pytermor

Release 2.0.0-dev.9

Alexandr Shavykin

Jun 21, 2022

CONTENTS

(yet another) Python library designed for formatting terminal output using ANSI escape codes. Implements automatic *"soft"* format termination. Provides a registry of low-level SGR (Select Graphic Rendition) `sequences` and formatting `spans` (or combined sequences). Also includes a set of formatters for pretty output.

Key feature of this library is providing necessary abstractions for building complex text sections with lots of formatting, while keeping the application code clear and readable.

CHAPTER

ONE

GUIDE

1.1 Getting started

1.1.1 Installation

```
pip install pytermor
```

1.1.2 Features

One of the core concepts of the library is *Span* class. Span is a combination of two control sequences; it wraps specified string with pre-defined leading and trailing SGR definitions.

Example code:

```
from pytermor import span

print(span.RED('Feat') + span.BOLD('ures'))
```

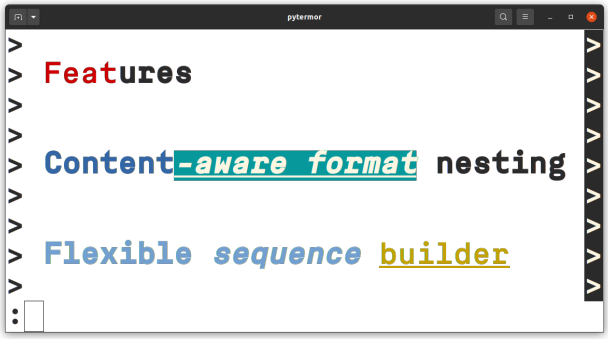
Content-aware format nesting

Compose text spans with automatic content-aware span termination. Preset spans can safely overlap with each other (as long as they require different *breaker* sequences to reset).

```
from pytermor import Span

span1 = Span('blue', 'bold')
span2 = Span('cyan', 'inversed', 'underlined', 'italic')

msg = span1(f'Content{span2("-aware format")} nesting')
print(msg)
```



Flexible sequence builder

Create your own *SGR sequences* with *build()* method, which accepts color/attribute keys, integer codes and even existing *SGRs*, in any amount and in any order. Key resolving is case-insensitive.

```
from pytermor import sequence, build

seq1 = build('hi_blue', 1)  # keys or integer codes
seq2 = build(seq1, sequence.ITALIC)  # existing SGRs
seq3 = build('underlined', 'YELLOW')  # case-insensitive

msg = f'{seq1}Flexible{sequence.RESET} ' + \
      f'{seq2}sequence{sequence.RESET} ' + \
      str(seq3) + 'builder' + str(sequence.RESET)
print(msg)
```

256 colors / True Color support

The library supports extended color modes:

- XTerm 256 colors indexed mode (see *Color and attribute preset list*);
- True Color RGB mode (16M colors).

```
from pytermor import color_indexed, color_rgb, sequence

start_color = 41
for idx, c in enumerate(range(start_color, start_color+(36*6), 36)):
    print(f'{color_indexed(c)}{sequence.COLOR_OFF}', end='')

print('\n')
for idx, c in enumerate(range(0, 256, 256//17)):
    r = max(0, 255-c)
    g = max(0, min(255, 127-(c*2)))
    b = c
    print(f'{color_rgb(r, g, b)}{sequence.COLOR_OFF}', end='')
```

Customizable output formats

@TODO

String and number formatters

@TODO

1.2 High-level abstractions

1.2.1 *Colors* and *Styles*

1.2.2 Output format control

1.2.3 Core API

@EXAMPLES

1.3 Low-level abstractions

So, what's happening under the hood?

1.3.1 Format soft reset

There are two ways to manage color and attribute termination:

- hard reset (SGR 0 | `e[0m`)
- soft reset (SGR 22, 23, 24 etc.)

The main difference between them is that *hard* reset disables all formatting after itself, while *soft* reset disables only actually necessary attributes (i.e. used as opening sequence in *Span* instance's context) and keeps the other.

That's what `Span` class is designed for: to simplify creation of soft-resetting text spans, so that developer doesn't have to restore all previously applied formats after every closing sequence.

Example

We are given a text span which is initially *bold* and *underlined*. We want to recolor a few words inside of this span. By default this will result in losing all the formatting to the right of updated text span (because *RESET*, or `e[0m`, clears all text attributes).

