} (a_n + b_n)$	<code>\sernao {(a_n + b_n)}</code>
$\sum_{n=p}^{\infty} (a_n + b_n)$	<code>\sernai {(a_n + b_n)}p</code>
$\sum_{w=p}^{\infty} (a_w + b_w)$	<code>\sernaik {(a_w + b_w)}pw</code>
$\sum_{n=0}^{\infty} c_n(x - a)^n$	<code>\powser cxa</code>
$\sum_{n=0}^{\infty} (c_n + d_n)(x - a)^n$	<code>\sernai {(c_n + d_n)(x - a)^n}0</code>
$\sum_{n=0}^{\infty} c_n x^n$	<code>\macser cx</code>
$\sum_{n=0}^{\infty} \frac{f^{(n)}(a)}{n!} (x - a)^n$	<code>\taylors fa</code>
$\sum_{n=0}^{\infty} \frac{f^{(n)}(0)}{n!} x^n$	<code>\maclors f</code>

3.10 Topology Commands

Symbol	Command
$\text{Int } A$	<code>\Int A</code>
\overline{A}	<code>\clos A</code>
$B_d(x, \epsilon)$	<code>\balled dx\epsilon</code>
$B(x, \epsilon)$	<code>\balle x\epsilon</code>
\bar{d}	<code>\bar d</code>
\sim	<code>\sim</code>
\simeq	<code>\htp</code>
\simeq_p	<code>\htpp</code>
$C(X, Y)$	<code>\cmp XY</code>
$P(Y; x_0, x_1)$	<code>\psp Y{x_0}{x_1}</code>
$[f]$	<code>\rcl f</code>
$f * g$	<code>f \ast g</code>
$P(X; x_0)$	<code>\lsp X{x_0}</code>
$\pi_1(X, x_0)$	<code>\fgrp X{x_0}</code>
$\hat{\alpha}$	<code>\hat \alpha</code>
$\bar{\alpha}$	<code>\bar \alpha</code>
\cong	<code>\cong</code>

4 Sample Document Outline

The basic structure of a .tex file that uses the Bard macros style file is seen in the sample below. This same outline can be found in the template for bardmacros.sty, which is called bardmacros_template.tex.

To start writing your homework, download the template and rename it with your own file name. It is best if the new name you give the template should include your name and either the assignment or section number, for example janesmithassignment1.tex, or the date of the assignment, for example janesmith09-23-2015.tex. Every time you write a new homework assignment, save a previous assignment as a new file with an appropriate name, and then modify it.

In the template, make sure to put in your own replacements for what is written between [] symbols, and remove the [] symbols (which are meant to imply that your own text needs to be inserted).

```
\documentclass[11pt, reqno]{article}
\usepackage{amssymb, amsthm, amsmath, amsfonts}
\usepackage{graphics}
\usepackage{bardmacros}

%<Your macros, if you have any>

\begin{document}

\hwinfo{[Your Name]}\{[Course]}\{[Date]\}

\doubleSPACE

\exero{[Exercise number]}
[Statement of exercise]
\exero

\demo
[Solution of exercise]
\demo

\end{document}
```