

PDFTOOLBOX

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PDFTOOLBOX offers a variety of tools for creating documents in plain $\text{T}_{\text{E}}\text{X}$. These include packages for structuring documents, coloring documents, etc. **PDFTOOLBOX** is a collection of packages intended to be used with plain $\text{T}_{\text{E}}\text{X}$. It is intended to be self-contained and does not promise compatibility with other packages.

PDFTOOLBOX is still experimental and may be subject to breaking changes. If you have an important document relying on it, the author advises keeping

PDFTOOLBOX is known to not interact with the `color`, `xcolor`, `tikz` and all related packages. This may or may not be changed in the future.

This documentation is split into sections corresponding to the different collections in **PDFTOOLBOX**. These are:

- (1) Data manipulation: counters, dictionaries, etc.
- (2) Document structure: layouts, table of contents, indices, etc.
- (3) Graphics: colors, diagrams, colored boxes, etc.

PDFTOOLBOX depends only on the `apnum` package.

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I. PDFTOOLBOX IN BRIEF

1 pdfData

The pdfData section of the **PDFTOOLBOX** toolbox is meant for creating instances of and manipulating datatypes.

1.1 Arrays

In the pdfData/arrays file, **PDFTOOLBOX** defines various macros for creating and manipulating arrays. There are two types of arrays, which are different in the macros used for them and the way they are stored internally.

- (Normal) arrays: these arrays are stored in the traditional way: an array [1; 2; 3] is stored in a macro whose meaning is equivalent to $\backslash X\{1}\backslash X\{2}\backslash X\{3}$. Manipulation of the array is done by defining $\backslash X$, and then executing the array macro.
- Macro arrays: these arrays are stored in a collection of macros: each element is stored in its own indexed macro. So an array [1; 2; 3] will be stored in three macros, whose values are 1, 2, 3 respectively.

All arrays are zero-indexed.

1.1.1 Normal Arrays

$\backslash createarray$ $\{\langle name \rangle\}$: creates an (normal) array whose name is *name*.

$\backslash ensurearray$ $\{\langle name \rangle\}$: ensures that an array by the name of *name* exists.

$\backslash localizearray$ $\{\langle name \rangle\}$: localizes (see localization) the array named by *name*.

$\backslash appendarray$ $\{\langle name \rangle\}\{\langle value \rangle\}$: appends *value* to the end of the array array named by *name*. *value* is inserted according to $\backslash currdef$.

$\backslash prependarray$ $\{\langle name \rangle\}\{\langle value \rangle\}$: prepends *value* to the end of the array array named by *name*. *value* is inserted according to $\backslash currdef$.

$\backslash appendarraymany$ $\{\langle name \rangle\}\{\langle value1 \rangle\}\{\langle value2 \rangle\} \dots \{\langle valueN \rangle\}$: appends *value1* through *valueN* to the end of the array array named by *name*. Each *value* is inserted according to $\backslash currdef$.

$\backslash arraylen$ $\{\langle name \rangle\}$: expands to the length of the array specified by *name*.

$\backslash getarraylen$ $\{\langle name \rangle\}\langle macro \rangle$: inserts the length of the array specified by *name* into the macro *macro*.

$\backslash arraymap$ $\{\langle name \rangle\}\langle macro \rangle$: if the array specified by *name* is equivalent to $[x_0; \dots; x_N]$ then doing $\backslash arraymap\{name\}\backslash X$ will execute $\backslash X\{x_1\}\{0\} \dots \backslash X\{x_N\}\{N\}$.

$\backslash indexarray$ $\{\langle name \rangle\}\{\langle i \rangle\}\langle macro \rangle$: Puts the *i*th element in the array specified by *name* into the macro *macro*.

$\backslash removearray$ $\{\langle name \rangle\}\{\langle i \rangle\}\langle macro \rangle$: Removes the *i*th element in the array specified by *name* and places it into the macro *macro*.

$\backslash removeitemarray$ $\{\langle name \rangle\}\{\langle value \rangle\}$: Removes all instances of *value* from the array specified by *name* (comparison is done using $\backslash ifx$ on macros containing *value* and the current index).

$\backslash printarray$ $\{\langle name \rangle\}$: Prints the array specified by *name*.

$\backslash copyarray$ $\{\langle src \rangle\}\{\langle dest \rangle\}$: Copies the array *src* into *dest*.

$\backslash concatenatearrays$ $\{\langle arr1 \rangle\}\{\langle arr2 \rangle\}\{\langle dest \rangle\}$: Concatenates the arrays *arr1* and *arr2* and places the result into a new array *dest*.

$\backslash initarray$ $\{\langle name \rangle\}\{\langle x1 \rangle, \dots, \langle xN \rangle\}$: Creates a new array by the name of *name* equivalent to $[x_1; \dots; x_N]$.

$\backslash findarray$ $\{\langle name \rangle\}\{\langle value \rangle\}$: Checks if the value *value* exists in the array *name* (checking is done via $\backslash ifx$). If the value exists, the value $\backslash True$ is placed into $\backslash @return@value$, otherwise it is equal to $\backslash False$.

$\backslash uniqueappendarray$ $\{\langle name \rangle\}\{\langle value \rangle\}$: Appends *value* to the array *name* only if it does not already exist in *name* ($\backslash @return@value$ is set accordingly).

$\backslash convertarray$ $\{\langle src \rangle\}\{\langle dest \rangle\}$: Converts a normal array *src* to a macro array *dest*.

`\mergesort` $\{\langle src \rangle\}\{\langle dest \rangle\}$: Sorts the array *src* and places the result in *dest*.

1.1.2 Macro Arrays

`\createmarray` $\{\langle name \rangle\}$: Creates a macro array by the name of *name*.

`\localizemarray` $\{\langle name \rangle\}$: Localizes (see localization) the macro array specified by *name*.

`\appendmarray` $\{\langle name \rangle\}\{\langle value \rangle\}$: Appends *value* to the macro array specified by *name*.

`\printmarray` $\{\langle name \rangle\}$: Prints the macro array specified by *name*.

`\convertmarray` $\{\langle src \rangle\}\{\langle dest \rangle\}$: Converts the macro array *src* into a normal array *dest*.

