PDFKit Guide

By Devon Govett

Version 0.100.177

Getting Started with PDFKit

Installation

Installation uses the npm package manager. Just type the following command after installing npm.

```
npm install @moritzloewenstein/pdfkit
```

Creating a document

Create a **`PDFDocument`** with in-memory data for its default font. In Node.js, your application can read the font before constructing the document:

```
import { createWriteStream, readFileSync } from 'node:fs';
import PDFDocument from '@moritzloewenstein/pdfkit';

const fontData = readFileSync('fonts/Roboto-Regular.ttf');
const doc = new PDFDocument({ font: 'Body', fontData });
```

`doc.stream` is a Web **`ReadableStream`**. In Node.js, you can also use **`pipe`** to write to a file stream or an HTTP response. Call **`end()`** to finalize the PDF.

```
doc.pipe(createWriteStream('/path/to/file.pdf'));    // write to PDF
doc.pipe(res);                                       // HTTP response

// add stuff to PDF here using methods described below...

// finalize the PDF and end the stream
doc.end();
```

The **`write`** and **`output`** methods found in PDFKit before version 0.5 are now deprecated.

Using PDFKit in the browser

Load the font as bytes, then use **`toBlob(doc)`** to collect the PDF for a preview or download. Use **`toBytes(doc)`** instead to get a **`Uint8Array`**.

```
import PDFDocument, { toBlob } from '@moritzloewenstein/pdfkit';

const fontData = await (await fetch('/fonts/Roboto-Regular.ttf')).arrayBuffer();
const doc = new PDFDocument({ font: 'Roboto', fontData });
doc.text('Hello, PDF!');
doc.end();
iframe.src = URL.createObjectURL(await toBlob(doc));
```

The helpers consume **`doc.stream`**; don't also pipe or read from the same stream. Revoke the object URL once you no longer need it.

This fork does not bundle built-in fonts. Provide the default font name and its data as **`font`** and **`fontData`**; see Fonts.

Document options

New documents default to PDF 1.7. PDF/A-1 documents default to PDF 1.4. Set **`pdfVersion`** explicitly if the recipient requires an older version.

Set **`pageLayout`** to control how a PDF viewer displays pages: **`singlePage`**, **`oneColumn`**, **`twoColumnLeft`**, **`twoColumnRight`**, **`twoPageLeft`**, or **`twoPageRight`**. In the two-column and two-page layouts, **`Left`** and **`Right`** indicate which side contains odd-numbered pages.

Set **`objectStreams: true`** to pack non-stream objects into object streams and replace the cross-reference table with a cross-reference stream. This can make documents with many objects smaller. It requires **`pdfVersion: '1.5'`** or later and cannot be combined with encryption or PDF/A-1.

Adding pages

The first page of a PDFKit document is added for you automatically when you create the document unless you provide **`autoFirstPage: false`**. Subsequent pages must be added by you. Luckily, it is quite simple!

```
doc.addPage()
```

Pass **`onPageAdded: doc => doc.text('Page Title')`** in the constructor options to draw on every new page, including the automatic first page. To handle pages added after construction only, you can also use the **`pageAdded`** event.

```
doc.on('pageAdded', () => doc.text("Page Title"));
```

You can also set some options for the page, such as its size and orientation.

The **`layout`** property can be either **`portrait`** (the default) or **`landscape`**. The **`size`** property can be either an array specifying **`[width, height]`** in PDF points (72 per inch), or a string specifying a predefined size. A list of the predefined paper sizes can be seen here. The default is **`letter`**.

Passing a page options object to the **`PDFDocument`** constructor will set the default paper size and layout for every page in the document, which is then overridden by individual options passed to the **`addPage`** method.

You can set the page margins in two ways. The first is by setting the **`margin`** / **`margins`** property to a single value, which applies that to all edges. The other way is to provide an object with **`top`**, **`right`**, **`bottom`**, and **`left`** values. By default, using a number this will be in points (the default PDF unit), however you can provide any of the following units inside a string and this will be converted for you: **`em`**, **`in`**, **`px`**, **`cm`**, **`mm`**, **`pc`**, **`ex`**, **`ch`**, **`rem`**, **`vw`**, **`vmin`**, **`vmax`**, **`%`**, **`pt`**. For those which are based on text sizes this will take the size of the font for the page (excluding **`rem`** which is always the document root font size) The default is a 1 inch (72 point) margin on all sides.

For example:

```
// Add a 50 point margin on all sides
doc.addPage({ margin: 50 });

// Add a 2 inch margin on all sides
doc.addPage({ margin: '2in' });

// Add a 2em(28pt) margin using the font size
doc.addPage({ fontSize: 14, margin: '2em' });

// Add different margins on each side
doc.addPage({
  margins: {
    top: 50,
    bottom: 50,
    left: 72,
    right: 72
  }
});
```

Switching to previous pages

PDFKit normally flushes pages to the output file immediately when a new page is created, making it impossible to jump back and add content to previous pages. This is normally not an issue, but in some circumstances it can be useful to add content to pages after the whole document, or a part of the document, has been created already. Examples include adding page numbers, or filling in other parts of information you don't have until the rest of the document has been created.

PDFKit has a **`bufferPages`** option in versions v0.7.0 and later that allows you to control when pages are flushed to the output file yourself rather than letting PDFKit handle that for you. To use it, just pass **`bufferPages: true`** as an option to the **`PDFDocument`** constructor. Then, you can call **`doc.switchToPage(pageNumber)`** to switch to a previous page (page numbers start at 0).

When you're ready to flush the buffered pages to the output file, call **`flushPages`**. This method is automatically called by **`doc.end()`**, so if you just want to buffer all pages in the document, you never need to call it. Finally, there is a **`bufferedPageRange`** method, which returns the range of pages that are currently buffered. Here is a small example that shows how you might add page numbers to a document.

```
// create a document, and enable bufferPages mode
let i;
let end;
const doc = new PDFDocument({
  font: 'Body', fontData,
  bufferPages: true});

// add some content...
doc.addPage();
// ...
doc.addPage();

// see the range of buffered pages
const range = doc.bufferedPageRange(); // => { start: 0, count: 2 }

for (i = range.start, end = range.start + range.count, range.start <= end; i < end; i+
+) {
  doc.switchToPage(i);
  doc.text(`Page ${i + 1} of ${range.count}`);
}

// manually flush pages that have been buffered
doc.flushPages();

// or, if you are at the end of the document anyway,
// doc.end() will call it for you automatically.
doc.end();
```

Page labels

Call **`addPageLabel(pageIndex, options)`** with the zero-based index where a range starts. Labels change what PDF viewers show, not what is drawn on the page.

```
doc.addPageLabel(0, { style: 'lowerRoman' }); // i, ii
doc.addPageLabel(2, { style: 'decimal' });    // 1, 2, …
doc.addPageLabel(10, { style: 'decimal', prefix: 'A-', start: 3 }); // A-3, A-4, …
```

`style` can be **`decimal`**, **`upperRoman`**, **`lowerRoman`**, **`upperAlpha`**, or **`lowerAlpha`**. Without a style, only **`prefix`** is shown. **`start`** defaults to 1.

Setting default font

Pass a name as **`font`** and its bytes or a parsed fontkit font as **`fontData`**. The name becomes a registered alias within the document. See Fonts for supported formats and how to select additional fonts.

Setting document metadata

PDF documents can have various metadata associated with them, such as the title, or author of the document. You can add that information by adding it to the **`doc.info`** object, or by passing an info object into the document at creation time.

Here is a list of all of the properties you can add to the document metadata. According to the PDF spec, each property must have its first letter capitalized.

- **`Title`** – the title of the document
- **`Author`** – the name of the author
- **`Subject`** – the subject of the document
- **`Keywords`** – keywords associated with the document
- **`Creator`** – the tool that created the source document
- **`Producer`** – the tool that generated the PDF
- **`CreationDate`** – the date the document was created (added automatically by PDFKit)
- **`ModDate`** – the date the document was last modified

Encryption and Access Privileges

To encrypt a PDF or set access permissions, explicitly set **`pdfVersion: '1.7ext3'`** (PDF 1.7 Extension Level 3, AES-256 revision 5). Supplying a non-empty user or owner password with any other version, including the default PDF 1.7, throws an error. Older versions remain available for unencrypted output. PDF/A does not allow encryption.

To enable encryption, provide a user password when creating the **`PDFDocument`** in **`options`** object. The PDF file will be encrypted when a user password is provided, and users will be prompted to enter the password to decrypt the file when opening it.

- **`userPassword`** - the user password (string value)

To set access privileges for the PDF file, you need to provide an owner password and permission settings in the **`option`** object when creating **`PDFDocument`**. By default, all operations are disallowed. You need to explicitly allow certain operations.

- **`ownerPassword`** - the owner password (string value)

- **`permissions`** - the object specifying PDF file permissions

Following settings are allowed in **`permissions`** object:

- **`printing`** - whether printing is allowed. Specify **`"lowResolution"`** to allow degraded printing, or **`"highResolution"`** to allow printing with high resolution

- **`modifying`** - whether modifying the file is allowed. Specify **`true`** to allow modifying document content

- **`copying`** - whether copying text or graphics is allowed. Specify **`true`** to allow copying

- **`annotating`** - whether annotating, form filling is allowed. Specify **`true`** to allow annotating and form filling

- **`fillingForms`** - whether form filling and signing is allowed. Specify **`true`** to allow filling in form fields and signing

- **`contentAccessibility`** - whether copying text for accessibility is allowed. Specify **`true`** to allow copying for accessibility

- **`documentAssembly`** - whether assembling document is allowed. Specify **`true`** to allow document assembly

You can specify either user password, owner password or both passwords. Behavior differs according to passwords you provides:

- When only user password is provided, users with user password are able to decrypt the file and have full access to the document.

- When only owner password is provided, users are able to decrypt and open the document without providing any password, but the access is limited to those operations explicitly permitted. Users with owner password have full access to the document.

- When both passwords are provided, users with user password are able to decrypt the file but only have limited access to the file according to permission settings. Users with owner

password have full access to the document.

Note that PDF file itself cannot enforce access privileges. When file is decrypted, PDF viewer applications have full access to the file content, and it is up to viewer applications to respect permission settings.

Passwords are truncated to 127 bytes of their UTF-8 representation.

PDF/A

PDF/A is a standard (ISO 19005-1:2005) which defines rules for electornic documents intended for long-term archiving. The restrictions on PDF/A documents are:

- Cannot be encrypted
- Fonts must be embedded
- No JavaScript
- No audio content
- No video content
- Addition of XMP metadata
- Must define color spaces

Currently, PDFKit aims to support PDF/A-1b, PDF/A-2b, PDF/A-3b and PDF/A-1a, PDF/A-2a, PDF/A-3a standards, also known as level B conformance and level A conformance, respectively.

In order to create PDF/A documents, set **`subset`** to either **`PDF/A-1`** or **`PDF/A-1b`** for level B (basic) conformance, or **`PDF/A-1a`** for level A (accessible) conformance when creating the **`PDFDocument`** in **`options`** object.

Similary, use **`PDF/A-2`** or **`PDF/A-2b`** for PDF/A-2 level B conformance and **`PDF/A-2a`** for PDF/A-2 level A conformance. **`PDF/A-3`** or **`PDF/A-3b`** can be used for PDF/A-3 level B conformance and **`PDF/A-3a`** for PDF/A-3 level A conformance.

PDF/A-1 defaults to PDF 1.4. PDF/A-2 and PDF/A-3 use the ordinary PDF 1.7 default. Set **`tagged: true`** for level A conformance.

In order to verify the generated document for PDF/A and its subsets conformance, veraPDF is an excellent open source validator.

PDF/A requires embedded fonts. Supply embeddable font data (for example, a TrueType font) as **`fontData`** for the document's default font, and pass any additional font sources to **`font()`** or **`registerFont()`**.

Adding content

Once you've created a **`PDFDocument`** instance, you can add content to the document. Check out the other sections described in this document to learn about each type of content you can add.

That's the basics! Now let's move on to PDFKit's powerful vector graphics abilities.

Paper Sizes

When creating a new document or adding a new page to your current document, PDFKit allows you to set the page dimensions. To improve convenience, PDFKit has a number of predefined page sizes. These sizes are based on the most commonly used standard page sizes.

Predefined Page Sizes

The following predefined sizes are based on the ISO (International) standards. All the dimensions in brackets are in PostScript points.

