

codeanatomy – Draw Code Anatomy*

Usage

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Released 2019/07/12

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1 Introduction

The idea of this Package is to typeset illustrations of pieces of code with annotations on each single parts of code (Code Anatomy). The origin of this idea is code illustrations in the textbook [1]. This package just provides tool to draw those figures.

2 Tutorial

In this tutorial we will draw an anatomy of a function like the figure 1 step by step.

2.1 Package Usage

To use this package, just insert `\usepackage{codeanatomy}` in your L^AT_EX file.

*This file describes v0.4-Alpha, last revised 2019/07/12.

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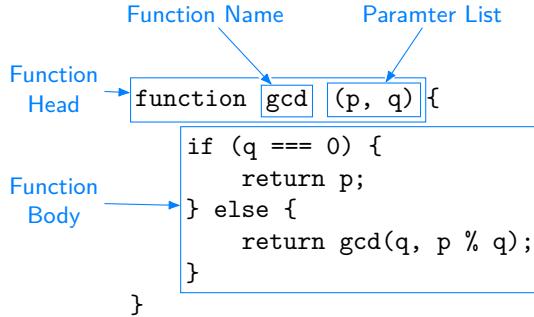


Figure 1: Anatomy of a function

2.2 Create an anatomy environment

Next step is to create a `tikzpicture` environment. All commands in this package must be placed in a `tikzpicture` environment with option `remember picture`.

```
\begin{tikzpicture}[remember picture]
  [on background layer]\draw[code grid debug] (-0.5,-0.5) grid (6.5,4.5);}
% ...
\end{tikzpicture}      plot a thin grey grid on background
                       usefull to determinate coordinate of annotation
```

necessary for
later mark

2.3 Typeset Code Listing in a TikZ-Node

As next step we need to put the piece of code in the `tikzpicture` environment using the command `\codeBlock`.

```
\begin{tikzpicture}[remember picture]
  [on background layer]\draw[code grid debug]
    (-0.5,-0.5) grid (6.5,4.5);}

\codeBlock{%
function gcd(p, q) {
  if (q === 0) {
    return p;
  } else {
    return gcd(q, p%q);
  }
}
```

Anatomy of Code

The result of the above code is shown in the figure 2, which is not what we really want. All extra whitespaces and newlines in the listing are removed, further more `{` and `}` are interpreted as L^AT_EX tokens and are not displayed.

We need to put `\ptab` and `\\"` into code to keep whitespaces and newlines. The characters `{` and `}` also need to be escaped by prefixing a `\` before them.

```

function gcd(p, q)  if (q === 0)  return p;  else  return gcd(q, p%q);

```

Figure 2: Unformatted Code

```

\begin{tikzpicture}[remember picture]
{[on background layer]\draw[code grid debug]
 (-0.5,-0.5) grid (6.5,4.5);}
\codeBlock{%
function gcd(p, q) \{ \\ \\\
\ptab{}if (q === 0) \{ \\ \\\
\ptab\ptab{}return p; \\ \\\
\ptab\} else \{ \\ \\\
\ptab\ptab{}return gcd(q, p\%q); \\ \\\
\ptab\} \\ \\\
\} \\ \\\
\}
\end{tikzpicture}

```

The result (figure 3) is much more like what we expect than the version before (figure 2).

```

function gcd(p, q) {
    if (q === 0) {
        return p;
    } else {
        return gcd(q, p%q);
    }
}

```

Figure 3: Formated Function

2.4 Mark Parts of Code

Now we can mark interesting parts of code with a blue boxes created by `\cPart`. At some positions we can use `\\\[<length>]` to add a little amount of vertical space, so that the boxes do not touch each others.

```
\begin{tikzpicture}[remember picture]
{[on background layer]\draw[code grid debug]
(-0.5,-0.5) grid (6.5,4.5);}
\codeBlock{%
\cPart{functionHead}{function\cPart{functionName}{gcd} \cPart{paramList}{(p, q)}} \{
\\[2.5pt]
\ptab{} \mtPoint{mostLeft} if (q === 0) \{ \\
\ptab \ptab{} return p; \\
\ptab \} else \{ \\
\ptab \ptab{} return gcd(q, p%q); \extremPoint{mostRight} \\
\ptab \mbPoint{mostBottom} \\
\} \\
\}
\fitExtrem{functionBody}{(mostLeft) (mostRight) (mostBottom)}
\end{tikzpicture}
```