However, there is an option to specify what attributes should be disabled or let the library do that for you:

```
from pytermor import sequence, span, Span

# automatically:
span_warn = Span(sequence.HI_YELLOW + sequence.UNDERLINED)
# or explicitly:
span_warn = Span.new(
    sequence.HI_YELLOW + sequence.UNDERLINED,  # sequences can be summed up, remember?
    sequence.COLOR_OFF + sequence.UNDERLINED_OFF,  # "counteractive" sequences
    hard_reset_after=False
)

orig_text = span.BOLD(f'this is {sequence.BG_GRAY}the original{sequence.RESET} string')
updated_text = orig_text.replace('original', span_warn('updated'), 1)
print(orig_text, '\n', updated_text)
```

As you can see, the update went well – we kept all the previously applied formatting. Of course, this method cannot be 100% applicable; for example, imagine that original text was colored blue. After the update "string" word won't be blue anymore, as we used `sequence.COLOR_OFF` escape sequence to neutralize our own yellow color. But it still can be helpful for a majority of cases (especially when text is generated and formatted by the same program and in one go).

1.3.2 Working with *Spans*

Use *Span* constructor to create new instance with specified control sequence(s) as a opening/starter sequence and **automatically composed** closing sequence that will terminate attributes defined in opening sequence while keeping the others (soft reset).

Resulting sequence params' order is the same as argument's order.

Each sequence param can be specified as:

- string key (see *Color and attribute preset list*);
- integer param value;
- existing *SequenceSGR* instance (params will be extracted).

It's also possible to avoid auto-composing mechanism and create *Span* with explicitly set parameters using *Span.new()*.

1.3.3 Creating and applying *SGRs*

You can use any of predefined sequences from *sequence* or create your own via standard constructor. Valid argument values as well as preset constants are described in *Color and attribute preset list* page.

There is also a set of methods for dynamic SequenceSGR creation:

- *build()* for non-specific sequences;

Important: SequenceSGR with zero params was specifically implemented to translate into an empty string and not into e[m, which would make sense, but also could be very entangling, as terminal emulators interpret that sequence as e[0m, which is *hard* reset sequence.

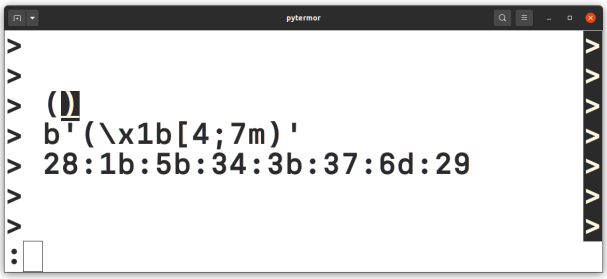
- *color_indexed()* for complex color selection sequences operating in 256-colors mode (for a complete list see *Color and attribute preset list*);
- *color_rgb()* for setting the colors in True Color 16M mode (however, some terminal emulators doesn't support it).

To get the resulting sequence chars use *encode()* method or cast instance to *str*.

```
from pytermor.sequence import SequenceSGR

seq = SequenceSGR(4, 7)
msg = f'({seq})'

print(msg + f'{SequenceSGR(0).encode()}')
print(str(msg.encode()))
print(msg.encode().hex(':'))
```



- First line is the string with encoded escape sequence;
- Second line shows up the string in raw mode, as if sequences were ignored by the terminal;
- Third line is hexademical string representation.

1.3.4 SGR sequence structure

1. `\x1b` is ESC *control character*, which opens a control sequence.
2. `[` is sequence *introducer*; it determines the type of control sequence (in this case it's CSI (Control Sequence Introducer)).
3. `4` and `7` are *parameters* of the escape sequence; they mean "underlined" and "inversed" attributes respectively. Those parameters must be separated by `;`.
4. `m` is sequence *terminator*; it also determines the sub-type of sequence, in our case SGR. Sequences of this kind are most commonly encountered.

1.3.5 Combining *SGRs*

One instance of *SequenceSGR* can be added to another. This will result in a new `SequenceSGR` with combined params.

```
from pytermor import sequence
from pytermor.sequence import SequenceSGR

combined = SequenceSGR(1, 31) + SequenceSGR(4)
print(f'{combined}combined{sequence.RESET}', str(combined).encode())
```

1.3.6 Core API

- @TODO
- *Span* constructor
- *Span.new()*

1.4 Color and attribute preset list

Preset lists are omitted from API docs to avoid unnesessary duplication; summary list of all presets defined in the library (not including *util.**) is displayed here.