A-series

- A0 (2383.94 x 3370.39)
- A1 (1683.78 x 2383.94)
- A2 (1190.55 x 1683.78)
- A3 (841.89 x 1190.55)
- A4 (595.28 x 841.89)
- A5 (419.53 x 595.28)
- A6 (297.64 x 419.53)
- A7 (209.76 x 297.64)
- A8 (147.40 x 209.76)
- A9 (104.88 x 147.40)
- A10 (73.70 x 104.88)

B-series

- B0 (2834.65 x 4008.19)
- B1 (2004.09 x 2834.65)
- B2 (1417.32 x 2004.09)
- B3 (1000.63 x 1417.32)
- B4 (708.66 x 1000.63)
- B5 (498.90 x 708.66)
- B6 (354.33 x 498.90)
- B7 (249.45 x 354.33)

- B8 (175.75 x 249.45)
- B9 (124.72 x 175.75)
- B10 (87.87 x 124.72)

C-series

- C0 (2599.37 x 3676.54)
- C1 (1836.85 x 2599.37)
- C2 (1298.27 x 1836.85)
- C3 (918.43 x 1298.27)
- C4 (649.13 x 918.43)
- C5 (459.21 x 649.13)
- C6 (323.15 x 459.21)
- C7 (229.61 x 323.15)
- C8 (161.57 x 229.61)
- C9 (113.39 x 161.57)
- C10 (79.37 x 113.39)

RA-series

- RA0 (2437.80 x 3458.27)
- RA1 (1729.13 x 2437.80)
- RA2 (1218.90 x 1729.13)
- RA3 (864.57 x 1218.90)
- RA4 (609.45 x 864.57)

SRA-series

- SRA0 (2551.18 x 3628.35)
- SRA1 (1814.17 x 2551.18)
- SRA2 (1275.59 x 1814.17)
- SRA3 (907.09 x 1275.59)
- SRA4 (637.80 x 907.09)

The following predefined sizes are based on the common paper sizes used mainly in the

United States of America and Canada. The dimensions in brackets are in PostScript points.

- EXECUTIVE (521.86 x 756.00)
- LEGAL (612.00 x 1008.00)
- LETTER (612.00 X 792.00)
- TABLOID (792.00 X 1224.00)

PDFKit supports also the following paper sizes. The dimensions in brackets are in PostScript points.

- 4A0 (4767.89 x 6740.79)
- 2A0 (3370.39 x 4767.87)
- FOLIO (612.00 X 936.00)

Setting the page size

In order to use the predefined sizes, the name of the size (as named in the lists above) should be passed to either the **`PDFDocument`** constructor or the **`addPage()`** function in the **`size`** property of the **`options`** object, as shown in the example below, using **`A7`** as the preferred size.

```
// Passing size to the constructor
const doc = new PDFDocument({size: 'A7'});

// Passing size to the addPage function
doc.addPage({size: 'A7'});
```

The predefined sizes are exported as **`PAGE_SIZES`**, which maps each name in upper case to its **`[width, height]`** in points.

```
import { PAGE_SIZES } from '@moritzloewenstein/pdfkit';

const [width, height] = PAGE_SIZES.A4;
```

User Unit (PDF 1.6+)

The **`userUnit`** option allows you to scale the physical size of a page without changing the coordinate system. This is useful for creating large format documents like posters or banners that exceed the standard PDF coordinate limit (200 inches or 14400 points).

The default value is **`1.0`**, where 1 unit equals 1/72 inch (1 point). Setting **`userUnit: 2.0`** means 1 unit equals 2/72 inch, effectively doubling the physical size of the page.

```
// Create a page with 2x physical size
doc.addPage({ size: 'A4', userUnit: 2.0 });

// Create a large poster (4x scale)
doc.addPage({ size: [612, 792], userUnit: 4.0 });
```

Vector Graphics in PDFKit

An introduction to vector graphics

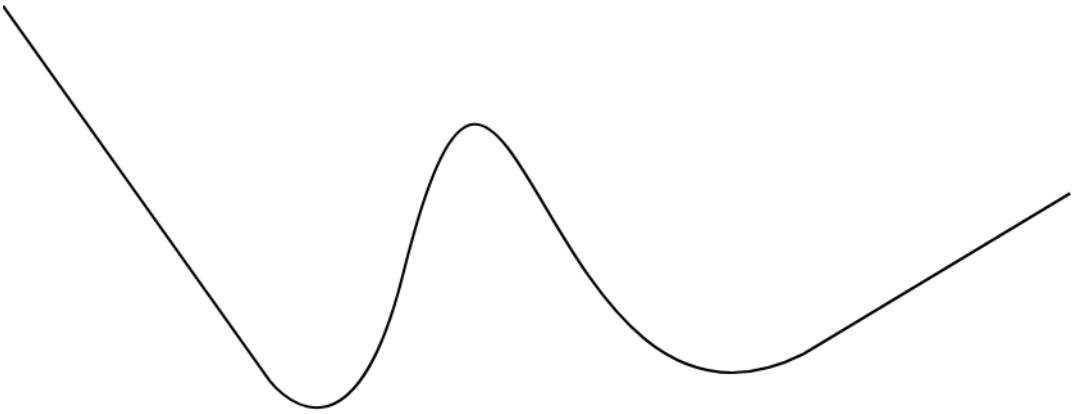
Unlike images which are defined by pixels, vector graphics are defined through a series of drawing commands. This makes vector graphics scalable to any size without a reduction in quality (pixelization). The PDF format was designed with vector graphics in mind, so creating vector drawings is very easy. The PDFKit vector graphics APIs are very similar to that of the HTML5 canvas element, so if you are familiar at all with that API, you will find PDFKit easy to pick up.

Creating basic shapes

Shapes are defined by a series of lines and curves. **`lineTo`**, **`bezierCurveTo`** and **`quadraticCurveTo`** all draw from the current point (which you can set with **`moveTo`**) to the specified point (always the last two arguments). Bezier curves use two control points and quadratic curves use just one. Here is an example that illustrates defining a path.

```
doc.moveTo(0, 20)                                 // set the current point
   .lineTo(100, 160)                              // draw a line
   .quadraticCurveTo(130, 200, 150, 120)          // draw a quadratic curve
   .bezierCurveTo(190, -40, 200, 200, 300, 150) // draw a bezier curve
   .lineTo(400, 90)                               // draw another line
   .stroke();                                     // stroke the path
```

The output of this example looks like this:

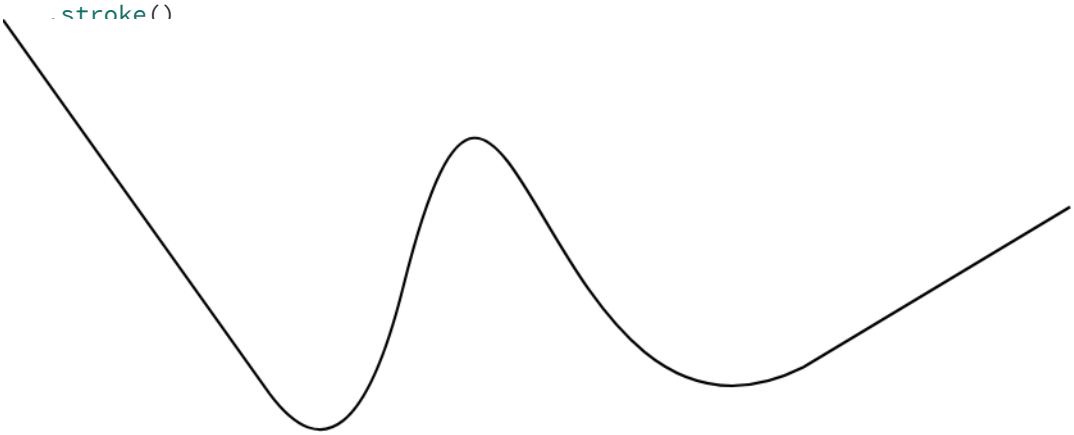


One thing to notice about this example is the use of method chaining. All methods in PDFKit are chainable, meaning that you can call one method right after the other without referencing the **`doc`** variable again. Of course, this is an option, so if you don't like how the code looks when chained, you don't have to write it that way.

SVG paths

PDFKit includes an SVG path parser, so you can include paths written in the SVG path syntax in your PDF documents. This makes it simple to include vector graphics elements produced in many popular editors such as Inkscape or Adobe Illustrator. The previous example could also be written using the SVG path syntax like this.

```
doc.path('M 0,20 L 100,160 Q 130,200 150,120 C 190,-40 200,200 300,150 L 400,90')
   .stroke()
```



The PDFKit SVG parser supports all of the command types supported by SVG, so any valid SVG path you throw at it should work as expected.

Shape helpers

PDFKit also includes some helpers that make defining common shapes much easier. Here is a list of the helpers.

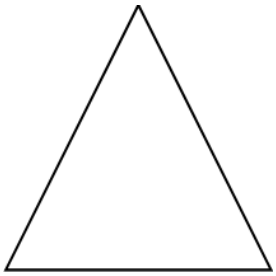
- **`rect(x, y, width, height)`**
- **`roundedRect(x, y, width, height, borderRadius)`**
- **`ellipse(centerX, centerY, radiusX, radiusY = radiusX)`**
- **`circle(centerX, centerY, radius)`**
- **`polygon(points...)`**

`roundedRect` accepts a single radius or an array of per-corner radii in clockwise order: top-left, top-right, bottom-right, bottom-left. A radius of **`0`** leaves that corner square. For example, to round only the right-side corners: **`roundedRect(x, y, w, h, [0, 20, 20, 0])`**.

The last one, **`polygon`**, allows you to pass in a list of points (arrays of x,y pairs), and it will create the shape by moving to the first point, and then drawing lines to each consecutive point. Here is how you'd draw a triangle with the polygon helper.

```
doc.polygon([100, 0], [50, 100], [150, 100]);
doc.stroke();
```

The output of this example looks like this:



Fill and stroke styles

So far we have only been stroking our paths, but you can also fill them with the **`fill`** method, and both fill and stroke the same path with the **`fillAndStroke`** method. Note that calling **`fill`** and then **`stroke`** consecutively will not work because of a limitation in the PDF spec. Use the **`fillAndStroke`** method if you want to accomplish both operations on the same path.

In order to make our drawings interesting, we really need to give them some style. PDFKit has many methods designed to do just that.

- **`lineWidth`**
- **`lineCap`**
- **`lineJoin`**
- **`miterLimit`**
- **`dash`**
- **`fillColor`**
- **`strokeColor`**
- **`opacity`**
- **`fillOpacity`**
- **`strokeOpacity`**

Some of these are pretty self explanatory, but let's go through a few of them.

Line cap and line join

The **`lineCap`** and **`lineJoin`** properties accept constants describing what they should do. This is best illustrated by an example.

```
// these examples are easier to see with a large line width
doc.lineWidth(25);

// line cap settings
doc.lineCap('butt')
   .moveTo(50, 20)
   .lineTo(100, 20)
   .stroke();

doc.lineCap('round')
   .moveTo(150, 20)
   .lineTo(200, 20)
   .stroke();

// square line cap shown with a circle instead of a line so you can see it
doc.lineCap('square')
   .moveTo(250, 20)
   .circle(275, 30, 15)
   .stroke();

// line join settings
doc.lineJoin('miter')
   .rect(50, 100, 50, 50)
   .stroke();

doc.lineJoin('round')
   .rect(150, 100, 50, 50)
   .stroke();

doc.lineJoin('bevel')
   .rect(250, 100, 50, 50)
   .stroke();
```

The output of this example looks like this.



Dashed lines

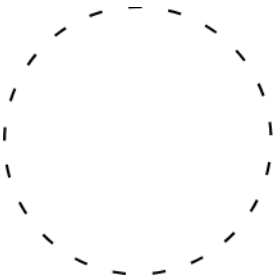
The **dash** method allows you to create non-continuous dashed lines. It takes a length specifying how long each dash should be, as well as an optional hash describing the additional properties **space** and **phase**. Lengths must be positive numbers; **dash** will throw if passed invalid lengths.

The **space** option defines the length of the space between each dash, and the **phase** option defines the starting point of the sequence of dashes. By default the **space** attribute is equal to the **length** and the **phase** attribute is set to **0**. You can use the **undash** method to make the line solid again.

The following example draws a circle with a dashed line where the space between the dashes is double the length of each dash.

```
doc.circle(100, 50, 50)
   .dash(5, {space: 10})
   .stroke();
```

The output of this example looks like this:



Color

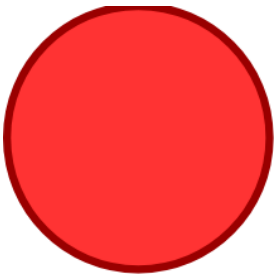
What is a drawing without color? PDFKit makes it simple to set the fill and stroke color and opacity. You can pass an array specifying an RGB or CMYK color, a hex color string, or use any of the named CSS colors (case-insensitive).

The **`fillColor`** and **`strokeColor`** methods accept an optional second argument as a shortcut for setting the **`fillOpacity`** and **`strokeOpacity`**. Finally, the **`opacity`** method is a convenience method that sets both the fill and stroke opacity to the same value.

The **`fill`** and **`stroke`** methods also accept a color as an argument so that you don't have to call **`fillColor`** or **`strokeColor`** beforehand. The **`fillAndStroke`** method accepts both fill and stroke colors as arguments.

```
doc.circle(100, 50, 50)
   .lineWidth(3)
   .fillOpacity(0.8)
   .fillAndStroke("red", "#900")
```

This example produces the following output:



For PDF/UA output, set **`fillColor`** and **`strokeColor`** before constructing a path (with **`moveTo`**, **`path`**, **`rect`**, **`circle`**, and similar methods). Then call **`fill`**, **`stroke`**, or **`fillAndStroke`** without color arguments. Passing colors to these painting methods can insert color-space operators in the middle of a path, which the PDF specification does not allow.