`\copymarray` $\{\langle src \rangle\}\{\langle dest \rangle\}$: Copies the macro array *src* into *dest*.

`\initmarray` $\{\langle name \rangle\}\{\langle x1 \rangle, \dots, \langle xN \rangle\}$: Creates a macro array *name* whose value is equivalent to $[x1, \dots, xN]$.

`\findmarray` $\{\langle name \rangle\}\{\langle value \rangle\}\langle macro \rangle$: Searches for *value* in the macro array *name*. If found, sets `\@return@value` to `\True` and *macro* to the index where *value* was found. Otherwise `\@return@value` is set to `\False`.

1.2 Stacks

In the `pdfData/stacks.tex` file, **PDFTOOLBOX** offers macros for creating and manipulating stack data structures. There are two types of stacks, which differ in how they store their data. They are generally used for different purposes:

- Normal stacks: these are normal stacks which store just the values given.
- Macro stacks: these stacks are meant to store only macros: they store both the definition and name of the macro.

1.2.1 Normal Stacks

`\createstack` $\{\langle name \rangle\}$: Creates a normal stack by the name of *name*.

`\stackpush` $\{\langle name \rangle\}\{\langle value \rangle\}$: Pushes the value *value* onto the stack specified by *name*.

`\stackdecrement` $\{\langle name \rangle\}$: Pops from the top of the stack specified by *name* (deleting the value).

`\stackpop` $\{\langle name \rangle\}\langle macro \rangle$: Pops from the top of the stack specified by *name* into *macro*.

`\stacktop` $\{\langle name \rangle\}\langle macro \rangle$: Places the top of the stack specified by *name* into the macro *macro* without popping.

1.2.2 Macro Stacks

Macro stacks store macros, as opposed to values. When pushing a macro `\X` onto the stack, not only is the meaning of `\X` stored, but so is its name.

`\createmacrostack` $\{\langle name \rangle\}$: Creates a macro stack by the name of *name*.

`\macrostackpush` $\{\langle name \rangle\}\langle macro \rangle$: Pushes the macro *macro* onto the macro stack specified by *name*.

`\macrostackdecrement` $\{\langle name \rangle\}$: Pops from the top of the macro stack specified by *name* (deleting the value).

`\macrostackset` $\{\langle name \rangle\}$: If the top of the macro stack specified by *name* has name `\X` and value *value*, sets `\X` to *value*.

`\macrostackpop` $\{\langle name \rangle\}$: Pops from the top of the macro stack specified by *name* (same as `\macrostackset`, but also pops the value off of the stack).

`\macrostackpeek` $\{\langle name \rangle\}\langle macro1 \rangle\langle macro2 \rangle$: If the top of the macro stack specified by *name* is $(\backslash X, value)$, then `\X` is placed into *macro1*, and *value* into *macro2*.

1.3 Localization

Using macro stacks, **PDFTOOLBOX** allows for *localization*. This gives the user the ability to create block scopes (as opposed to just plain-ol' \TeX groups). The usage is simple and as follows:

- (1) The user enters a scope using `\beginscope`.
- (2) The user *localizes* a macro `\X` by doing `\localize\X`.
- (3) The user exits the scope using `\endscope`. Once the scope is exited, the previous definition of localized macros is restored.

So for example,

```

1  \def\X{0}
2  \beginscope
3    \localize\X
4    \def\X{1}
5    \X
6    \beginscope
7      \def\X{2}
8      \X
9    \endscope
10   \X
11 \endscope
12 \X

```

Will output 1 2 2 0. As opposed to

```

1  \def\X{0}
2  \bgroup
3    \def\X{1}
4    \X
5    \bgroup
6      \def\X{2}
7      \X
8    \egroup
9    \X
10 \egroup
11 \X

```

Which will output 1 2 1 0.

1.4 Counters

In the `pdfData/counters.tex`, **PDFTOOLBOX** implements counters. Counters are simple wrappers over plain- \TeX counters. They hold integer values, are mutable, and can be made dependent on one another so that when one is altered another is set to zero.

`\createcounter` $\{ \langle name \rangle \} [\langle c1 \rangle, \dots, \langle cN \rangle]$: Creates a counter by the name *name* dependent on counters *c1*, ..., *cN*.

`\adddependentcounter` $\{ \langle secondary \rangle \} \{ \langle primary \rangle \}$: Makes the *secondary* counter dependent on the *primary* one; whenever *primary* is (non-independently; see e.g. `\setcounter`) altered, *secondary* is set to zero.

`\zerodependents` $\{ \langle primary \rangle \}$: Sets to zero all counters dependent on *primary*.

`\setcounter` $\{ \langle counter \rangle \} \{ \langle amount \rangle \}$: Sets *counter* to *amount* (zeroing all counters dependent on *counter*).

`\advancecounter` $\{ \langle counter \rangle \} \{ \langle amount \rangle \}$: Advances *counter* by *amount* (zeroing all counters dependent on *counter*).

`\setcounter` $\{ \langle counter \rangle \} \{ \langle amount \rangle \}$: Sets *counter* to *amount* (without zeroing all counters dependent on *counter*).

`\advancecounter` $\{\langle counter \rangle\}\{\langle amount \rangle\}$: Advances *counter* by *amount* (without zeroing all counters dependent on *counter*).

`\counter` $\{\langle name \rangle\}$: Returns the T_EX counter corresponding to the PDFTOOLBOX counter *name*. Useful for example when printing the value of a counter: simply do `\the\counter{name}`.

1.5 Dictionaries

In the pdfData/dictionaries.tex file, PDFTOOLBOX implements dictionaries (also colloquially known as “hashmaps” or “maps”). These are simple maps between keys and values.

`\createdict` $\{\langle name \rangle\}$: Creates a dictionary by the name *name*.

`\adddict` $\{\langle name \rangle\}\{\langle key \rangle\}\{\langle value \rangle\}$: Adds the (*key* : *value*) key-value pair to the dictionary specified by *name*.

`\indexdict` $\{\langle name \rangle\}\{\langle key \rangle\}$: Expands to the value of *key* in the dictionary *name*.

`\keyindict` $\{\langle name \rangle\}\{\langle key \rangle\}$: Sets `\@return@value` according to if *key* is found in the dictionary *name*.