There are two types of color palettes used in modern terminals – first one containing 16 colors (library references that palette as *default*, see *ColorDefault*), and second one consisting of 256 colors (referenced as *indexed*, e.g. *ColorIndexed*). There is also True Color mode (referenced as *RGB* mode), but it is not palette-based.

Actual colors of *default* palette depend on user's terminal settings, i.e. the result color of `ColorDefault` is not guaranteed to exactly match the corresponding color in the list below. However, usually that's not an issue, because users expect their terminal theme to work (almost) everythere and will be surprised when the applicationforcefully override default colors with custom ones (in any case, that can be accomplished by using *ColorRGB* or `ColorIndexed`; their color values are hard to customize without special configurations; but it's recommended notto use them for regular output).

1.4.1 Presets

Legend

- INT (intcode module -- 1st or 3rd SGR param value)
- SEQ (sequence module)
- SPN (span module)
- CLR (color module)
- STY (style module)

Table 1: Meta, attribute and breaker presets

	Name	INT	SEQ	SPN	CLR	STY	Description
Meta							
	NOOP		V	V	V	V	No-operation; always encoded as empty string
	RESET	0	V				Reset all attributes and colors
Attributes							
	BOLD	1	V	V		V[1]	Bold or increased intensity
	DIM	2	V	V		V	Faint, decreased intensity
	ITALIC	3	V	V		V	Italic; *not widely supported*
	UNDERLINED	4	V	V		V	Underline
	BLINK_SLOW	5	V			V[2]	Sets blinking to < 150 cpm
	BLINK_FAST	6	V				150+ cpm; *not widely supported*
	INVERSED	7	V	V		V	Swap foreground and background colors
	HIDDEN	8	V				Conceal characters; *not widely supported*
	CROSSLINED	9	V			V	Strikethrough
	DOUBLE_UNDERLINED	21	V				Double-underline; *on several terminals disables* BOLD *instead*
	COLOR_EXTENDED	38					Set foreground color [*indexed*/*RGB* mode]; *use* color_indexed *and* color_rgb *instead*
	BG_COLOR_EXTENDED	48					Set background color [*indexed*/*RGB* mode]; *use* color_indexed *and* color_rgb *instead*
	OVERLINED	53	V	V		V	Overline; *not widely supported*
Breakers							
	BOLD_DIM_OFF	22	V				Disable BOLD and DIM attributes. *Special aspects... It's impossible to reliably disable them on a separate basis.*
	ITALIC_OFF	23	V				Disable italic
	UNDERLINED_OFF	24	V				Disable underlining
	BLINK_OFF	25	V				Disable blinking
	INVERSED_OFF	27	V				Disable inversing
	HIDDEN_OFF	28	V				Disable conecaling
	CROSSLINED_OFF	29	V				Disable strikethrough
	COLOR_OFF	39	V				Reset foreground color
	BG_COLOR_OFF	49	V				Reset background color
	OVERLINED_OFF	55	V				Disable overlining

Table 2: *Default* and *indexed* color presets

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
Foreground *default* colors								
	BLACK	30	V	V	V		#000000	Black
	RED	31	V	V	V		#800000	Maroon
	GREEN	32	V	V	V		#008000	Green
	YELLOW	33	V	V	V		#808000	Olive
	BLUE	34	V	V	V		#000080	Navy
	MAGENTA	35	V	V	V		#800080	Purple
	CYAN	36	V	V	V		#008080	Teal
	WHITE	37	V	V	V		#c0c0c0	Silver
Background *default* colors								
	BG_BLACK	40	V	V	V		#000000	Black
	BG_RED	41	V	V	V		#800000	Maroon
	BG_GREEN	42	V	V	V		#008000	Green
	BG_YELLOW	43	V	V	V		#808000	Olive
	BG_BLUE	44	V	V	V		#000080	Navy
	BG_MAGENTA	45	V	V	V		#800080	Purple
	BG_CYAN	46	V	V	V		#008080	Teal
	BG_WHITE	47	V	V	V		#c0c0c0	Silver
High-intensity foreground *default* colors								
	GRAY	90	V	V	V		#808080	Grey
	HI_RED	91	V	V	V		#ff0000	Red
	HI_GREEN	92	V	V	V		#00ff00	Lime
	HI_YELLOW	93	V	V	V		#ffff00	Yellow
	HI_BLUE	94	V	V	V		#0000ff	Blue
	HI_MAGENTA	95	V	V	V		#ff00ff	Fuchsia
	HI_CYAN	96	V	V	V		#00ffff	Aqua
	HI_WHITE	97	V	V	V		#ffffff	White
High-intensity background *default* colors								
	BG_GRAY	100	V	V	V		#808080	Grey
	BG_HI_RED	101	V	V	V		#ff0000	Red
	BG_HI_GREEN	102	V	V	V		#00ff00	Lime
	BG_HI_YELLOW	103	V	V	V		#ffff00	Yellow
	BG_HI_BLUE	104	V	V	V		#0000ff	Blue
	BG_HI_MAGENTA	105	V	V	V		#ff00ff	Fuchsia
	BG_HI_CYAN	106	V	V	V		#00ffff	Aqua
	BG_HI_WHITE	107	V	V	V		#ffffff	White
***Indexed* colors**								
	IDX_BLACK[3]	0			V		#000000	Black
	IDX_MAROON	1			V		#800000	Maroon
	IDX_GREEN	2			V		#008000	Green