Gradients

PDFKit also supports gradient fills. Gradients can be used just like color fills, and are applied with the same methods (e.g. **`fillColor`**, or just **`fill`**). Before you can apply a gradient with these methods, however, you must create a gradient object.

There are two types of gradients: linear and radial. They are created by the **`linearGradient`** and **`radialGradient`** methods. Their function signatures are listed below:

- **`linearGradient(x1, y1, x2, y2)`** – **`x1,y1`** is the start point, **`x2,y2`** is the end point
- **`radialGradient(x1, y1, r1, x2, y2, r2)`** – **`r1`** is the inner radius, **`r2`** is the outer radius

Once you have a gradient object, you need to create color stops at points along that gradient. Stops are defined at percentage values (0 to 1), and take a color value (any usable by the fillColor method), and an optional opacity.

You can see both linear and radial gradients in the following example:

```
// Create a linear gradient
let grad = doc.linearGradient(50, 0, 150, 100);
grad.stop(0, 'green')
    .stop(1, 'red');

doc.rect(50, 0, 100, 100);
doc.fill(grad);

// Create a radial gradient
grad = doc.radialGradient(300, 50, 0, 300, 50, 50);
grad.stop(0, 'orange', 0)
    .stop(1, 'orange', 1);

doc.circle(300, 50, 50);
doc.fill(grad);
```

Here is the output from the this example:



Winding rules

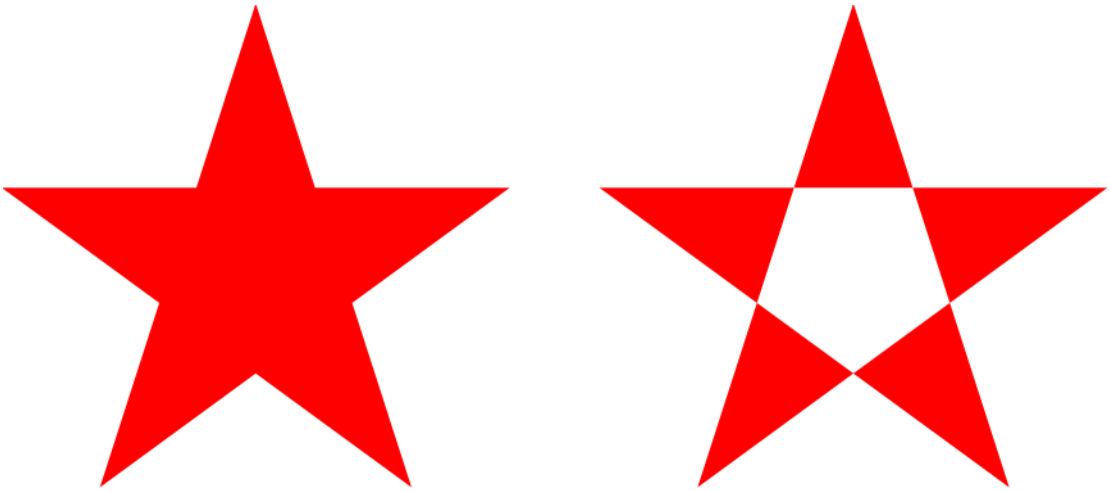
Winding rules define how a path is filled and are best illustrated by an example. The winding rule is an optional attribute to the **`fill`** and **`fillAndStroke`** methods, and there are two values to choose from: **`non-zero`** and **`even-odd`**.

```
// Initial setup
doc.fillColor('red')
   .translate(-100, -50)
   .scale(0.8);

// Draw the path with the non-zero winding rule
doc.path('M 250,75 L 323,301 131,161 369,161 177,301 z')
   .fill('non-zero');

// Draw the path with the even-odd winding rule
doc.translate(280, 0)
   .path('M 250,75 L 323,301 131,161 369,161 177,301 z')
   .fill('even-odd');
```

You'll notice that I used the **`scale`** and **`translate`** transformations in this example. We'll cover those in a minute. The output of this example, with some added labels, is below.



Saving and restoring the graphics stack

Once you start producing more complex vector drawings, you will want to be able to save and restore the state of the graphics context. The graphics state is basically a snapshot of all the styles and transformations (see below) that have been applied, and many states can be created and stored on a stack. Every time the **`save`** method is called, the current graphics state is pushed onto the stack, and when you call **`restore`**, the last state on the stack is applied to the context again. This way, you can save the state, change some styles, and then restore it to how it was before you made those changes.

Transformations

Transformations allow you to modify the look of a drawing without modifying the drawing itself. There are three types of transformations available, as well as a method for setting the transformation matrix yourself. They are **`translate`**, **`rotate`** and **`scale`**.

The **`translate`** transformation takes two arguments, **`x`** and **`y`**, and effectively moves the origin of the page which is (0, 0) by default, to the left and right **`x`** and **`y`** units.

The **`rotate`** transformation takes an angle and optionally, an object with an **`origin`** property. It rotates the document **`angle`** degrees around the passed **`origin`** or by default, around the origin (top left corner) of the page.

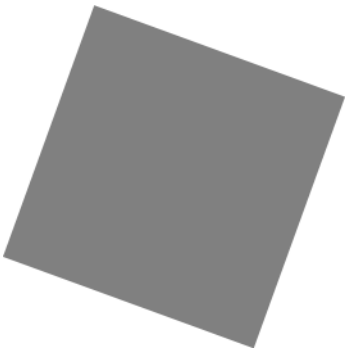
The **`scale`** transformation takes a scale factor and an optional **`origin`** passed in an options hash as with the **`rotate`** transformation. It is used to increase or decrease the size of the units in the drawing, or change its size. For example, applying a scale of **`0.5`** would make the drawing appear at half size, and a scale of **`2`** would make it appear twice as large.

If you are feeling particularly smart, you can modify the transformation matrix yourself using the **`transform`** method.

We used the **`scale`** and **`translate`** transformations above, so here is an example of using the **`rotate`** transformation. We'll set the origin of the rotation to the center of the rectangle.

```
doc.rotate(20, {origin: [150, 70]})
   .rect(100, 20, 100, 100)
   .fill('gray');
```

This example produces the following effect.



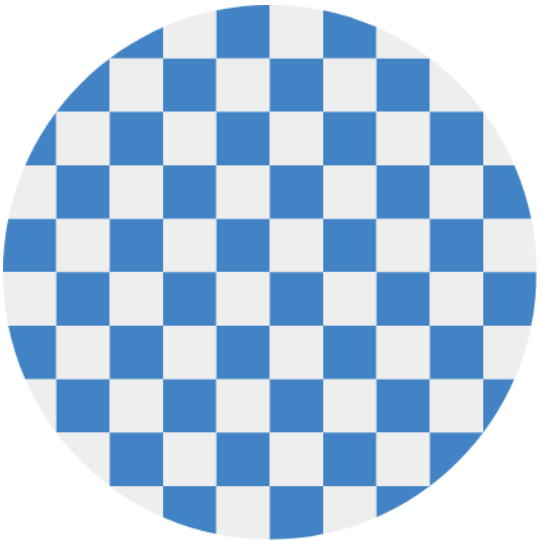
Clipping

A clipping path is a path defined using the normal path creation methods, but instead of being filled or stroked, it becomes a mask that hides unwanted parts of the drawing. Everything falling inside the clipping path after it is created is visible, and everything outside the path is invisible. Here is an example that clips a checkerboard pattern to the shape of a circle.

```
// Create a clipping path
doc.circle(100, 100, 100)
   .clip();

// Draw a checkerboard pattern
for (let row = 0; row < 10; row++) {
  for (let col = 0; col < 10; col++) {
    const color = (col % 2) - (row % 2) ? '#eee' : '#4183C4';
    doc.rect(row * 20, col * 20, 20, 20)
       .fill(color);
  }
}
```

The result of this example is the following:



If you want to "unclip", you can use the **`save`** method before the clipping, and then use **`restore`** to retrieve access to the whole page.

That's it for vector graphics in PDFKit. Now let's move on to learning about PDFKit's text support!

Text in PDFKit

The basics

PDFKit makes adding text to documents quite simple, and includes many options to customize the display of the output. Adding text to a document is as simple as calling the **`text`** method.

```
doc.text('Hello world!')
```

Internally, PDFKit keeps track of the current X and Y position of text as it is added to the document. This way, subsequent calls to the **`text`** method will automatically appear as new lines below the previous line. However, you can modify the position of text by passing X and Y coordinates to the **`text`** method after the text itself.

```
doc.text('Hello world!', 100, 100)
```

If you want to move down or up by lines, just call the **`moveDown`** or **`moveUp`** method with the number of lines you'd like to move (1 by default).

Line wrapping and justification

PDFKit includes support for line wrapping out of the box! If no options are given, text is automatically wrapped within the page margins and placed in the document flow below any previous text, or at the top of the page. PDFKit automatically inserts new pages as necessary so you don't have to worry about doing that for long pieces of text. PDFKit can also automatically wrap text into multiple columns.

The text will automatically wrap unless you set the **`lineBreak`** option to **`false`**. A line can break wherever the Unicode line-breaking rules allow, including after a hyphen or slash. Set **`lineBreak`** to **`'whitespace'`** to keep words such as **`design-system`** or URLs together when they fit on a line. This mode still allows breaks at whitespace, soft hyphens and zero-width spaces; words too wide for a line are still split. By default it will wrap to the page margin, but the **`width`** option allows you to set a different width the text should be wrapped to. If you set the **`height`** option, the text will be clipped to the number of lines that can fit in that height.

When line wrapping is enabled, you can choose a text justification. There are four options: **`left`** (the default), **`center`**, **`right`**, and **`justify`**. They work just as they do in your favorite word processor, but here is an example showing their use in a text box.

```
const lorem = 'Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam in
suscipit purus.  Vestibulum ante ipsum primis in faucibus orci luctus et ultrices
posuere cubilia Curae; Vivamus nec hendrerit felis. Morbi aliquam facilisis risus eu
lacinia. Sed eu leo in turpis fringilla hendrerit. Ut nec accumsan nisl.';

doc.fontSize(8);
doc.text(`This text is left aligned. ${lorem}`, {
  width: 410,
  align: 'left'
}
);

doc.moveDown();
doc.text(`This text is centered. ${lorem}`, {
  width: 410,
  align: 'center'
}
);

doc.moveDown();
doc.text(`This text is right aligned. ${lorem}`, {
  width: 410,
  align: 'right'
}
);

doc.moveDown();
doc.text(`This text is justified. ${lorem}`, {
  width: 410,
  align: 'justify'
}
);

// draw bounding rectangle
doc.rect(doc.x, 0, 410, doc.y).stroke();
```

The output of this example, looks like this:

This text is left aligned. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam in suscipit purus. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Vivamus nec hendrerit felis. Morbi aliquam facilisis risus eu lacinia. Sed eu leo in turpis fringilla hendrerit. Ut nec accumsan nisl.

This text is centered. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam in suscipit purus. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Vivamus nec hendrerit felis. Morbi aliquam facilisis risus eu lacinia. Sed eu leo in turpis fringilla hendrerit. Ut nec accumsan nisl.

This text is right aligned. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam in suscipit purus. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Vivamus nec hendrerit felis. Morbi aliquam facilisis risus eu lacinia. Sed eu leo in turpis fringilla hendrerit. Ut nec accumsan nisl.

This text is justified. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam in suscipit purus. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Vivamus nec hendrerit felis. Morbi aliquam facilisis risus eu lacinia. Sed eu leo in turpis fringilla hendrerit. Ut nec accumsan nisl.

Text styling

PDFKit has many options for controlling the look of text added to PDF documents, which can be passed to the `text` method. They are enumerated below.

- `lineBreak` - set to `false` to disable wrapping, or `'whitespace'` to wrap only at whitespace, soft hyphens and zero-width spaces when a word fits on a line
- `width` - the width that text should be wrapped to (by default, the page width minus the left and right margin)
- `height` - the maximum height that text should be clipped to
- `rotation` - the rotation of the text in degrees (by default 0)
- `ellipsis` - the character to display at the end of the text when it is too long. Set to `true` to use the default character.
- `columns` - the number of columns to flow the text into
- `columnGap` - the amount of space between each column (1/4 inch by default)
- `indent` - the amount in PDF points (72 per inch) to indent each paragraph of text
- `indentAllLines` - wheter to indent all lines of a paragraph (`false` by default - indents only the first line)
- `paragraphGap` - the amount of space between each paragraph of text
- `lineGap` - the amount of space between each line of text
- `wordSpacing` - the amount of space between each word in the text
- `characterSpacing` - the amount of space between each character in the text
- `horizontalScaling` - ability to scale text horizontally (`100` percent by default)
- `fill` - whether to fill the text (`true` by default)
- `stroke` - whether to stroke the text
- `link` - a URL to link this text to (shortcut to create an annotation)
- `goTo` - go to anchor (shortcut to create an annotation)
- `destination` - create anchor to this text
- `underline` - whether to underline the text
- `underlineOffset` - distance in PDF points to move the underline; positive values move it down, and negative values move it up
- `strike` - whether to strike out the text
- `decorationThickness` - thickness of the underline and strikethrough in PDF points (defaults to a value based on font size)
-

`oblique` – whether to slant the text (angle in degrees or **`true`**)

- **`baseline`** – the vertical alignment of the text with respect to its insertion point (values as canvas textBaseline)

- **`continued`** – whether the text segment will be followed immediately by another segment. Useful for changing styling in the middle of a paragraph.