1.6 Mappings

In pdfData/key-value.tex, PDFTOOLBOX implements the ability to pass key-value parameters to macros.

`\mapkeys` $\{\langle options \rangle\}\{\langle input \rangle\}$: Maps the key-value pairs given in *input* according to *options*. *options* is itself a set of key-value pairs, where the value of each key is an array which may contain:

- **name** (required): the name of the macro to give the value of the key;
- **required**: added if the key is required;
- **definition**: what definition macro to use for defining the value (e.g. `\def`, `\edef`);
- **mapping**: how to map the input to the value: the input is defined relative to **definition** into a macro wrapped with **mapping**;
- **default**: the default value of the key.

Or the value may be empty (no array), which means it is *valueless* and acts as a boolean flag.

So for example, you may have a macro defined like so:

```

1  \def\puthi #1{Hello (#1)}
2
3  \def\getinput #1{%
4    \mapkeys{
5      first={
6        name=fst,
7        required,
8        definition=\edef,
9        mapping=\puthi%
10     },
11     second={
12       name=snd,
13       default=S. Lurp%
14     }%
15   }{#1}%
16 }
17
18 \getinput{first=pdftoolbox}
19 (\fst) (\snd)

```

This will output (Hello (pdftoolbox)) (S. Lurp).

`\keyexists` $\{\langle key \rangle\}\langle macro \rangle\backslash lastkeys$: This is an internal command, added to this documentation only due to its usefulness. Given a key name *key*, this macro checks if it exists in the map corresponding to the last call to `\mapkeys` (the macro itself is more versatile, but we restrict it to this case). If the key does not exist, then *macro* is set to `_nul`. This is useful with valueless keys.

`\mapkeys` is a bit finicky when it comes to spaces and commas, but the rule is simple: place a comment at the end of each list. That means that within each key's array, you must place a comment at the end (otherwise an extraneous space is added to the value), and after the last key's array you must place a comment.

2 pdfDstruct

The pdfDstruct section of the **PDFTOOLBOX** toolbox is for managing the structure of your documents.

2.1 Layout

In pdfDstruct/layout.tex, **PDFTOOLBOX** provides a macro `\setlayout` for setting up the layout of the document. The use is

```
\setlayout {[page width=<wd>],} [page height=<ht>],] [horizontal margin=<hwd>],]
           [vertical margin=<vwd>]]}
```

2.2 Hyperlinks

In pdfDstruct/hyperlinks.tex, **PDFTOOLBOX** provides macros for creating and managing hyperlinks.

`\anchor` [*type*]{*name*}: Creates an anchor (a reference, if you will) to the current point in the document.

`\gotoanchor` [*type*]{*name*}{*material*}: Creates a clickable field containing *material* which, when clicked, will go to the anchor labeled with the type *type* and name *name*.

`\url` {*url*}{*material*}: Creates a clickable field containing *material* which, when clicked, will redirect to the url *url*.

`\createbordertype` {*type*}{*color*}{*wd*}: Sets the border type of anchor type *type* to be of color *color* and width *wd*. Urls have border type `url`. If a type doesn't have a specified border type, the `default` one is used.

2.3 Fonts

In pdfDstruct/fonts.tex, **PDFTOOLBOX** provides macros for accessing and controlling fonts.

`\addfont` {*name*}{*sizes*}: This will add a font by the name *name* so that it is accessible by **PDFTOOLBOX**. *sizes* is a key-value dictionary which specifies the font codes for different sizes of the font. For example, in pdfDstruct/fonts.tex is the usage:

```
1      \addfont{rm}{%
2          default=cmr10,
3          5pt=cmr5,
4          6pt=cmr6,
5          7pt=cmr7,
6          8pt=cmr8,
7          9pt=cmr9,
8          10pt=cmr10,
9          12pt=cmr12,
10         17pt=cmr17
11     }
```

So now **PDFTOOLBOX** has access to the computer modern roman font (`cmr`) at the sizes specified. The purpose of the default size is for when a size is not available. For example, requesting the `rm` font at size 13 will give you `cmr10` at 13pt. The default size is required.

PDFTOOLBOX provides the following fonts:

```
rm: cmr   it: cmti   bf: cmbx   sc: cmcsc   mi: cmmi   sy: cmsy   ex: cmex   sl: cmsl
ss: cmss  tt: cmtt   msam: msam  msbm: msbm  eufm: eufm  rsfs: rsfs
```

`\applyfontcode` *font code*: Applies the font specified by *font code*. For example, `\applyfontcode cmr10` will set the font to `cmr10`.

`\setfontfamily` {*font*}{*family*}: Sets math font family *family* to the font *font* (which is specified by `\addfont`). For example, `\setfontfamily{rm}{0}` sets the alpha-numeric font family to `rm`.

`\setfont {font}`: Sets the current font to *font*. The current font is stored in the macro `\currfont`.

`\setscale {scale}`: Sets the current font scale to *scale*. The current font scale is stored in the macro `\currscale`.

`\setfontandscale {font}{scale}`: Sets the current font to *font* and scale to *scale*.

PDFTOOLBOX also provides the following font switches (which are simple wrappers around `\setfont` which also set `\fam`):

`\bf, \it, \bb, \sf, \sl, \frak, \scr`

`\mathfonttable {family}[offset]{table}`: The `\mathfonttable` macro's purpose is to define multiple mathematical characters for the same family. *table* consists of a sequence of macros followed by numbers (e.g. `\square0`) which correspond to the name of the macro and the math type (in this case 0: ordinary/`\mathord`). `\mathfonttable` will iterate over *table* and `\mathchardef` the macro to be equal to the character at the current position in family *family* of the type specified. If *offset* is specified, it will start iterating over the family starting from the offset.

More explicitly, if *family* is *X* and the *i*th index in the table is `\X N`, then the macro does essentially

`\mathchardef\X = XNi`

To skip over an index, simply write `_`.