continues on next page

[1] for this and subsequent items in "Attributes" section: as boolean flags.
[2] as `blink`.

Table 2 – continued from previous page

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
	IDX_OLIVE	3			V		#808000	Olive
	IDX_NAVY	4			V		#000080	Navy
	IDX_PURPLE	5			V		#800080	Purple
	IDX_TEAL	6			V		#008080	Teal
	IDX_SILVER	7			V		#c0c0c0	Silver
	IDX_GRAY	8			V		#808080	Grey
	IDX_RED	9			V		#ff0000	Red
	IDX_LIME	10			V		#00ff00	Lime
	IDX_YELLOW	11			V		#ffff00	Yellow
	IDX_BLUE	12			V		#0000ff	Blue
	IDX_FUCHSIA	13			V		#ff00ff	Fuchsia
	IDX_AQUA	14			V		#00ffff	Aqua
	IDX_WHITE	15			V		#ffffff	White
	IDX_GREY_0	16			V		#000000	Grey0
	IDX_NAVY_BLUE	17			V		#00005f	NavyBlue
	IDX_DARK_BLUE	18			V		#000087	DarkBlue
	IDX_BLUE_3	19			V		#0000af	Blue3
	IDX_BLUE_2	20			V		#0000d7	**Blue3**[4]
	IDX_BLUE_1	21			V		#0000ff	Blue1
	IDX_DARK_GREEN	22			V		#005f00	DarkGreen
	IDX_DEEP_SKY_BLUE_4	23			V		#005f5f	DeepSkyBlue4
	IDX_DEEP_SKY_BLUE_4	24			V		#005f87	DeepSkyBlue4
	IDX_DEEP_SKY_BLUE_4	25			V		#005faf	DeepSkyBlue4
	IDX_DODGER_BLUE_3	26			V		#005fd7	DodgerBlue3
	IDX_DODGER_BLUE_2	27			V		#005fff	DodgerBlue2
	IDX_GREEN_4	28			V		#008700	Green4
	IDX_SPRING_GREEN_4	29			V		#00875f	SpringGreen4
	IDX_TURQUOISE_4	30			V		#008787	Turquoise4
	IDX_DEEP_SKY_BLUE_3	31			V		#0087af	DeepSkyBlue3
	IDX_DEEP_SKY_BLUE_3	32			V		#0087d7	DeepSkyBlue3
	IDX_DODGER_BLUE_1	33			V		#0087ff	DodgerBlue1
	IDX_GREEN_3	34			V		#00af00	Green3
	IDX_SPRING_GREEN_3	35			V		#00af5f	SpringGreen3
	IDX_DARK_CYAN	36			V		#00af87	DarkCyan
	IDX_LIGHT_SEA_GREEN	37			V		#00afaf	LightSeaGreen
	IDX_DEEP_SKY_BLUE_2	38			V		#00afd7	DeepSkyBlue2
	IDX_DEEP_SKY_BLUE_1	39			V		#00afff	DeepSkyBlue1
	IDX_GREEN_3	40			V		#00d700	Green3
	IDX_SPRING_GREEN_3	41			V		#00d75f	SpringGreen3
	IDX_SPRING_GREEN_2	42			V		#00d787	SpringGreen2
	IDX_CYAN_3	43			V		#00d7af	Cyan3
	IDX_DARK_TURQUOISE	44			V		#00d7d7	DarkTurquoise
	IDX_TURQUOISE_2	45			V		#00d7ff	Turquoise2
	IDX_GREEN_1	46			V		#00ff00	Green1
	IDX_SPRING_GREEN_2	47			V		#00ff5f	SpringGreen2
	IDX_SPRING_GREEN_1	48			V		#00ff87	SpringGreen1
	IDX_MEDIUM_SPRING_GREEN	49			V		#00ffaf	MediumSpringGreen
	IDX_CYAN_2	50			V		#00ffd7	Cyan2
	IDX_CYAN_1	51			V		#00ffff	Cyan1