- **`features`** – an array of OpenType feature tags to apply. Can also be provided as an object with features as keys and boolean values. If not provided, a set of defaults is used. To deactivate default font features, you have to explicitly set them to false (**`{ liga: false }`**). When providing an empty array the default font features will still be used.

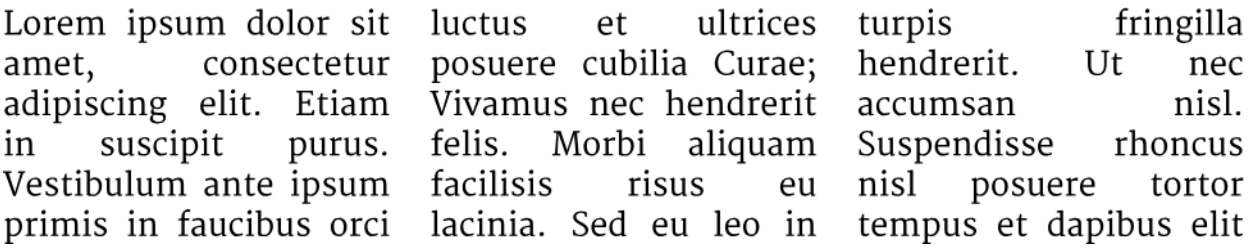
Additionally, the fill and stroke color and opacity methods described in the vector graphics section are applied to text content as well.

Here is an example combining some of the options above, wrapping a piece of text into three columns, in a specified width and height.

```
const lorem = 'Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam in
suscipit purus. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices
posuere cubilia Curae; Vivamus nec hendrerit felis. Morbi aliquam facilisis risus eu
lacinia. Sed eu leo in turpis fringilla hendrerit. Ut nec accumsan nisl. Suspendisse
rhoncus nisl posuere tortor tempus et dapibus elit porta. Cras leo neque, elementum a
rhoncus ut, vestibulum non nibh. Phasellus pretium justo turpis. Etiam vulputate,
odio vitae tincidunt ultricies, eros odio dapibus nisi, ut tincidunt lacus arcu eu
elit. Aenean velit erat, vehicula eget lacinia ut, dignissim non tellus. Aliquam nec
lacus mi, sed vestibulum nunc. Suspendisse potenti. Curabitur vitae sem turpis.
Vestibulum sed neque eget dolor dapibus porttitor at sit amet sem. Fusce a turpis
lorem. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere
cubilia Curae;';

doc.text(lorem, {
  columns: 3,
  columnGap: 15,
  height: 100,
  width: 465,
  align: 'justify'
});
```

The output looks like this:



Text measurements

If you're working with documents that require precise layout, you may need to know the size of a piece of text. PDFKit has three methods to achieve this: **`widthOfString(text, options)`** , **`heightOfString(text, options)`** and **`boundsOfString(text, options)/ boundsOfString(text, x, y, options)`**. All methods use the same options described in the Text styling section, and take into account the eventual line wrapping.

However **`boundsOfString`** factors in text rotations and multi-line wrapped text, effectively producing the bounding box of the text, **`{x: number, y: number, width: number, height: number}`**. If **`x`** and **`y`** are not defined they will default to use **`this.x`** and **`this.y`**.

Lists

The **`list`** method creates a bulleted list. It accepts as arguments an array of strings, and the optional **`x`**, **`y`** position. You can create complex multilevel lists by using nested arrays. Lists use the following additional options:

- **`bulletRadius`**
- **`textIndent`**
- **`bulletIndent`**
- **`start`** – starting number for the top level of a **`numbered`** or **`lettered`** list. The default is **`1`** (**`A`** for lettered lists); for example, **`3`** starts at **`C`**. Nested lists still start at **`1`** (**`A`**).

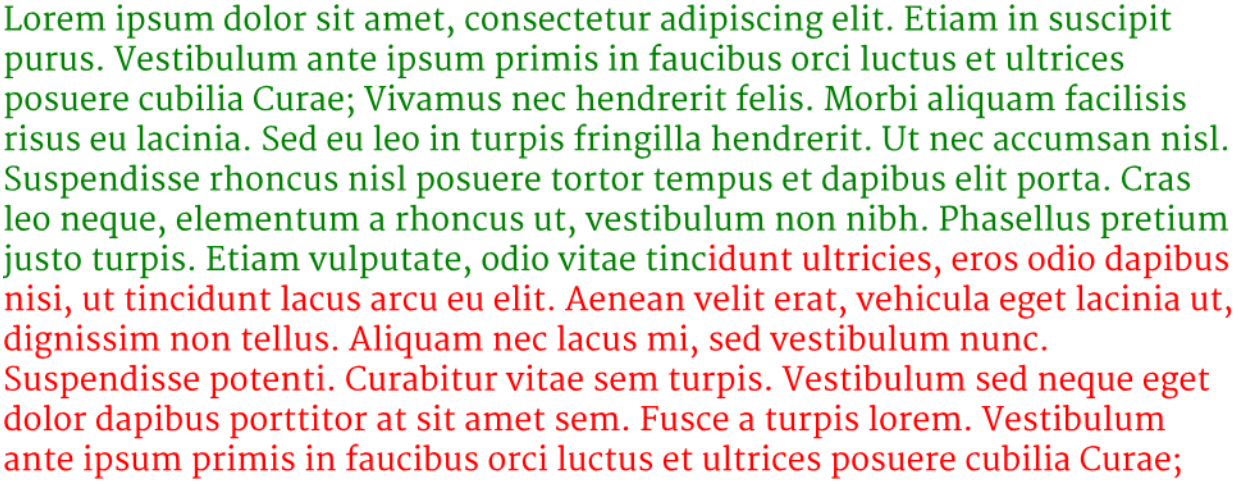
Rich Text

As mentioned above, PDFKit supports a simple form of rich text via the **`continued`** option. When set to true, PDFKit will retain the text wrapping state between **`text`** calls. This way, when you call text again after changing the text styles, the wrapping will continue right where it left off.

The options given to the first **`text`** call are also retained for subsequent calls after a **`continued`** one, but of course you can override them. In the following example, the **`width`** option from the first **`text`** call is retained by the second call.

```
doc.fillColor('green')
   .text(lorem.slice(0, 500), {
     width: 465,
     continued: true
   }).fillColor('red')
   .text(lorem.slice(500));
```

Here is the output:



To cancel a link in rich text set the **`link`** option to **`null`**.

```
doc.fillColor('red')
   .text(lorem.slice(0, 199), {
     width: 465,
     continued: true
   })
   .fillColor('blue')
   .text(lorem.slice(199, 282), {
     link: 'http://www.example.com',
     continued: true
   })
   .fillColor('green')
   .text(lorem.slice(182, 400), {
     link: null
   });
```

Here is the output:

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam in suscipit purus. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Vivamus nec hendrerit felis. Morbi aliquam facilisis risus eu lacinia. Sed eu leo in turpis fringilla hendrerit.hendrerit felis. Morbi aliquam facilisis risus eu lacinia. Sed eu leo in turpis fringilla hendrerit. Ut nec accumsan nisl. Suspendisse rhoncus nisl posuere tortor tempus et dapibus elit porta. Cras leo neque, elementum

With **`continued`** text, **`center`** and **`right`** alignment apply to each segment rather than to the line as a whole, so segments can overlap.

Fonts

This fork embeds fonts from memory instead of shipping the 14 standard PDF fonts or reading font files from disk. It supports TrueType (**`.ttf`**), OpenType (**`.otf`**), WOFF, WOFF2, TrueType Collection (**`.ttc`**), and Datafork TrueType (**`.dfont`**) fonts.

Supply a name in **`options.font`** and the default font data in **`options.fontData`** when creating a document. To change fonts, call **`doc.font()`** with a **`Uint8Array`**, an **`ArrayBuffer`**, or an already-parsed fontkit font instance. For collection bytes, pass the PostScript name of the desired face as the second argument (or set **`options.fontFamily`** for the default font).

```
const goodDog = await fetch('/fonts/GoodDog.ttf').then(res => res.arrayBuffer());
const doc = new PDFDocument({ font: 'Body', fontData: goodDog });
doc.fontSize(18).text('This is Good Dog!');

const chalkboard = await fetch('/fonts/Chalkboard.ttc').then(res => res.arrayBuffer())
;
doc.font(chalkboard, 'Chalkboard-Bold').text('This is Chalkboard.');
```

Use **`registerFont()`** to give an in-memory font source a reusable alias:

```
doc.registerFont('Heading', chalkboard, 'Chalkboard-Bold');
doc.font('Heading').text('This is a heading.');
```

That's about all there is too it for text in PDFKit. Let's move on now to images.

Images in PDFKit

Pass a **`Uint8Array`** or a base64 data URL to the **`image`** method along with any options. PDFKit supports JPEG and PNG. To load an image from a URL in a browser, fetch it first and pass the response bytes (**`new Uint8Array(await response.arrayBuffer())`**). If an X and Y position are not provided, the image is rendered at the current point in the text flow (below the last line of text). Otherwise, it is positioned absolutely at the specified point. The image will be scaled according to the following options.

- Neither **`width`** or **`height`** provided – image is rendered at full size
- **`width`** provided but not **`height`** – image is scaled proportionally to fit in the provided **`width`**
- **`height`** provided but not **`width`** – image is scaled proportionally to fit in the provided **`height`**
- Both **`width`** and **`height`** provided – image is stretched to the dimensions provided
- **`scale`** factor provided – image is scaled proportionally by the provided scale factor
- **`fit`** array provided – image is scaled proportionally to fit within the passed width and height
- **`scaleDown`** array provided – like **`fit`**, but never enlarges the image
- **`cover`** array provided – image is scaled proportionally to completely cover the rectangle defined by the passed width and height
- **`link`** – a URL to link this image to (shortcut to create an annotation)
- **`goTo`** – go to anchor (shortcut to create an annotation)
- **`destination`** – create anchor to this image
- **`ignoreOrientation`** – (true/false) ignore JPEG EXIF orientation. By default, images with JPEG EXIF orientation are properly rotated and/or flipped. Defaults to **`false`**, unless **`ignoreOrientation`** option set to **`true`** when creating the **`PDFDocument`** object (e.g. **`new PDFDocument({ignoreOrientation: true})`**)
- **`flipH`** and **`flipV`** – mirror the image horizontally or vertically within its placed rectangle, after applying its EXIF orientation
- **`opacity`** – a value between **`0`** (fully transparent) and **`1`** (fully opaque). For PNGs with transparency, it compounds with the existing transparency

When a **`fit`**, **`scaleDown`**, or **`cover`** array is provided, PDFKit accepts these additional options:

- **`align`** – horizontally align the image, the possible values are **`'left'`**, **`'center'`** and **`'right'`**
- **`valign`** – vertically align the image, the possible values are **`'top'`**, **`'center'`** and **`'bottom'`**

Here is an example showing some of these options. **`imageBytes`** contains the JPEG data.

```
// Scale proportionally to the specified width
```

```
doc.image(imageBytes, 0, 15, {width: 300})
   .text('Proportional to width', 0, 0);

// Fit the image within the dimensions
doc.image(imageBytes, 320, 15, {fit: [100, 100]})
   .rect(320, 15, 100, 100)
   .stroke()
   .text('Fit', 320, 0);

// Stretch the image
doc.image(imageBytes, 320, 145, {width: 200, height: 100})
   .text('Stretch', 320, 130);

// Scale the image
doc.image(imageBytes, 320, 280, {scale: 0.25})
   .text('Scale', 320, 265);

// Fit the image in the dimensions, and center it both horizontally and vertically
doc.image(imageBytes, 430, 15, {fit: [100, 100], align: 'center', valign: 'center'})
   .rect(430, 15, 100, 100).stroke()
   .text('Centered', 430, 0);
```

This example produces the following output:

Proportional to width



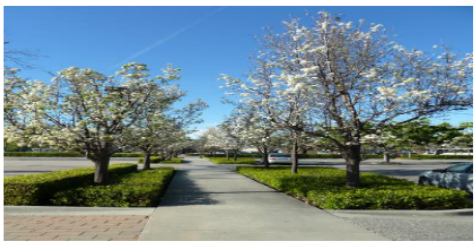
Fit



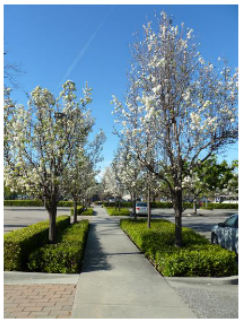
Centered



Stretch



Scale



That is all there is to adding images to your PDF documents with PDFKit. Now let's look at adding outlines.