Using `\mathfonttable`, **PDFTOOLBOX** defines the following:

<code>\boxdot</code> : \boxdot	<code>\boxplus</code> : \boxplus	<code>\boxtimes</code> : \boxtimes	<code>\square</code> : \square
<code>\blacksquare</code> : \blacksquare	<code>\diamond</code> : \diamond	<code>\blackdiamond</code> : \blacklozenge	<code>\rotateclockwise</code> : \circlearrowright
<code>\rotatecounterclockwise</code> : \circlearrowleft	<code>\rightleftharpoons</code> : \rightleftharpoons	<code>\leftrightharpoons</code> : \leftrightharpoons	<code>\boxminus</code> : \boxminus
<code>\Vdash</code> : \Vdash	<code>\Vvdash</code> : \Vvdash	<code>\vDash</code> : \vDash	<code>\twoheadrightarrow</code> : \twoheadrightarrow
<code>\twoheadleftarrow</code> : \twoheadleftarrow	<code>\leftleftarrows</code> : \leftleftarrows	<code>\rightrightarrows</code> : \rightrightarrows	<code>\upuparrows</code> : \upuparrows
<code>\downwardarrows</code> : \downwardarrows	<code>\uprightharpoon</code> : \uprightharpoon	<code>\downrightharpoon</code> : \downrightharpoon	<code>\upleftharpoon</code> : \upleftharpoon
<code>\downleftharpoon</code> : \downleftharpoon	<code>\rightarrowtail</code> : \rightarrowtail	<code>\leftarrowtail</code> : \leftarrowtail	<code>\leftrightarrows</code> : \leftrightarrows
<code>\rightleftarrows</code> : \rightleftarrows	<code>\Lsh</code> : \Lsh	<code>\Rsh</code> : \Rsh	<code>\rightsquigarrow</code> : \rightsquigarrow
<code>\leftrightsquigarrow</code> : \leftrightsquigarrow	<code>\looparrowleft</code> : \looparrowleft	<code>\looparrowright</code> : \looparrowright	<code>\circeq</code> : \circeq
<code>\succsim</code> : \succsim	<code>\gtrsim</code> : \gtrsim	<code>\gtrapprox</code> : \gtrapprox	<code>\multimap</code> : \multimap
<code>\therefore</code> : \therefore	<code>\because</code> : \because	<code>\Doteq</code> : \doteq	<code>\triangleq</code> : \triangleq
<code>\prec</code> : \prec	<code>\less</code> : \less	<code>\lessapprox</code> : \lessapprox	

2.4 Hooks

PDFTOOLBOX provides a tool, inspired by L^AT_EX, called *hooks* (source in `pdfDstruct/hooks.tex`). Hooks are simply snippets of code that can be inserted into macros and then altered later. An example is given at the end of this section.

`\createhook {name}`: Creates a hook by the name of *name*.

`\appendtohook {name}{code}`: Appends *code* to the hook specified by *name*.

`\prependtohook {name}{code}`: Prepends *code* to the hook specified by *name*.

`\callhook {name}`: Calls the hook specified by *name*.

PDFTOOLBOX provides a builtin hook called `end` which is executed by `\bye`. Throughout the document, you can add macros to an array called `document data`, then all these definitions are written to the file `\jobname.data` by the `end` hook.

Specifically, you can use the `\docdata` macro to add a macro to the document's data, e.g. if you have a macro `\name` which has the author's name (say, S. Lurp), you can do `\docdata\name`, and this will write the line `\gdef\name{S. Lurp}` to the data file. Then at the beginning of the document next compilation, you can load all definitions in the data file.

2.5 Indices

In `pdfDstruct/index.tex`, **PDFTOOLBOX** provides macros for creating an index. The index is organized into *categories* and *items* within each category, and an associated *value*. A category may be something like "manifolds" and an item within this category may be "topological" which has a value corresponding to the page number where topological manifolds are defined.

`\indexize {options}`: Adds an item to the index, specified by options, which has fields:

- (1) `category` (required): the category of the item;
- (2) `item`: the item of the item;
- (3) `value` (required): the value of the item;
- (4) `expand value` (valueless): added if `value` should be expanded (e.g. if `value` is a macro corresponding to the page number, it needs to be expanded);
- (5) `add hyperlink` (valueless): whether or not the item's values should be hyperlinked.

`\seealso {options}`: Adds a “see also” item to the index: one which redirects to another index item. `options` is a map which has fields:

- (1) `category` (required): the category of the item;
- (2) `item`: the item of the item;
- (3) `dest` (required): the destination of the “see also” (e.g. if the item is “wedge product”, you may want to also see “exterior product”, and so the destination may be “exterior product”);
- (4) `hyperlink`: an anchor to link to;
- (5) `index link` (valueless): a flag of whether or not the anchor is within the index.

To link to an item within the index, suppose of category `C` and item `I`, set `hyperlink` to `C:I` (or just `C`: if `I` is empty), and set `index link`.

`\index`: Prints the index.

`\addtoindex {category}[item]`: Adds an item to the index of category `category` and item `item`. Its value is `\@defaultindexval` (by default `\the\pageno`), and `expand value` and `add hyperlink` are set.

2.6 Lists

In `pdfDstruct/lists.tex`, `PDFTOOLBOX` provides macros for creating lists of text.

There are two types of lists: unenumerated and enumerated. Unenumerated lists start with `\blist` and end with `\elist`. Each item begins with `\item`. The symbol used for each bullet point is determined by the nested depth of the list. For a depth of N , the symbol used is stored in the macro `\liststyleN`.

Similarly enumerated lists start with `\benum` and end with `\elist`. Each item begins with `\item`, and the style for the enumeration is determined by the depth of the list. For a depth of N , the n th element is styled with `\enumstyleN{n}`.

To add text in between items (not as part of the list), you can use `\mtext`.

2.7 Table of Contents

In `pdfDstruct/tableofcontents.tex`, `PDFTOOLBOX` provides macros for creating and displaying tables of content.

`\addtoccontent {marker}{title}{value}{depth}{anchor}`: Adds content to the table of contents. The marker is `marker` (e.g. 1.1; this is printed to the left of the title), title is `title` (e.g. chapter name), value is `value` (e.g. page number), depth is `depth`, and is linked to the anchor `anchor`. The depth `depth` determines the style used in the table (see `\settocdepthformat`).

`\tableofcontents`: Prints the table of contents.