`cPart` can be nested

`extremPoints` are used to mark outer most points of a multiline code part

`fitExtrem` draws a rectangle which covers all passed extrem points

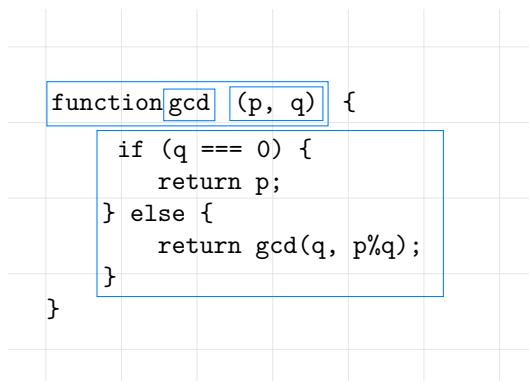


Figure 4: Function with marked parts

2.5 Create Annotation Labels

We can use `\codeAnnotation` to create annotation labels for each parts of code. To draw an arrow from label to a code part we can use the TikZ command
`\draw[->,annotation] (<annotation label>) -- (<code part>);`.
Whereas (`<annotation label>`)s are the first argument of `\codeAnnotations` and (`<code part>`)s are the first argument of `\cParts`.

```

\begin{tikzpicture}[remember picture]
{[on background layer]\draw[code grid debug]
 (-0.5,-0.5) grid (6.5,4.5);}
\codeBlock{%
\cPart{functionHead} {function \cPart{functionName}{gcd} \cPart{paramList}{(p, q)}} \{
\\[2.5pt]
\ptab{} \mtPoint{mostLeft} if (q === 0) \{ \\
\ptab\ptab{} return p; \\
\ptab\} else \{ \\
\ptab\ptab{} return gcd(q, p \% q); \extremPoint{mostRight} \\
\ptab\mbPoint{mostBottom}\} \\
\}
}

\fitExtrem{functionBody}{(mostLeft) (mostRight) (mostBottom)}

% Annotations
\codeAnnotation{functionHeadText}{(-1,3)}{Function\head}
\codeAnnotation{functionBodyText}{(-1,1)}{Function\body}
\codeAnnotation{functionNameText}{( 1,4)}{Function\name}
\codeAnnotation{paramListText}{ ( 3,4)}{Parameter\list}

% Annotation labels to code parts
\draw[->,annotation] (functionHeadText) -- (functionHead);
\draw[->,annotation] (functionBodyText) -- (functionBody);
\draw[->,annotation] (functionNameText) -- (functionName);
\draw[->,annotation] (paramListText) -- (paramList);
\end{tikzpicture}

```

Instead of operator -- we can use operator to [*TikZ options*] to draw a path from (*<annotation label*) to (*<code part*). Finally we can remove the command \draw[code grid debug]... at the begin of the `tikzpicture`. The final result is shown in the figure 5, which is almost the same as figure 1.

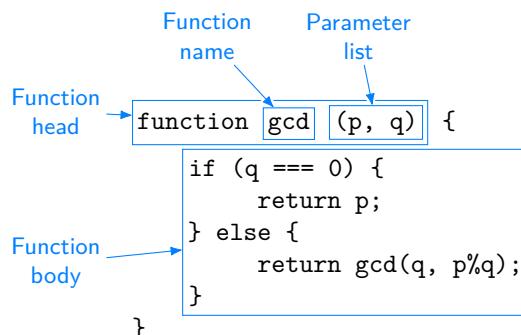


Figure 5: Function with Annotation Labels

3 Usage in conjunction with `listings`

As we see in the previous section, the command `\codeBlock` cannot typeset whitespaces correctly as we expect. A way to typeset code listing is using the package `listings`. See `codeanatomy.lstlisting.pdf`

4 Customize style

TODO

References

- [1] Robert Sedgewick and Kevin Wayne. *Computer Science. An Interdisciplinary Approach.* Addison-Wesley, 2016.