Outlines in PDFKit

Outlines are the heirachical bookmarks that display in some PDF readers. Currently only page bookmarks are supported, but more may be added in the future. They are simple to add and only require a single method:

- **`addItem(title, options)`**

Here is an example of adding a bookmark with a single child bookmark.

```
// Get a reference to the Outline root
const { outline } = doc;

// Add a top-level bookmark
const top = outline.addItem('Top Level');

// Add a sub-section
top.addItem('Sub-section');
```

Options

The **`options`** parameter supports the following properties:

Option	Type	Default	Description
expanded	boolean	false	Show children by default
pageNumber	number	null	Link to specific page by index (0-based). If null, links to current page
fit	boolean	true	Use Fit destination (fit entire page in window)
top	number	0	Top position for XYZ destination (requires fit: false)
left	number	0	Left position for XYZ destination (requires fit: false)
zoom	number	0	Zoom level for XYZ destination (0 = current zoom, requires fit: false)

Expanded sections

If **`expanded`** is set to **`true`**, all of that section's children will be visible by default.

```
// Add a top-level bookmark
const top = outline.addItem('Top Level', { expanded: true });

// Add a sub-section
top.addItem('Sub-section');
```

Link to a specific page

Use **`pageNumber`** to link to a specific page by its index (0-based).

```
doc.text('Page 1');
doc.addPage();
doc.text('Page 2');
doc.addPage();
doc.text('Page 3');

// Link to page 1 (index 0)
outline.addItem('Chapter 1', { pageNumber: 0 });
// Link to page 2 (index 1)
outline.addItem('Chapter 2', { pageNumber: 1 });
```

Custom position and zoom (XYZ destination)

Set **`fit: false`** to use XYZ destination with custom position and zoom level.

```
// Jump to top-left corner of the page with 150% zoom
outline.addItem('Section 1', {
```

```
  fit: false,
  top: 0,
  left: 0,
  zoom: 1.5
});

// Jump to a specific position (100pt from top)
outline.addItem('Section 2', {
  pageNumber: 1,
  fit: false,
  top: 100,
  left: 0,
  zoom: 0  // 0 means keep current zoom level
});
```

Annotations in PDFKit

Annotations are interactive features of the PDF format, and they make it possible to include things like links and attached notes, or to highlight, underline or strikeout portions of text. Annotations are added using the various helper methods, and each type of annotation is defined by a rectangle and some other properties. Here is a list of the available annotation methods:

- `note(x, y, width, height, contents, options)`
- `link(x, y, width, height, url, options)`
- `goTo(x, y, w, h, name, options)`
- `highlight(x, y, width, height, options)`
- `underline(x, y, width, height, options)`
- `strike(x, y, width, height, options)`
- `lineAnnotation(x1, y1, x2, y2, options)`
- `rectAnnotation(x, y, width, height, options)`
- `ellipseAnnotation(x, y, width, height, options)`
- `textAnnotation(x, y, width, height, text, options)`
- `fileAnnotation(x, y, width, height, file, options)`

Many of the annotations have a **`color`** option that you can specify. You can use an array of RGB values, a hex color, a named CSS color value, or a named spot color value for that option.

A custom icon can be set using option **`Name`** property. Possible values are: **`'Comment'`**, **`'Key'`**, **`'Note'`**, **`'Help'`**, **`'NewParagraph'`**, **`'Paragraph'`** and **`'Insert'`**.

When supplying PDF dictionary entries in **`options`**, use their exact spelling and case (for example, **`Name`** rather than **`name`**). PDFKit does not capitalize these keys or change the options object. PDFKit-specific options such as **`color`** and **`structParent`** use their documented casing.

In a tagged PDF, pass a structure element as **`structParent`** to associate the annotation with it. For a link annotation, use a **`Link`** element. See Tagged Links for text links and manually placed link annotations.

If you are adding an annotation to a piece of text, such as a link or underline, you will need to know the width and height of the text in order to create the required rectangle for the annotation. There are two methods that you can use to do that. To get the width of any piece of text in the current font, just call the **`widthOfString`** method with the string you want to measure. To get the line height in the current font, just call the **`currentLineHeight`** method.

You must remember that annotations have a stacking order. If you are putting more than one annotation on a single area and one of those annotations is a link, make sure that the link is the last one you add, otherwise it will be covered by another annotation and the user won't

be able to click it.

Here is an example that uses a few of the annotation types.

```
// Add the link text
doc.fontSize(25)
   .fillColor('blue')
   .text('This is a link!', 20, 0);

// Measure the text
const width = doc.widthOfString('This is a link!');
const height = doc.currentLineHeight();

// Add the underline and link annotations
doc.underline(20, 0, width, height, {color: 'blue'})
   .link(20, 0, width, height, 'http://google.com/');

// Create the highlighted text
doc.moveDown()
   .fillColor('black')
   .highlight(20, doc.y, doc.widthOfString('This text is highlighted!'), height)
   .text('This text is highlighted!');

// Create text with a spot color
doc.addSpotColor('PANTONE185C', 0, 100, 78, 9)
doc.moveDown()
   .fillColor('PANTONE185C')
   .text('This text uses spot color!');

// Create the crossed out text
doc.moveDown()
   .strike(20, doc.y, doc.widthOfString('STRIKE!'), height)
   .text('STRIKE!');

// Create note
doc.note(10, 30, 30, 30, "Text of note");

// Create note with custom options
doc.note(10, 80, 30, 30, "Text of custom note", {Name: 'Key', color: 'red'});

// Adding go to as annotation
doc.goTo(20, doc.y, 10, 20, 'LINK', {});
```

The output of this example looks like this.

This is a link!

This text is highlighted!

This text uses spot color!

~~STRIKE!~~

Annotations are currently not the easiest things to add to PDF documents, but that is the fault of the PDF spec itself. Calculating a rectangle manually isn't fun, but PDFKit makes it easier for a few common annotations applied to text, including links, underlines, and strikes. Here's an example showing two of them:

```
doc.fontSize(20)
   .fillColor('red')
   .text('Another link!', 20, 0, {
     link: 'http://apple.com/',
     underline: true
   }
);
```

The output is as you'd expect:

Another link!

Forms in PDFKit

Forms are an interactive feature of the PDF format. Forms make it possible to add form annotations such as text fields, combo boxes, buttons and actions. Before adding forms to a PDF you must call the document **`initForm()`** method.

- **`initForm(options)`** – Must be called before adding a form annotation to the document. See Font for the **`embedFonts`** option.

```
doc.initForm(); // uses the current document font as the default form field font
```

Form Annotation Methods

Form annotations are added using the following document methods.

- **`formText( name, x, y, width, height, options)`**
- **`formPushButton( name, x, y, width, height, options)`**
- **`formCombo( name, x, y, width, height, options)`**
- **`formList( name, x, y, width, height, options)`**
- **`formRadioButton( name, x, y, width, height, options)`**
- **`formCheckbox( name, x, y, width, height, options)`**

The above methods call the **`formAnnotation`** method with type set to one of **`text`**, **`pushButton`**, **`radioButton`**, **`checkbox`**, **`combo`** or **`list`**.

- **`formAnnotation( name, type, x, y, width, height, options)`**

name Parameter

Form annotations are each given a **`name`** that is used for identification. Field names are hierarchical using a period ('.') as a separaror (**e.g. shipping.address.street**). More than one form field can have the same name. When this happens, the fields will have the same value. There is more information on **`name`** in the **Field Names** section below.

options Parameter

Common Annotation Options

The following **`options`** are accepted by all form annotation methods:

- **`parent`** [**PDFReference**] - Parent field returned by **`formField`**.
- **`structParent`** [**PDFStructureElement**] - Structure element returned by **`doc.struct()`**. Use a separate **`Form`** element for each widget in a tagged PDF. This is distinct from **`parent`**, which controls the form field hierarchy.
- **`required`** [**boolean**] - The field must have a value by the time the form is submitted.
- **`noExport`** [**boolean**] - The field will not be exported if a form is submitted.
- **`readOnly`** [**boolean**] - The user may not change the value of the field, and the field will not respond to mouse clicks. This is useful for fields that have computed values.
- **`value`** [**number|string**] - The field's value.
- **`defaultValue`** [**number|string**] - The default value to which the field reverts if a reset-form action is executed.
- **`alternateName`** [

string] – Alternate field name (**`TU`**), used as the field's accessible name or tooltip. Use a meaningful description, not just the internal field name.

- **`backgroundColor`** – Field background color.
- **`borderColor`** – Field border color.
- **`fontSize`** [**number**] – Sets the font size used in the field appearance string. The default, **`0`**, means auto sizing. An explicit size applies even when the field uses the default form font.
- **`hidden`** [**boolean**] – Builds the field starting hidden, instead of the usual default of visible and printable, for a field an interactive action (see **`onClick`** below) will reveal later.

Color options accept an array of RGB values, a hex color, or a named CSS color. Method-specific options listed below are accepted in addition to these common options.

Field Actions

These options are accepted by all form annotation methods. Each takes trusted JavaScript to run when the event occurs, given as a string or as a function:

- **`onClick`** – The mouse button is released inside the field.
- **`onMouseDown`** – The mouse button is pressed inside the field.
- **`onMouseEnter`** – The cursor enters the field.
- **`onMouseExit`** – The cursor leaves the field.
- **`onFocus`** – The field receives the input focus.
- **`onBlur`** – The field loses the input focus.

```
doc.formPushButton('btn1', 10, 200, 100, 30, {
  label: 'Test Button',
  onClick: 'app.alert("clicked");'
});
```

A function is written into the document as its source text and runs in the viewer, not where the document was generated, so it cannot use variables or functions from the surrounding program. **`this`** is the document, and the viewer's own globals, such as **`app`**, are in scope:

```
doc.formPushButton('btn1', 10, 200, 100, 30, {
  label: 'Test Button',
  onClick: function () {
    app.alert('clicked');
    this.getField('otherField').value = 'updated from btn1';
  }
});
```

Write the handler with **`function`** syntax; an arrow function cannot take the **`this`** binding.

Text Field Options

These options are accepted by **`formText`**:

- **`align`** [**string**] – Sets the alignment to **`left`**, **`center`** or **`right`**.

- **multiline** [boolean] - Allows the field to have multiple lines of text.
- **password** [boolean] - The text will be masked (e.g. with asterisks).
- **noSpell** [boolean] - If set, text entered in the field is not spell-checked.
- **format** [object] - See the section on **Text Field Formatting** below.

```
doc.formText('leaf2', 10, 60, 200, 40, {
  multiline: true,
  align: 'right',
  format: {
    type: 'date',
    params: 'm/d'
  }
});
```

Combo Field Options

These options are accepted by **formCombo**:

- **select** [array] - Array of choices to display in the combo field.
- **align** [string] - Sets the alignment to **left**, **center** or **right**.
- **edit** [boolean] - Allows the user to enter a value in the field.
- **sort** [boolean] - The field options will be sorted alphabetically.
- **multiSelect** [boolean] - Allows more than one choice to be selected.
- **noSpell** [boolean] - If set and **edit** is true, text entered in the field is not spell-checked.

```
opts = {
  select: ['', 'github', 'bitbucket', 'gitlab'],
  value: '',
  defaultValue: '',
  align: 'left'
};
doc.formCombo('ch1', 10, y, 100, 20, opts);
```

List Field Options

These options are accepted by **formList**:

- **select** [array] - Array of choices to display in the list field.
- **align** [string] - Sets the alignment to **left**, **center** or **right**.
- **sort** [boolean] - The field options will be sorted alphabetically.
- **multiSelect** [boolean] - Allows more than one choice to be selected.

Push Button Field Options

These options are accepted by **formPushButton**:

• **label** [string] – Sets the label text. You can also set an icon, but for this you will need to 'expert-up' and dig deeper into the PDF Reference manual.

• **onClick** [string | function] – JavaScript to run when the button is clicked. See Field Actions.

```
var opts = {
  backgroundColor: 'yellow',
  label: 'Test Button'
};
doc.formPushButton('btn1', 10, 200, 100, 30, opts);
```

Radio Button Field Options

These options are accepted by **formRadioButton**:

• **toggleToOffButton** [boolean] – Allows a selected radio button to be toggled off by clicking it again.

Checkbox Field Options

formCheckbox accepts the common annotation options.

Form Field Options

formField(name, options) creates an invisible field node and accepts these options:

• **parent** [PDFReference] – Parent field returned by **formField**.

• **required** [boolean] – The field must have a value by the time the form is submitted.

• **noExport** [boolean] – The field will not be exported if a form is submitted.

• **readOnly** [boolean] – The user may not change the value of the field.

• **value** [number|string] – The field's value.

• **defaultValue** [number|string] – The default value to which the field reverts if a reset-form action is executed.

• **backgroundColor** – Field background color.

• **borderColor** – Field border color.

• **fontSize** [number] – Sets the font size used in the field appearance string.

Numeric values and defaults in text and choice fields are stored as text. For example, **value: 0** and **value: '0'** set the same field value.

Text Field Formatting

When needing to format the text value of a Form Annotation, the following **options** are available. This will cause predefined document JavaScript actions to automatically format the text. Refer to the section **Formatting scripts** in Acrobat Forms Plugin of the Acrobat SDK documentation for more information.

Add a format dictionary to **`options`**. The dictionary must contain a **`type`** attribute.

- **`format`** – generic object
- **`format.type`** – value must be one of **`date`**, **`time`**, **`percent`**, **`number`**, **`zip`**, **`zipPlus4`**, **`phone`** or **`ssn`**.

When **`type`** is **`date`**, **`time`**, **`percent`** or **`number`** the format dictionary must contain additional parameters as described below.