`\settocdepthformat {depth}{options}`: Sets the format of the table of contents at the depth `depth`. `options` is a map with the following fields:

- `marker`: the style for the marker (default is `\setfont{rm}`; the marker is passed as a parameter to `marker`);
- `marker buffer`: the buffer between the title and marker (default is `.25cm`);
- `title`: the style for the title (default is `\setfont{rm}`; the title is passed as a parameter to `title`);

- **value**: the style for the value (default is `\setfont{rm}`; the value is passed as a parameter to `value`);
- **leader**: the leader to add between the title and value (default is nothing);
- **indent**: the amount to indent the line (default is 0pt);
- **buffer**: the amount of buffer to add around the line (default is 0pt).

PDFTOOLBOX provides four types of sectioning: parts, sections, subsections, and subsubsections. Each has a counter in its name (e.g. `section`), and a macro with the current section name (e.g. `\currsection`).

`\section (*){\title}`: Adds a section to the document. If the asterisk is added, the section is a “pseudosection”: the section counter is not incremented and not displayed, and the section is not added to the table of contents. Otherwise the section counter is incremented and displayed, and the section is added to the table of contents.

`\subsection (*){\title}`: Adds a subsection to the document. If the asterisk is added, the subsection is a “pseudosubsection”: the subsection counter is not incremented and not displayed, and the subsection is not added to the table of contents. Otherwise the subsection counter is incremented and displayed, and the subsection is added to the table of contents.

`\subsubsection (*){\title}`: Adds a subsubsection to the document. If the asterisk is added, the subsubsection is a “pseudosubsubsection”: the subsubsection counter is not incremented and not displayed, and the subsubsection is not added to the table of contents. Otherwise the subsubsection counter is incremented and displayed, but the subsubsection is still not added to the table of contents.

3 pdfGraphics

The pdfGraphics section of the **PDFTOOLBOX** toolbox is for pdf-specific graphics macros. You can use it to create colorful documents with illustrations, etc.

3.1 Colors

In `pdfGraphics/colors.tex`, **PDFTOOLBOX** provides macros for coloring text and areas of your document.

`\color <color space>{\code}`

`\color {\name}` : Switches the color of the document. In its first form, *color space* corresponds to either `rgb` or `cmyk`, and *code* is either an `rgb` or `cmyk` code. In its second form, if *name* is a predefined color name (see `\definecolor`), the color is switched to it.

`\localcolor <color space>{\code}{\text}`

`\localcolor {\name}{\text}` : Switches the color of *text*, according to the options provided (see `\color`).

`\definecolor {\name}{\color space}{\code}`: Defines a color of name *name* whose space is *color space* (either `rgb` or `cmyk`) of code *code* (either an `rgb` or `cmyk` code).

`\letcolor {\new name}{\name}`: Defines a color of name *new name* to be equal to the existing color of name *name*.

`\definecolormacro {\name}{\color space}{\code}`: Calls `\definecolor`, and also defines a macro of name *name* which is equivalent to `\localcolor <color space>{\code}{\#1}`.

The following colors are defined:

red blue green yellow orange purple ~~white~~ black darkgreen grey

`\highlightbox <color space>{\code}{\material}`

`\highlightbox {\name}{\material}` : Colors the background of the material *material* according to the color provided. For example `\highlightbox {red}{pdfToolbox}` will yield **pdfToolbox**.

`\coloredbox <color space>{\code}{\material}`

`\coloredbox {\name}{\material}` : Like `\highlightbox` but adds a buffer of space around *material* in accordance with `\bufferwidth` and `\bufferheight`. For example the following code: `\coloredbox {red}{pdfToolbox}`; will yield **pdfToolbox**.

`\framecoloredbox` $\langle color\ space\rangle\{\langle code\rangle\}\{\langle material\rangle\}$
`\framecoloredbox` $\{\langle name\rangle\}\{\langle material\rangle\}$: Like `\coloredbox` but adds a frame around *material* of width `\framewidth`. For example `\framecoloredbox {red}{pdfToolbox}` will yield .

`\framebox` $\{\langle material\rangle\}$: Adds a frame around *material* with a buffer of `\bufferwidth` and `\bufferheight` of width `\framewidth`.

`\curvedcolorbox` $\{\langle stroke\ color\rangle\}\{\langle bg\ color\rangle\}\{\langle material\rangle\}\{\langle curve\ control\rangle\}$: Creates a curved color framed box around *material* with frame color *stroke color* and background color *bg color* (which may be names or of the form `<color space>\{<code>\}`). The curve's stroke width is determined by `\curvewidth`, and the buffer around the material is determined by `\curvebuffer`. *control* is a sequence of 4 symbols (either `.` or `X`) which determine whether a corner is curved or not. A `.` corresponds to a curve and a `X` corresponds to a right corner. A shadow of color `\boxshadowcolor` is added to the box, at an *x* and *y* offset of `\shadowxoff` and `\shadowyoff` respectively.

So for example:

```
\curvedcolorbox {blue}{red}\color {white}pdfToolbox}{...} : 
\curvedcolorbox {blue}{red}\color {white}pdfToolbox}{X...} : 
\curvedcolorbox {blue}{red}\color {white}pdfToolbox}{.X..} : 
\curvedcolorbox {blue}{red}\color {white}pdfToolbox}{..X.} : 
\curvedcolorbox {blue}{red}\color {white}pdfToolbox}{...X} : 
```

`\fakebold` $\{\langle material\rangle\}$: Bolds the material *material* (essentially just thickening the stroke width according to `\fakeboldwidth`).

`\flip` $\{\langle material\rangle\}$: \approx flip *material* about its vertical axis.

3.2 Colorboxes

In `pdfGraphics/colorboxes.tex`, **PDFTOOLBOX** provides macros for pretty printing textboxes (ppboxes). These are simply colored textboxes which can split across pages. There are two kinds of pretty textboxes: ppboxes and linedppboxes.

`\bppbox` $\{\langle bg\ color\rangle\}\{\langle stroke\ color\rangle\}\{\langle fg\ color\rangle\}\{\langle curve\ control\rangle\}$... `\eppbox`: This creates a ppbox, which is just a wrapper around `\curvedcolorbox`.

`\blinedppbox` $\{\langle bg\ color\rangle\}\{\langle stroke\ color\rangle\}\{\langle fg\ color\rangle\}$... `\elinedppbox`: This creates a colored textbox with a rule down the left side. For example:

This is a linedppbox with a red background, black stroke, and white text.