Date format

- **`format.param`** (**string**) – specifies the value and display format and can include:
- **`d`** – single digit day of month
- **`dd`** – double digit day of month
- **`m`** – month digit
- **`mm`** – month double digit
- **`mmm`** – abbreviated month name
- **`mmmm`** – full month name
- **`yy`** – two digit year
- **`yyyy`** – four digit year
- **`hh`** – hour for 12 hour clock
- **`HH`** – hour for 24 hour clock
- **`MM`** – two digit minute
- **`tt`** – am or pm

```
// Date text field formatting
doc.formText('field.date', 10, 60, 200, 40, {
  align: 'center',
  format: {
    type: 'date',
    param: 'mmmm d, yyyy'
  }
});
```

Time format

- **`format.param`** – value must be a number between 0 and 3, representing the formats "14:30", "2:30 PM", "14:30:15" and "2:30:15 PM".

```
// Time text field formatting
doc.formText('field.time', 10, 60, 200, 40, {
  align: 'center',
  format: {
    type: 'time',
```

```
    param: 2
  }
});
```

Number and percent format

- **`format.nDec`** [**number**] – the number of places after the decimal point
- **`format.sepComma`** [**boolean**] – display a comma separator, otherwise do not display a separator.
- **`format.negStyle`** [**string**] (number only) – the value must be one of **`MinusBlack`** , **`Red`**, **`ParensBlack`**, **`ParensRed`**
- **`format.currency`** [**string**] (number only) – a currency symbol to display
- **`format.currencyPrepend`** [**boolean**] (number only) – set to true to prepend the currency symbol

```
// Currency text field formatting
doc.formText('leaf2', 10, 60, 200, 40, {
  multiline: true,
  align: 'right',
  format: {
    type: 'number',
    nDec: 2,
    sepComma: true,
    negStyle: 'ParensRed',
    currency: '$',
    currencyPrepend: true
  }
});
```

Field Names

Form Annotations are, by default, added to the root of the PDF document. A PDF form is organized in a name heirarchy, for example **shipping.address.street**. Capture this heirarchy either by setting the **name** of each **form annotation** with the full hierarchical name (e.g. **shipping.address.street**) or by creating a hierarchy of **form fields** and **form annotations** and refering to a form field or form annotations parent using **options.parent**.

A **form field** is an invisible node in the PDF form and is created using the document **formField** method. A form field must include the node's **name** (e.g. **shipping**) and may include other information such as the default font that is to be used by all child form annotations.

Using the **formField** method you might create a **shipping** field that is added to the root of the document, an **address** field that refers to the **shipping** field as it's parent, and a **street** Form Annotation that would refer to the **address** field as it's parent.

Create form fields using the document method:

- **formField(name, options)** - returns a reference to the field

-- Example PDF using field hierarchy, three text fields and a push button --

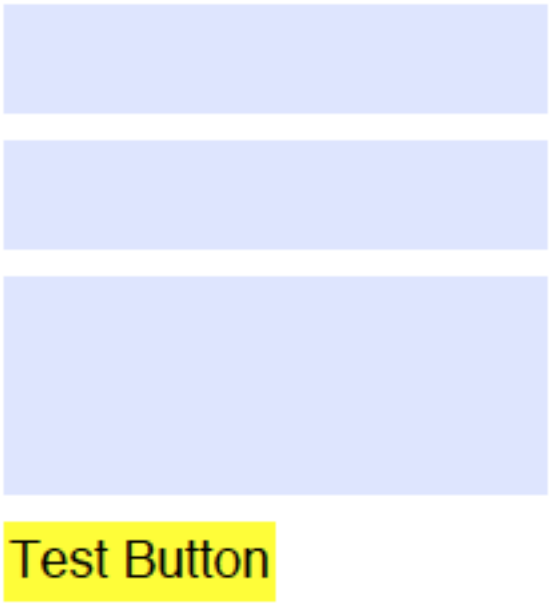
```
doc.initForm(); // uses the current document font as the default form field font

let rootField = doc.formField('rootField');
let child1Field = doc.formField('child1Field', { parent: rootField });
let child2Field = doc.formField('child2Field', { parent: rootField });

// Add text form annotation 'rootField.child1Field.leaf1'
doc.formText('leaf1', 10, 10, 200, 40, {
  parent: child1Field,
  multiline: true
});
// Add text form annotation 'rootField.child1Field.leaf2'
doc.formText('leaf2', 10, 60, 200, 40, {
  parent: child1Field,
  multiline: true
});
// Add text form annotation 'rootField.child2Field.leaf1'
doc.formText('leaf1', 10, 110, 200, 80, {
  parent: child2Field,
  multiline: true
});

// Add push button form annotation 'btn1'
var opts = {
  backgroundColor: 'yellow',
  label: 'Test Button'
};
doc.formPushButton('btn1', 10, 200, 100, 30, opts);
```

The output of this example looks like this.



Advanced Form Field Use

Older implementations used to pass all unknown options to the internal PDF object structure. A small set of direct PDF dictionary escape hatches is still recognized: **`Ff`**, **`MK.CA`**, and **`AA`** when a **`format`** option is used but its use is discouraged and likely will be removed in future versions.

If an option is not supported, open an issue on Github and it will be considered for addition to the API.

Font

The font used for a Form Annotation is set using the **`document.font`** method. Yes that's the same method as is used when setting the text font.

`initForm` uses the current font as the default. Call **`font`** before **`initForm`** to change the default, or before **`formField`** or a form annotation method to use a different font for that field.

```
doc.font(fontBytes);
doc.formText('myfield', 10, 10, 200, 20);
```

Pass **`{ embedFonts: true }`** to **`initForm`** to embed full copies of the fonts used in the form. See Form Field Appearances for when to use this.

Named JavaScript

In support of Form Annotations that execute JavaScript in PDF, you may use the following document method:

- **`addNamedJavaScript( name, string )`**

Limitations

It is recommended that you test your PDF form documents across all platforms and viewers that you wish to support.

Form Field Appearances

Form elements must each have an **appearance** set using the **AP** attribute of the annotation. If this attribute is not set, the form element's value **may** not be visible. Because appearances can be complex to generate, Adobe Acrobat has an option to build these apperances from form values and Form Annotation attributes when a PDF is first opened. To do this PDFKit always sets the Form dictionary's **NeedAppearances** attribute to true. This could mean that the PDF will be **dirty** upon open, meaning it will need to be saved.

The **NeedAppearances** flag may not be honored by all PDF viewers.

Some form documents may not need to generate appearances. This may be the case for text Form Annotations that initially have no value. This is not true for push button widget annotations. Please test

With a custom font, a viewer building the appearance this way may show the field in a substitute font: the font PDFKit embeds for page content is subsetted and addressed by glyph id, which gives the viewer no way to resolve the field's text itself. Passing **embedFonts** to **initForm** embeds a complete copy of each font used in a field, with a character map viewers can use for glyphs covered by both the font and WinAnsi encoding:

```
doc.font(fontBytes);
doc.initForm({ embedFonts: true });
```

That copy holds the whole font rather than the glyphs used so far, so it adds roughly the size of the font file to the document, per font. It is off by default for that reason, and only affects custom fonts — the standard 14 fonts are not embedded at all.

Document JavaScript

Many PDF Viewers, aside from Adobe Acrobat Reader, do not implement document JavaScript. Even Adobe Readers may not implement document JavaScript where it is not permitted by a device's app store terms of service (e.g. iOS devices).

Radio and Checkboxes

Support for radio and checkboxes requires a more advanced attention to their rendered appearances and are not supported in this initial forms release.

Destinations

Anchor may specify a destination by **`addNamedDestination(name, ...args)`**, which consists of a page, the location of the display window on that page, and the zoom factor to use when displaying that page.

Examples of creating anchor:

```
// Insert anchor for current page
doc.addNamedDestination('LINK');

// Insert anchor for current page with only horizontal magnified to fit where
vertical top is 100
doc.addNamedDestination('LINK', 'FitH', 100);

// Insert anchor to display a portion of the current page, 1/2 inch in from the top
and left and zoomed 50%
doc.addNamedDestination('LINK', 'XYZ', 36, 36, 50);

// Insert anchor for this text
doc.text('End of paragraph', { destination: 'ENDP' });
```

Each destination type takes a fixed, positional parameter list:

type	parameters
XYZ	left, top, zoom
Fit	none
FitH	top
FitV	left
FitR	left, bottom, right, top
FitB	none
FitBH	top
FitBV	left

`XYZ` is the only type whose vertical coordinate is converted: give its **`top`** measured from the top of the page, as everywhere else in PDFKit. The others are written through unchanged, so **`FitH`** and **`FitBH`**'s **`top`**, and **`FitR`**'s **`bottom`** and **`top`**, are measured from the bottom of the page.

A destination carrying more parameters than its type takes is not valid; **`FitR`** must carry all four, and **`XYZ`** at least **`left`** and **`top`**. For **`XYZ`**, **`FitH`**, **`FitV`**, **`FitBH`** and **`FitBV`** a parameter may be **`null`**, which tells the reader to keep that aspect of its current view. Called with no type at all, **`addNamedDestination(name)`** writes **`XYZ`** with all three parameters **`null`**.

Examples of go to link to anchor:

```
// Go to annotation
doc.goTo(10, 10, 100, 20, 'LINK')

// Go to annotation for this text
doc.text('Another goto', 20, 0, {
  goTo: 'ENDP',
```

```
  underline: true
});
```

Attachments in PDFKit

Embedded Files

Embedded files make it possible to embed any external file into a PDF. Adding an embedded file is as simple as calling the **`file`** method and specifying a filepath.

```
doc.file(path.join(__dirname, 'example.txt'))
```

It is also possible to embed data directly as a Buffer, ArrayBuffer or base64 encoded string. If you are embedding data, it is recommended you also specify a filename like this:

```
doc.file(Buffer.from('this will be a text file'), { name: 'example.txt' })
```

When embedding a data URL, the **`type`** option will be set to the data URL's MIME type automatically:

```
doc.file('data:text/plain; base64,YmFzZTY0IHN0cmluZw==', { name: 'base64.txt' })
```

There are a few other options for **`doc.file`**:

- **`name`** - specify the embedded file's name
- **`type`** - specify the embedded file's subtype as a MIME-Type
- **`description`** - add descriptive text for the embedded file
- **`hidden`** - if true, do not show file in the list of embedded files
- **`creationDate`** - override the date and time the file was created
- **`modifiedDate`** - override the date and time the file was last updated
- **`relationship`** - relationship between the PDF document and its attached file. Can be 'Alternative', 'Data', 'Source', 'Supplement' or 'Unspecified'.

If you are attaching a file from your file system, creationDate and modifiedDate will be set to the source file's creationDate and modifiedDate.

Setting the **`hidden`** option prevents this file from showing up in the pdf viewer's attachment panel. While this may not be very useful for embedded files, it is absolutely necessary for file annotations, to prevent them from showing up twice in the attachment panel.

File Annotations

A file annotation contains a reference to an embedded file that can be placed anywhere in the document. File annotations show up in your reader's annotation panel as well as the attachment panel.

In order to add a file annotation, you should first read the chapter on annotations. Like other annotations, you specify position and size with **`x`**, **`y`**, **`width`** and **`height`**, unlike other annotations you must also specify a file object. The file object may contain the same options as **`doc.file`** in the previous section with the addition of the source file or buffered data in **`src`** .

Here is an example of adding a file annotation:

```
const file = {
  src: path.join(__dirname, 'example.txt'),
  name: 'example.txt',
  description: 'file annotation description'
}
const options = { Name: 'Paperclip' }

doc.fileAnnotation(100, 100, 100, 100, file, options)
```

The annotation's appearance may be changed by setting the **`Name`** option to one of the three predefined icons **`GraphPush`**, **`Paperclip`** or **`Push`** (default value).

Accessibility

Accessible PDFs are usable by visually impaired users who rely on screen readers/text-to-speech engines/vocalisation.

The two main tasks required to create accessible PDFs are marking content and defining the document's logical structure. These are detailed in the following sections.

Some other simpler tasks are also required.

This checklist covers everything that is required to create a conformant PDF/UA (PDF for Universal Accessibility) document (which is an extension of Tagged PDF):

- Pass the option **`pdfVersion: '1.5'`** (or a higher version) when creating your **`PDFDocument`** (depending on the features you use, you may only need 1.4; refer to the PDF reference for details).

- Pass the option **`subset: 'PDF/UA'`** when creating your **`PDFDocument`** (if you wish the PDF to be identified as PDF/UA-1).

- Pass the option **`tagged: true`** when creating your **`PDFDocument`** (technically, this sets the **`Marked`** property in the **`Markings`** dictionary to **`true`** in the PDF).

- Provide a **`Title`** in the **`info`** option, and pass **`displayTitle: true`** when creating your **`PDFDocument`**.

- Specify natural language in the document options and/or logical structure and/or non-structure marked **`Span`** content.

- Add logical structure with all significant content included.

- Include accessibility information (such as alternative text, actual text, etc.) in the logical structure and/or non-structure marked **`Span`** content.

- Include all spaces which separate words/sentences/etc. in your marked structure content, even at the ends of lines, paragraphs, etc.. I.e. don't do **`doc.text("Hello, world!")`** but instead do **`doc.text("Hello, world! ")`**.

- Mark all non-structure content as artifacts.