The width of the rule is determined by `\pprulewd`, the vertical buffer within the box (around the text) is determined by `\pprulevbuf`, and the horizontal buffer on the left is `\pprulehbuf`.

3.3 Illustrating

In `pdfGraphics/pdfdraw.tex`, **PDFTOOLBOX** provides macros for creating illustrations.

This feature scares me. Its implementation is a mess and I am scared to change it; but I will need to at some point.

`\bdrawing` ... `\edrawing`: Begin a drawing environment. The drawing environment is a plane as large as the drawings within it. (0,0) corresponds to the bottom left corner.

`\addnode` $\{\langle text\rangle\}\{\langle x\rangle\}\{\langle y\rangle\}\{\langle name\rangle\}$: Creates a node by the name of *name* with text *text* at coordinate (*x*, *y*). You can access the following values (called node-relative coordinates): `<name>.left`, `<name>.top`, `<name>.right`, `<name>.bottom`, `<name>.xcenter`, `<name>.ycenter`.

`\drawpath` $\{\langle start\ x\rangle\}\{\langle start\ y\rangle\}\{\langle end\ x\rangle\}\{\langle end\ y\rangle\}\{\langle x\ off\rangle\}\{\langle y\ off\rangle\}\{\langle start\ cap\rangle\}\{\langle end\ cap\rangle\}\{\langle color\rangle\}$: Draws a line from (*start x*, *start y*) to (*end x*, *end y*). This is offset by *off x* on the *x*-axis and *off y* on the *y*-axis (these are dimensions). *start cap* is the linecap used at the starting point, and *end cap* is the linecap used at the end point (see `\definelinecap`). The line is drawn in the color *color*.

The coordinates may be numeric values or node-relative coordinates (see `\addnode`).

`\drawbezier` $\langle\{start\ x\}\rangle\langle\{start\ y\}\rangle\langle\{end\ x\}\rangle\langle\{end\ y\}\rangle\langle\{off\}\rangle\langle\{curvature\}\rangle\langle\{start\ cap\}\rangle\langle\{end\ cap\}\rangle\langle\{color\}\rangle$: Draws a curve from $(start\ x, start\ y)$ to $(end\ x, end\ y)$ with curvature $curvature$. This is offset by off , which must be a pair of the form $\langle\{x\ off\}\rangle\langle\{y\ off\}\rangle$ corresponding to the x -axis offset and y -axis offset respectively (dimensions). $start\ cap$ is the linecap used at the starting point, and $end\ cap$ is the linecap used at the end point (see `\definelinecap`). The line is drawn in the color $color$.

The coordinates may be numeric values or node-relative coordinates (see `\addnode`).

`\definelinecap` $\langle\{name\}\rangle\langle\{code\}\rangle\langle\{width\}\rangle$: Defines a linecap by the name of $name$. $code$ is the code which draws the linecap (see Internals of pdfDraw), and $width$ is the width of the linecap.

The provided linecaps are:

>: → <: ← | -: ⊢ -|: ⊣ >>: ≫ <<: ≪ o: o

There is also an empty linecap `-`.

Outside of drawing environments, **PDFTOOLBOX** provides a macro to make diagrams, `\drawdiagram`. Its usage is `\drawdiagram` $\langle\{table\}\rangle\langle\{arrows\}\rangle$. $table$ is a normal T_EX alignment table (similar format as `\halign`, without the preamble). $arrows$ is a collection of `\diagarrow` macro calls.

`\diagarrow` $\langle\{options\}\rangle$: Draws an arrow in a `\drawdiagram` diagram. $options$ contains the following keys:

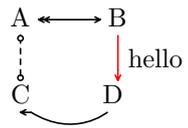
- **from** (required): the cell from which to start the arrow. Cells start indexing at $\{1,1\}$ for the top left cell where the first number is the row and the second the column;
- **to** (required): the cell to end the arrow;
- **left cap** (default `-`): the start linecap;
- **right cap** (default `>`): the end linecap;
- **color** (default `black`): the color to draw the arrow in;
- **x off** (default `0pt`): the x -axis offset;
- **y off** (default `0pt`): the y -axis offset;
- **text**: the text to add on the arrow;
- **x distance** (default `0pt`): the amount to move the text on the x -axis;
- **y distance** (default `0pt`): the amount to move the text on the y -axis;
- **slide** (default `.5`): where to place the text relative to the arrow;
- **curve**: the amount to curve the arrow;
- **dashed** (valueless): add to make the arrow line dashed;
- **dotted** (valueless): add to make the arrow line dotted;
- **origin orient**: the placement of the start of the arrow relative to the origin (a pair like $\{left, bottom\}$);
- **dest orient**: the placement of the end of the arrow relative to the destination (a pair like $\{left, bottom\}$).

So for example,

```

1 \drawdiagram{
2   A&B\cr
3   C&D
4 }{
5   \diagarrow{from={1,1}, to={1,2}, left cap=<<}
6   \diagarrow{from={1,2}, to={2,2}, color=rgb{1 0 0}, text={hello}, x distance=.5cm}
7   \diagarrow{from={2,2}, to={2,1}, curve=10pt, origin orient={xcenter,bottom}, dest orie
8     nt={xcenter,bottom}}
9   \diagarrow{from={2,1}, to={1,1}, dashed, left cap=o, right cap=o}
9 }
```

Will yield



Between each row of the diagram, space of width `\diagrowbuf` is added. Between each column, `\diagcolbuf`. The height of each row is at least `\diagrowheight` and the width of each column is at least `\diagcolwidth`.

II. PDFTOOLBOX INTERNALS

1 Utilities

In `pdfToolbox-utils.tex`, `PDFTOOLBOX` provides various useful utilities for a variety of (relatively) simple tasks.

1.1 Simple Macros

`_checkloaded` $\langle name \rangle$: Place this at the beginning of a package or a file in a package to ensure you don't include the same file multiple times. It will check if $name$ has already been loaded: if it has been, it stops input; otherwise it remembers that $name$ has been loaded and continues inputting it.