- As well as creating the logical structure, write objects to the PDF in the natural "reading order".

- Do not convey information solely using visuals (such as colour, contrast or position on the page).

- No flickering or flashing content.

Marked Content

Marked content sequences are foundational to creating accessible PDFs.

All marked content sequences are associated with a registered tag, such as 'Span'.

Example of marking content:

```
// Mark some text as a "Span"
doc.markContent('Span');
doc.text('Hello, world! ');
doc.endMarkedContent();
```

Marked content is automatically ended when a page is ended, and if a new page is automatically added by text wrapping, marking is automatically begun again on the new page.

Tags to use are listed in a later section.

Marked Content Options

When marking content, you can provide options (take care to use correct capitalisation):

- **`type`** – used for artifact content; may be **`Pagination`** (e.g. headers and footers), **`Layout`** (e.g. rules and backgrounds) or **`Page`** (cut marks etc.)
- **`bbox`** – bounding box for artifact content: **`[left, top, right, bottom]`** in default coordinates
- **`attached`** – used for **`Pagination`** artifact content, array of one or more strings: **`Top`**, **`Bottom`**, **`Left`**, **`Right`**
- **`lang`** – used for **`Span`** content: human language code (e.g. **`en-AU`**) which overrides default document language, and any enclosing structure element language
- **`alt`** – used for **`Span`** content: alternative text for an image or other visual content
- **`expanded`** – used for **`Span`** content: the expanded form of an abbreviation or acronym
- **`actual`** – used for **`Span`** content: the actual text the content represents (e.g. if it is rendered as vector graphics)

It is advisable not to use **`Span`** content for specifying alternative text, expanded form, or actual text, especially if there is a possibility of the content automatically wrapping, which would result in the text appearing twice. Set these options on an associated structure element instead.

Logical Structure

Logical structures defines the reading order of a document, and can provide alternative text for images and other visual content.

To define logical structure, you need to mark the structure content, keep a reference to it, then incorporate it into a structure tree.

So far, PDFKit only supports marked content in the logical structure, not annotations, forms, or anything else.

Example of marking structure content:

```
// Mark some text as a paragraph ("P"); the tag should match the intended structure element's type
const myStructContent = doc.markStructureContent('P');
doc.text('Hello, world! ');
doc.endMarkedContent();
```

Example of the simplest of structure trees:

```
// Add a single structure element which includes the structure content to the document's structure
doc.addStructure(doc.struct('P', myStructContent));
```

Tags/element types to use are listed in a later section.

Note that to be conformant to Tagged PDF, all content not part of the logical structure should be marked as **`Artifact`**.

Automatic Ending of Structure Content and Artifacts

Structure content does not nest, and is mutually exclusive with artifact content; marking structure or artifact content will automatically end current marking of structure or artifact content (and any descendent marking):

```
// Mark multiple paragraphs without needing to close them
doc.markContent('Artifact', { type: "Layout" });
doc.rect(x1, y1, w1, h1);
const myStructContent = doc.markStructureContent('P');
doc.text('Hello, world! ');
doc.markContent('Artifact', { type: "Layout" });
doc.rect(x2, y2, w2, h2);
const myStructContent = doc.markStructureContent('P');
doc.markContent('Span');
doc.text('Bonjour, tout le monde! ');
doc.markContent('Artifact', { type: "Layout" });
doc.rect(x3, y3, w3, h3);
const myStructContent = doc.markStructureContent('P');
doc.text('Hello again! ');
```

Complex Structure

Multiple elements may be added directly to the document, or to structure elements, and may nest:

```
// Create nested structure elements
```

```
const section1 = doc.struct('Sect', [
    doc.struct('P', [
        someTextStructureContent,
        doc.struct('Link', someLinkStructureContent),
        moreTextStructureContent
    ])
]);
const section2 = doc.struct('Sect', secondSectionStructureContent);

// Add them to the document's structure
doc.addStructure(section1).addStructure(section2);
```

Incremental Construction of Structure

Structure can be built incrementally. Elements can optionally be (recursively) ended once you have finished adding to them, allowing them to be flushed out as soon as possible:

```
// Begin a new section and add it to the document's structure
const mySection = doc.struct('Sect');
doc.addStructure(mySection);

// Create a new paragraph and add it to the section
const myParagraph = doc.struct('P');
mySection.add(myParagraph);

// Add content, both to the page, and the paragraph
const myParagraphContent = doc.markStructureContent('P');
myParagraph.add(myParagraphContent);
doc.text('Hello, world! ');

// End the paragraph, allowing it to be flushed out, freeing memory
myParagraph.end();
```

Note that if you provide children when creating a structure element (i.e. providing them to **`doc.struct()`** rather than using **`structElem.add()`**) then **`structElem.end()`** is called automatically. You therefore cannot add additional children with **`structElem.add()`**, i.e. you cannot mix atomic and incremental styles for the same structure element.

For an element to be flushed out, it must:

- be ended,
- have been added to its parent, and
- if it has content defined through closures (see next section), be attached to the document's structure (through its ancestors)

When you call **`doc.end()`**, the document's structure is recursively ended, resulting in all elements being flushed out. If you created elements but forgot to add them to the document's structure, they will not be flushed, but the PDF stream will wait for them to be flushed before ending, causing your application to hang. Make sure if you create any elements, you add them to a parent, so ultimately all elements are attached to the document. It's best to add elements to their parents as you go.

Shortcut for Elements Containing Only Marked Content

The common case where a structure element contains only content marked with a tag matching the structure element type can be achieved by using a closure:

```
doc.addStructure(doc.struct('P', () => {
    doc.text('Hello, world! ');
}));
```

This is equivalent to:

```
const myStruct = doc.struct('P');
doc.addStructure(myStruct);
const myStructContent = doc.markStructureContent('P');
doc.text('Hello, world! ');
doc.endMarkedContent();
myStruct.add(myStructContent);
myStruct.end();
```

Note that the content is marked and the closure is executed **if/when the element is attached to the document's structure**. This means that you can do something like this:

```
const myParagraph = doc.struct('P', [
    () => { doc.text("Please see ", { continued: true }); },
    doc.struct('Link', () => {
        doc.text("something", { link: "http://www.example.com/", continued: true });
    }),
    () => { doc.text(" for details. ", { link: null }); }
]);
```

and no content will be added to the page until/unless something like this is done:

```
doc.addStructure(section1);
section1.add(myParagraph); // Content is added now
```

or alternatively:

```
section1.add(myParagraph);
doc.addStructure(section1); // Content is added now
```

This is important because otherwise when the **`Link`** element is constructed, its content will be added to the page, and then the list containing the link element will be passed to the construct the **`P`** element, and only during the construction of the **`P`** element will the other **`P`** content be added to the page, resulting in page content being out of order. It's best to add elements to their parents as you go.

Structure Element Options

When creating a structure element, you can provide options:

- **`title`** – title of the structure element (e.g. "Chapter 1")
- **`lang`** – human language code (e.g. **`en-AU`**) which overrides default document language
- **`alt`** – alternative text for an image or other visual content
- **`expanded`** – the expanded form of an abbreviation or acronym
- **`actual`** – the actual text the content represents (e.g. if it is rendered as vector graphics)
- **`bbox`** – bounding box of the element's content in PDFKit coordinates **`[left, top, right, bottom]`**, required for **`Figure`** elements in PDF/UA
- **`placement`** – layout placement of the element: **`'Block'`** (the default when **`bbox`** is set) or

`'Inline'`

Example of a structure tree with options specified:

```
const titlePage = doc.struct('Sect', {
    title: 'Title Page'
}, [
    doc.struct('H', [
        doc.struct('Span', {
            expanded: 'Portable Document Format for Universal Accessibility',
            actual: 'PDF/UA'
        }, [
            pdfUAStructureContent
        ]),
        doc.struct('Span', {
            actual: 'in a Nutshell'
        }, [
            inANutshellStructureContent
        ]),
    ]),
    doc.struct('Figure', {
        alt: 'photo of a concrete path with tactile paving',
        bbox: [100, 200, 500, 600]
    }, [
        photoStructureContent
    ])
]);
```

Automatic Marking and Structure Construction for Text

The **`text()`** method accepts a **`structParent`** option which you can use to specify a structure element to add each paragraph to. It will mark each paragraph of content, create a structure element for it, and then add it to the parent element you provided. It will use the **`P`** type, unless you specify a different type with a **`structType`** option.

Example of creating structure automatically with **`text()`**:

```
// Create a section, add it to the document structure, then add paragraphs to it
const section = doc.struct('Sect');
doc.addStructure(section);
doc.text("Foo. \nBar. ", { structParent: section });
```

This is equivalent to:

```
const section = doc.struct('Sect');
doc.addStructure(section);
section.add(doc.struct('P', () => { doc.text("Foo. "); }));
section.add(doc.struct('P', () => { doc.text("Bar. "); }));
```

The **`list()`** method also accepts a **`structParent`** option. By default, it add list items (type **`LI`**) to the parent, each of which contains a label (type **`Lbl`**, which holds the bullet, number, or letter) and a body (type **`LBody`**, which holds the actual item content). You can override the default types with a **`structTypes`** option, which is a list: **`[ itemType, labelType, bodyType ]`**. You can make any of the types **`null`** to omit that part of the structure (i.e. to add labels and bodies directly to the parent, and/or to collapse the label and body into a single element).

Example of creating structure automatically with **`list()`**:

```
// Create a list, add it to the structure tree, then add items to it
const list = doc.struct('List');
someElement.add(list);
doc.list(["Foo. ", "Bar. "], { structParent: list });
```

Tagged Links

For a text link, call **`text()`** with its **`link`** option inside a **`Link`** structure element's content callback. This associates the clickable annotation with the same structure element as the visible text. Provide a descriptive link label:

```
const paragraph = doc.struct('P');
doc.addStructure(paragraph);
paragraph.add(doc.struct('Link', { alt: 'PDFKit documentation' }, () => {
  doc.text('PDFKit documentation', { link: 'https://pdfkit.org/', underline: true });
}));
paragraph.end();
```

When placing a link directly with **`doc.link()`**, pass **`{ structParent: link }`** in the annotation options, where **`link`** is its **`Link`** structure element. Add the annotation before ending the element. For a named destination added with **`doc.goTo()`**, pass the structure parent explicitly in the same way.

Tags and Structure Element Types

Here are the tags and structure element types which are defined in Tagged PDF. You must ensure you give them with the correct capitalisation.

Tagged PDF also supports custom types which map to standard types, but PDFKit does not have support for this.

Non-structure tags:

- **`Artifact`** – used to mark all content not part of the logical structure
- **`ReversedChars`** – every string of text has characters in reverse order for technical reasons (due to how fonts work for right-to-left languages); strings may have spaces at the beginning or end to separate words, but may not have spaces in the middle

"Grouping" elements:

- **`Document`** – whole document; must be used if there are multiple parts or articles
- **`Part`** – part of a document
- **`Art`** – article
- **`Sect`** – section; may nest
- **`Div`** – generic division
- **`BlockQuote`** – block quotation
- **`Caption`** – describing a figure or table
- **`TOC`** – table of contents, may be nested, and may be used for lists of figures, tables, etc.
- **`TOCI`** – table of contents (leaf) item
- **`Index`** – index (text with accompanying **`Reference`** content)
- **`NonStruct`** – non-structural grouping element (element itself not intended to be exported to other formats like HTML, but 'transparent' to its content which is processed normally)
- **`Private`** – content only meaningful to the creator (element and its content not intended to be exported to other formats like HTML)

"Block" elements:

- **`H`** – heading (first element in a section, etc.)
- **`H1`** to **`H6`** – heading of a particular level intended for use only if nesting sections is not possible for some reason
- **`P`** – paragraph
- **`L`** – list; should include optional **`Caption`**, and list items
- **`LI`** – list item; should contain **`Lbl`** and/or **`LBody`**

- **`Lbl`** – label (bullet, number, or "dictionary headword")
- **`LBody`** – list body (item text, or "dictionary definition"); may have nested lists or other blocks

"Table" elements:

- **`Table`** – table; should either contain **`TR`**, or **`THead`**, **`TBody`** and/or **`TFoot`**
- **`TR`** – table row
- **`TH`** – table heading cell
- **`TD`** – table data cell
- **`THead`** – table header row group
- **`TBody`** – table body row group; may have more than one per table
- **`TFoot`** – table footer row group

"Inline" elements:

- **`Span`** – generic inline content
- **`Quote`** – inline quotation
- **`Note`** – e.g. footnote; may have a **`Lbl`** (see "block" elements)
- **`Reference`** – content in a document that refers to other content (e.g. page number in an index)
- **`BibEntry`** – bibliography entry; may have a **`Lbl`** (see "block" elements)
- **`Code`** – code
- **`Link`** – hyperlink; contains the link annotation and its marked text, when present
- **`Annot`** – annotation (other than a link)
- **`Ruby`** – Chinese/Japanese pronunciation/explanation
- **`RB`** – Ruby base text
- **`RT`** – Ruby annotation text
- **`RP`** – Ruby punctuation
- **`Warichu`** – Japanese/Chinese longer description
- **`WT`** – Warichu text
- **`WP`** – Warichu punctuation

"Illustration" elements (should have **`alt`** and/or **`actualtext`** set):

- **`Figure`** – figure, should also have **`bbox`** set
- **`Formula`** – formula

- **`Form`** – form widget

Limitations

Font embedding

PDF/UA and PDF/A require every font used in the document to be embedded. A reference to one of the standard PDF fonts (such as Helvetica or Courier) without font data does not meet this requirement. Use TrueType or OpenType font data instead, supplied when creating the document or with **`doc.font(fontBytes)`**.