A few useful short macros:

- `_xp`: shorthand for `\expandafter`;
- `_nul`: defined to be `\nul`; useful as a marker (used, for example, to mark the end of something);
- `_id`: defined as `\def_id#1{#1}`;
- `_gobble`: gobbles the next parameter;
- `_gobbletilnul`: gobbles until it sees `\nul` (definition is `\def_gobbletilnul#1\nul{}`);
- `_mstrip`: given a control sequence, returns its name without the escape character;
- `\True`: defined to be `\True`; used when returning a value;
- `\False`: defined to be `\False`; used when returning a value;
- `\glet`: `\global\let`;
- `_xplet`: takes two inputs A and B, suppose they expand to X and Y respectively. Then `_xplet{A}{B}` is equivalent to `\let XY`;
- `_afterfi`: within an `\if... \fi` construct, placing code inside `_afterfi` will execute it (if the condition matches) after the `\fi`;
- `\say`: prints the input on the terminal (on its own line).

`_ifnextchar` $\langle char \rangle \{ \langle first \rangle \} \{ \langle second \rangle \}$ `\@ifnextchar` $\langle char \rangle \{ \langle first \rangle \} \{ \langle second \rangle \}$: Inspired by L^AT_EX. Looks at the following character, if it is equal to $char$, executes $first$ and otherwise executes $second$. The following character is left in the input stream.

`_ifstar` $\{ \langle first \rangle \} \{ \langle second \rangle \}$ `\@ifstar` $\{ \langle first \rangle \} \{ \langle second \rangle \}$: Inspired by L^AT_EX. Looks at the following character, if it is an asterisk, executes $first$ and otherwise executes $second$. The asterisk is removed from the stream.

`_nopt` $\{ \langle dim expression \rangle \}$: Expands to the computation of $dim expression$ (a dimension expression) without the trailing `pt`.

`_noptfloor` $\{ \langle dim expression \rangle \}$: Expands to the whole part of the computation of $dim expression$ (a dimension expression) without the trailing `pt`.

`\literal` $\langle macro definition \rangle$: Equivalent to `\def\X<macro definition>\X`.

`_getline` $\langle macro \rangle$: Reads until a linebreak and then passes that to $macro$ as its parameter.

`\reverse` $\langle macro \rangle \{ \langle list \rangle \}$: Reverses $list$ and puts the result in $macro$.

1.2 Setters

`PDFTOOLBOX` has a concept of *setters*: these are the macros used for defining things. There are four three: `\currlet`, `\currdef`, `\curredef`, `\currset`. These generally alternate between `\let`, `\def`, `\edef`, `\empty` and `\glet`, `\gdef`, `\xdef`, `\global`. You can change the definitions via the two macros `\localsetters` and `\globalsetters`.

So for example, if you'd like to use an array and make the changes global, you'd first execute `\globalsetters`.

1.3 Repeating Macros

`\commap` $\langle macro \rangle \langle list \rangle$: If *list* is a comma-separated list of the form x_1, \dots, x_N and *macro* is $\backslash X$, this will execute $\backslash X\{x_1\} \dots \backslash X\{x_N\}$.

`\map` $\langle macro \rangle \langle list \rangle$: If *list* is a list of the form $x_1 \backslash dots x_N$ where each x_i is a group or a single token, and *macro* is $\backslash X$, this will execute $\backslash X\{x_1\} \dots \backslash X\{x_N\}$.

`_repeat` $\langle times \rangle \langle code \rangle$: Executes *code* *times* times.

`_prepeat` $\langle times \rangle \langle macro \rangle$: If *times* is *N* and *macro* $\backslash X$, executes $\backslash X\{1\} \dots \backslash X\{N\}$.

`_varrepeat` $\langle start \rangle \langle stop \rangle \langle step \rangle \langle comparison \rangle \langle macro \rangle$: If *macro* is $\backslash X$, *start* is *i*, *step* is *d*, and *stop* is *f*: executes $\backslash X\{i\} \backslash X\{i+d\} \backslash X\{i+2d\} \dots \backslash X\{i+Nd\}$ until the condition $(i+Nd \text{ comparison } f)$ is satisfied.

2 pdfData Internals

Due to the nature of its use, most of the macros defined in the pdfData section have already been explained. The only part of pdfData which requires explanation regarding its internals is mappings, which offers richer features than already explained.

2.1 Mappings

Mappings are stored in two places: a *key list*, which is simply a macro consisting of pairs of the form $\langle key \rangle \langle value \rangle$, and macros $\backslash key@k$ (the second *k* is variable in the name) whose definition is *v*.

Essentially, the major macro in this part is `_mapkeys_with_setter`. Its usage is

```
\_mapkeys_with_setter  $\langle mapkey macro \rangle \langle key macro \rangle \langle map \rangle$ 
```

where *mapkey macro* is the macro which manages the creation of a key-value pair (explained below), *key macro* is a macro to store the list of keys, and *map* is a map of key-value pairs.

What happens is `_mapkeys_with_setter` will iterate over *map* and for every key-value pair (*k*, *v*) if the setter *mapkey macro* is $\backslash M$ and *key macro* is $\backslash K$, it calls $\backslash M \backslash K\{k\}\{v\}$. This should (if $\backslash M$ is defined properly) update $\backslash K$ to include the pair (*k*, *v*). Furthermore, it should store the value *v* in the macro $\backslash key@k$ (the second *k* is variable in the name).

The macro `_update_lastkeys` is provided for the former: to update $\backslash K$. Simply pass `_update_lastkeys $\backslash K\{k\}\{v\}$` . The simplest setter (*mapkey macro*) is `_vanilla_mapkey`, which does exactly what was described and nothing more. Its definition is simply:

```
\def\_vanilla_mapkey#1#2#3{%
  \_xp\def\csname key@\_id#2\endcsname{#3}%
  \_update_lastkeys{#1}{#2}{#3}%
}
```

You can use the macro `\getvalue` to get the value of a key: its definition is simply

```
\def\getvalue#1{%
  \csname key@#1\endcsname%
}
```

Another macro is `\keyexists` whose use is

```
\keyexists  $\langle key \rangle \langle macro \rangle \langle key list \rangle$ 
```

It checks if the key *key* is in *key list*, and if it is, defines *macro* to be equal to the key. Otherwise *macro* is defined to be `_nul`. For this reason, if you'd like a key to have no value, it is advised to use the `\novalue` macro (whose definition is just `\novalue`).

Another setter is `_vardef_mapkey`, whose only difference from `_vanilla_mapkey` is that instead of `\def`ing $\backslash key@k$ to be equal to *v*, `_vardef_mapkey` uses `_vardef` instead of `\def` (which can be set before calling `_vardef_mapkey`), and `_vardefs $\backslash key@k$` to be the (once) expansion of `_varmap\{v\}` (where `_varmap`) can also be set before calling (`_vardef_mapkey`).

`\mapkeys` is defined as follows:

```

\def\mapkeys#1#2{%
  \mapkeys_with_setter\_vanilla_mapkey\_keymappings{#1}%
  \xp\_setdefaults\_xp{\_keymappings}%
  \mapkeys_with_setter\_protected_mapkey\_lastkeys{#2}%
  \_check_required_supplied%
}

```

So first it gets the key-value pairs in *options* (#1) using `_vanilla_mapkey`; it places the results in `_keymappings`. Then it sets the default values (this is what `_setdefaults` does; as well as figuring out which keys are required). Then `\mapkeys` calls `_mapkeys_with_setter` using the setter `_protected_mapkey` on *input* (#2). It stores the results in `_lastkeys`. Then it checks that the required keys have been supplied (`_check_required_supplied`).

The setter `_protected_mapkey` is more complicated than the previously-discussed setters. Its use, like all setters, is

```
\_protected_mapkey <key list>{\<key>}{\<value>}
```

But in this case, *key* has a value also in `_keymappings` as well; this value corresponds to another map containing the settings of *key* (name, default, required, etc.). So now `_protected_mapkey` will find the settings of *key*, and get the values of each field (via `_mapkeys_with_setter`). Then it calls `_vardef_mapkey` with *key* and *value*, using the definitions of `_vardef` and `_varmap` according to the settings. Finally it sets the macro name (if provided in the settings) to be equal to the value.

3 pdfGraphics Internals

3.1 Colors

There are some useful macros in the `pdfGraphics/colors.tex`, here we describe them.

These macros and file require a clean-up. Unfortunately many other macros are dependent on them, and I am scared to significantly alter anything. One day, though.

```

\_rgb_encode {\<rgb code>}
\_rgb_encodebg {\<rgb code>}
\_rgb_encodefg {\<rgb code>}
\_cmyk_encode {\<cmyk code>}
\_cmyk_encodebg {\<cmyk code>}
\_cmyk_encodefg {\<cmyk code>}: Gets the code for the specified color for the foreground or background or
both.

```

```

\_setcolor_code {\<pdf code>}: Sets the current color using pdf code (which can be obtained using one of the
above macros). Essentially just pushing pdf code onto the color stack. After the current group, calls
\_pdfcolor_restore.

```

```
\_pdfcolor_restore: Restores the color (pops from the color stack).
```

```

\_color_set {\<color space>}{\<color code>}
\_colorbg_set {\<color space>}{\<color code>}
\_colorfg_set {\<color space>}{\<color code>}: Sets the current color using color code according to color space
(either rgb or cmyk).

```

```

\_color_defined {\<name>}
\_colorbg_defined {\<name>}
\_colorfg_defined {\<name>}: Sets the current color according to the color name (see \definecolor).

```

```

\_getcolorparam <macro>{\<place>}{\<color>}: Gets the pdf code for color (which may be of the form rgb{...},
cmyk{...}, or {name}), and calls macro with it as a parameter. place is either fg, bg, or left empty.

```

```

\_setcolor {\<place>}{\<color>}: Sets the current color according to place and color. place is either fg, bg, or
left empty.

```

```

\_getcolor {\<place>}{\<color>}: Expands to the pdf code for color (place is either fg, bg, or left empty).

```

4 Colorboxes

PDFTOOLBOX provides a relatively simple interface for creating colorboxes like `\bppbox`. The main macro is `_splitcontentbox`, whose usage is

```
\_splitcontentbox {<buffer>}<macro>
```

Which repetitively splits the box `_contentbox` into `_splitbox` to fill the remaining material on a page or in the box itself. Then the split box is passed to `macro` for pretty formatting. `buffer` is the total amount of vertical buffering that `macro` adds to the box it prints.

So to create your own prettyprint-box (ppbox), you create two macros, say `\beginpp` and `\endpp`. In `\beginpp` you add the code which should go before the ppbox and starts getting content for `_contentbox`. For example, it could be as simple as:

```
\def\beginpp#1#2{%
  \def\_colorcontentbox{%
    \hbox{\coloredbox{#1}{\_setcolor}{#2}\box\_splitbox}}%
  }%
  \par\kern.5cm\null\par%
  \setbox\_contentbox=\vbox\bgroup
    \hsize=\dimexpr\hsize-\bufferwidth * 2\relax%
  }

\def\endpp{%
  \egroup%
  \_splitcontentbox{\bufferwidth * 2}\_colorcontentbox%
  \kern.5cm\relax%
}
```

This creates a ppbox which is simply a wrapper around `\coloredbox`. It colors the background in `#1` and the foreground in `#2`.

In depth, here's how it works:

- (1) First, `\beginpp` defines `_colorcontentbox` to simply place `_splitbox` into a `\coloredbox` of color `#1`, and sets the foreground color to `#2`.
- (2) Then it adds some space before the start of the first ppbox. The reason for the `\null\par` is to move the kern from the list of recent contributions to the main vertical list (see, e.g. the `TEXbook` for more information on `TEX`'s output routines).
- (3) Then `\beginpp` begins reading content for `_contentbox`. It alters `\hsize` to compensate for the buffer added by `\coloredbox`.
- (4) When `\endpp` is called, it first stops the capture of `_contentbox` with `\egroup`.
- (5) Then it calls `_splitcontentbox{\bufferwidth * 2}_colorcontentbox`, which splits the captured material (in `_contentbox`) and places each `_splitbox` in `_colorcontentbox`, which was defined in `\beginpp`. `\bufferwidth * 2` corresponds to the amount of vertical buffering `_colorcontentbox` adds to `_splitbox`.
- (6) `\endpp` adds buffering after the final ppbox.

4.1 Illustrating

This is a complicated and messy part of **PDFTOOLBOX**. Documentation will be added once it is cleaned up.

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