Tables in PDFKit

The basics

PDFKit makes adding tables to documents quite simple, and includes many options to customize the display of the output.

A simple table

Basic tables can be defined without configuration:

```
doc.table({
    data: [
        ['Column 1', 'Column 2', 'Column 3'],
        ['One value goes here', 'Another one here', 'OK?']
    ]
})
```

or the more verbose way

```
doc.table()
   .row(['Column 1', 'Column 2', 'Column 3'])
   .row(['One value goes here', 'Another one here', 'OK?'])
```

Column 1	Column 2	Column 3
One value goes here	Another one here	OK?

Defining column widths

Tables allow you to define the widths of columns:

- `*` – distributes equally, filling the whole available space (default)
- **`fixed value`** – a fixed width based on the document content

Example:

```
doc.table({
   columnStyles: [100, "*", 200, "*"],
   data: [
        ["width=100", "star-sized", "width=200", "star-sized"],
        [
            "fixed-width cells have exactly the specified width",
            { text: "nothing interesting here", textColor: "grey" },
            { text: "nothing interesting here", textColor: "grey" },
            { text: "nothing interesting here", textColor: "grey" }
        ],
   ],
});
```

width=100	star-sized	width=200	star-sized
fixed-width cells have exactly the specified width	nothing interesting here	nothing interesting here	nothing interesting here

Defining row heights

```
doc.table({
    rowStyles: [20, 50, 70],
    data: [
        ["row 1 with height 20", "column B"],
        ["row 2 with height 50", "column B"],
        ["row 3 with height 70", "column B"],
    ],
});
```

row 1 with height 20	column B
row 2 with height 50	column B
row 3 with height 70	column B

With same height:

```
doc.table({
    rowStyles: 40,
    data: [
        ["row 1", "column B"],
        ["row 2", "column B"],
        ["row 3", "column B"],
    ],
});
```

row 1	column B
row 2	column B
row 3	column B

With height from function:

```
doc.table({
    rowStyles: (row) => (row + 1) * 25,
    data: [
        ["row 1", "column B"],
        ["row 2", "column B"],
        ["row 3", "column B"],
    ],
});
```

row 1	column B
row 2	column B
row 3	column B

Column/row spans

Each cell can set a rowSpan or colSpan

```
doc.table({
  columnStyles: [200, "*", "*"],
  data: [
    [{ colSpan: 2, text: "Header with Colspan = 2" }, "Header 3"],
    ["Header 1", "Header 2", "Header 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    [
      {
        rowSpan: 3,
        text: "rowspan set to 3\nLorem ipsum dolor sit amet, consectetur adipisicing
elit, sed do eiusmod tempor",
      },
      "Sample value 2",
      "Sample value 3",
    ],
    ["Sample value 2", "Sample value 3"],
    ["Sample value 2", "Sample value 3"],
    [
      "Sample value 1",
      {
        colSpan: 2,
        rowSpan: 2,
        text: "Both:\nrowspan and colspan\ncan be defined at the same time",
      },
    ],
    ["Sample value 1"],
  ],
})
```

Header with Colspan = 2		Header 3
Header 1	Header 2	Header 3
Sample value 1	Sample value 2	Sample value 3
rowspan set to 3 Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor	Sample value 2	Sample value 3
	Sample value 2	Sample value 3
	Sample value 2	Sample value 3
Sample value 1	Both: rowspan and colspan can be defined at the same time	
Sample value 1		

Styling

No borders:

```
doc.table({
  rowStyles: { border: false },
  data: [
    ["Header 1", "Header 2", "Header 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
  ],
})
```

Header 1	Header 2	Header 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3

Header line only:

```
doc.table({
  rowStyles: (i) => {
    return i < 1 ? { border: [0, 0, 1, 0] } : { border: false };
  },
  data: [
    ["Header 1", "Header 2", "Header 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
  ],
})
```

Header 1	Header 2	Header 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3

Light Horizontal lines:

```
doc.table({
  rowStyles: (i) => {
    return i < 1
      ? { border: [0, 0, 2, 0], borderColor: "black" }
      : { border: [0, 0, 1, 0], borderColor: "#aaa" };
  },
  data: [
    ["Header 1", "Header 2", "Header 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
  ],
})
```

Header 1	Header 2	Header 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3

But you can provide a custom styler as well

```
doc.table({
  // Set the style for all cells
  defaultStyle: { border: 1, borderColor: "gray" },
  // Set the style for cells based on their column
  columnStyles: (i) => {
    if (i === 0) return { border: { left: 2 }, borderColor: { left: "black" } };
    if (i === 2) return { border: { right: 2 }, borderColor: { right: "black" } };
  },
  // Set the style for cells based on their row
  rowStyles: (i) => {
    if (i === 0) return { border: { top: 2 }, borderColor: { top: "black" } };
    if (i === 3) return { border: { bottom: 2 }, borderColor: { bottom: "black" } };
  },
  data: [
    ["Header 1", "Header 2", "Header 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
  ],
})
```

Header 1	Header 2	Header 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3

Zebra style

```
doc.table({
  rowStyles: (i) => {
    if (i % 2 === 0) return { backgroundColor: "#ccc" };
  },
  data: [
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
    ["Sample value 1", "Sample value 2", "Sample value 3"],
  ],
})
```

Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3
Sample value 1	Sample value 2	Sample value 3

Optional border

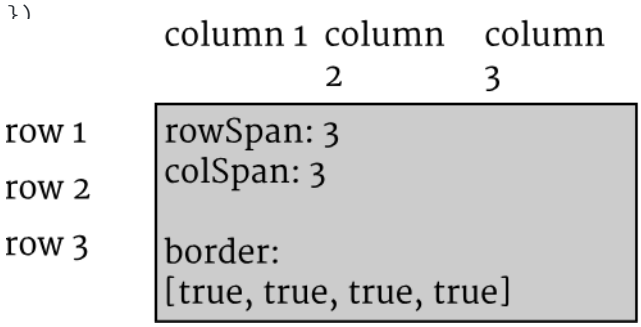
```
doc.table({
  data: [
    [
      { border: [true, false, false, false], backgroundColor: "#eee", text: "border:\n
[true, false, false, false]" },
      { border: false, backgroundColor: "#ddd", text: "border:\nfalse" },
      { border: true, backgroundColor: "#eee", text: "border:\ntrue" },
    ],
    [
      { rowSpan: 3, border: true, backgroundColor: "#eef", text: "rowSpan: 3\n\n
border:\ntrue" },
      { border: undefined, backgroundColor: "#eee", text: "border:\nundefined
(default)" },
      { border: [false, false, false, true], backgroundColor: "#ddd", text: "border:\n
[false, false, false, true]" },
    ],
    [
      { colSpan: 2, border: true, backgroundColor: "#efe", text: "colSpan: 2\n\n
border:\ntrue" },
    ],
    [
      { border: 0, backgroundColor: "#eee", text: "border:\n0 (same as false)" },
      { border: [false, true, true, false], backgroundColor: "#ddd", text: "border:\n
[false, true, true, false]" },
    ],
  ],
})
```

<table>
<tr><td>border:
[true, false, false, false]</td><td>border:
false</td><td>border:
true</td></tr>
<tr><td rowspan="3">rowSpan: 3

border:
true</td><td>border:
undefined (default)</td><td>border:
[false, false, false, true]</td></tr>
<tr><td colspan="2">colSpan: 2

border:
true</td></tr>
<tr><td>border:
0 (same as false)</td><td>border:
[false, true, true, false]</td></tr>
</table>

```
doc.table({
  defaultStyle: { border: false, width: 60 },
  data: [
    ["", "column 1", "column 2", "column 3"],
    [
      "row 1",
      {
        rowSpan: 3,
        colSpan: 3,
        border: true,
        backgroundColor: "#ccc",
        text: "rowSpan: 3\ncolSpan: 3\n\nborder:\n[true, true, true, true]",
      },
    ],
    ["row 2"],
    ["row 3"],
  ],
})
```



When defining multiple styles, the cells follow the precedence:

1. **`defaultStyle`**
2. **`columnStyles`**
3. **`rowStyles`**
4. **`cellStyle`**

so if a table was:

```
doc.table({
  defaultStyle: { border: 1 },
  columnStyles: { border: { right: 2 } },
  rowStyles: { border: { bottom: 3 } },
  data: [
    [{ border: { left: 4 } }]
  ]
})
```

The resulting cell would have a style of:

```
{
    border: {
        top: 1, // From the default
        right: 2, // From the column
        bottom: 3, // From the row
        left: 4  // From the cell
    }
}
```

Internally, PDFKit keeps track of the current X and Y position of table as it is added to the document. This way, any calls to **`text`** or **`table`** will be placed below the table row.

```
doc
    .text('before')
    .table({
        data: [
            ['Column 1', 'Column 2', 'Column 3'],
            ['One value goes here', 'Another one here', 'OK?']
        ]
    })
    .text('after')
```

before

Column 1	Column 2	Column 3
One value goes here	Another one here	OK?

after

Table options

- **`position`** – The position of the table (default **`{x: doc.x, y: doc.y}`**)
- **`maxWidth`** – The maximum width the table can expand to (defaults to the remaining content width (offset from the tables position))
- **`columnStyles`** – Column definitions of the table. (default **`auto`**)
- **`rowStyles`** – Row definitions of the table. (default **`*`**)
- **`defaultStyle`** – Defaults to apply to every cell
- **`data`** – The data to render (not required, you can call **`.row()`**). This can be an iterable (async or sync)
- **`headerRows`** – Number of initial rows to repeat at the top of each new table page (default **`0`**). Repeats are skipped if the next row would not fit below them. Cells that span from a header row into a body row are not repeated. For accessible headers, set **`type: 'TH'`** and **`scope`** separately.
- **`debug`** – Whether to show the debug lines for all the cells (default **`false`**)

Cell options

- **`text`** – The value, will be cast to a string (**`null`** and **`undefined`** are not rendered but the cell is still outlined)
- **`rowSpan`** – How many rows this cell covers, follows the same logic as HTML **`rowspan`**
- **`colSpan`** – How many columns this cell covers, follows the same logic as HTML **`colspan`**
- **`padding`** – The padding for the cell (default **`0.25em`**)
- **`border`** – The border for the cell (default **`1pt`**)
- **`borderColor`** – The border colors for the cell (default **`black`**)
- **`font`** – Font options for the cell
- **`src`** – A font registered with **`doc.registerFont()`**, or font data as a **`Uint8Array`** or **`ArrayBuffer`**, as accepted by **`doc.font()`**
- **`family`** – The face or variation to select from a font source, as in the second argument to **`doc.font()`**. It only applies when the cell, its row, or its column provides a **`src`**. To select a font already registered by name, use **`src`**.
- **`size`** – The font size
- **`backgroundColor`** – Set the background color of the cell
- **`align`** – The alignment of the cell text (default **`{x: 'left', y: 'top'}`**)
- **`textStroke`** – The text stroke (default **`0`**)
- **`textStrokeColor`** – Sets the text stroke color of the cells text (default **`black`**)
- **`textColor`** – Sets the text color of the cells text (default **`black`**)
- **`type`** – Sets the cell type (for accessibility) (default **`TD`**)
- **`scope`** – The scope of a **`TH`** cell in a tagged table: **`Row`**, **`Column`**, or **`Both`**
- **`textOptions`** – Sets any text options you wish to provide (such as rotation)
- **`debug`** – Whether to show the debug lines for the cell (default **`false`**)

Column, row, and cell font options are combined in that order. A more specific **`src`** replaces both the inherited source and its **`family`**; a **`family`** or **`size`** on its own refines the inherited font.

To use a registered font (where **`iconFontData`** contains the font bytes):

```
doc.registerFont('Icons', iconFontData);
doc.table({
    data: [['Label', { text: '\uf118', font: { src: 'Icons', size: 20 } }]],
});
```

Column options

Extends the cell options above with:

- **`width`** – The width of the column (default **`*`**)
- **`minWidth`** – The minimum width of the column (default **`0`**)
- **`maxWidth`** – The maximum width of the column (default **`Infinity`**)

Row options

Extends the cell options above with:

- **`height`** – The height of the row (default **`auto`**)
- **`minHeight`** – The minimum height of the row (default **`0`**)
- **`maxHeight`** – The maximum height of the row (default **`Infinity`**)

You made it!

That's all there is to creating PDF documents in PDFKit. It's really quite simple to create beautiful multi-page printable documents using Node.js!

This guide was generated from Markdown files using a PDFKit generation script. The examples are actually run to generate the output shown inline. The script generates both the website and the PDF guide, and can be found on Github. Check it out if you want to see an example of a slightly more complicated renderer using a parser for Markdown and a syntax highlighter.

If you have any questions about what you've learned in this guide, please don't hesitate to ask the author or post an issue on Github. Enjoy!