continues on next page

Table 2 – continued from previous page

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
	IDX_DARK_RED	52			V		#5f0000	DarkRed
	IDX_DEEP_PINK_4	53			V		#5f005f	DeepPink4
	IDX_PURPLE_4	54			V		#5f0087	Purple4
	IDX_PURPLE_4	55			V		#5f00af	Purple4
	IDX_PURPLE_3	56			V		#5f00d7	Purple3
	IDX_BLUE_VIOLET	57			V		#5f00ff	BlueViolet
	IDX_ORANGE_4	58			V		#5f5f00	Orange4
	IDX_GREY_37	59			V		#5f5f5f	Grey37
	IDX_MEDIUM_PURPLE_4	60			V		#5f5f87	MediumPurple4
	IDX_SLATE_BLUE_3	61			V		#5f5faf	SlateBlue3
	IDX_SLATE_BLUE_3	62			V		#5f5fd7	SlateBlue3
	IDX_ROYAL_BLUE_1	63			V		#5f5fff	RoyalBlue1
	IDX_CHARTREUSE_4	64			V		#5f8700	Chartreuse4
	IDX_DARK_SEA_GREEN_4	65			V		#5f875f	DarkSeaGreen4
	IDX_PALE_TURQUOISE_4	66			V		#5f8787	PaleTurquoise4
	IDX_STEEL_BLUE	67			V		#5f87af	SteelBlue
	IDX_STEEL_BLUE_3	68			V		#5f87d7	SteelBlue3
	IDX_CORNFLOWER_BLUE	69			V		#5f87ff	CornflowerBlue
	IDX_CHARTREUSE_3	70			V		#5faf00	Chartreuse3
	IDX_DARK_SEA_GREEN_4	71			V		#5faf5f	DarkSeaGreen4
	IDX_CADET_BLUE	72			V		#5faf87	CadetBlue
	IDX_CADET_BLUE	73			V		#5fafaf	CadetBlue
	IDX_SKY_BLUE_3	74			V		#5fafd7	SkyBlue3
	IDX_STEEL_BLUE_1	75			V		#5fafff	SteelBlue1
	IDX_CHARTREUSE_3	76			V		#5fd700	Chartreuse3
	IDX_PALE_GREEN_3	77			V		#5fd75f	PaleGreen3
	IDX_SEA_GREEN_3	78			V		#5fd787	SeaGreen3
	IDX_AQUAMARINE_3	79			V		#5fd7af	Aquamarine3
	IDX_MEDIUM_TURQUOISE	80			V		#5fd7d7	MediumTurquoise
	IDX_STEEL_BLUE_1	81			V		#5fd7ff	SteelBlue1
	IDX_CHARTREUSE_2	82			V		#5fff00	Chartreuse2
	IDX_SEA_GREEN_2	83			V		#5fff5f	SeaGreen2
	IDX_SEA_GREEN_1	84			V		#5fff87	SeaGreen1
	IDX_SEA_GREEN_1	85			V		#5fffaf	SeaGreen1
	IDX_AQUAMARINE_2	86			V		#5fffd7	**Aquamarine1**
	IDX_DARK_SLATE_GRAY_2	87			V		#5fffff	DarkSlateGray2
	IDX_DARK_RED	88			V		#870000	DarkRed
	IDX_DEEP_PINK_4	89			V		#87005f	DeepPink4
	IDX_DARK_MAGENTA	90			V		#870087	DarkMagenta
	IDX_DARK_MAGENTA	91			V		#8700af	DarkMagenta
	IDX_DARK_VIOLET	92			V		#8700d7	DarkViolet
	IDX_PURPLE	93			V		#8700ff	Purple
	IDX_ORANGE_4	94			V		#875f00	Orange4
	IDX_LIGHT_PINK_4	95			V		#875f5f	LightPink4
	IDX_PLUM_4	96			V		#875f87	Plum4
	IDX_MEDIUM_PURPLE_3	97			V		#875faf	MediumPurple3
	IDX_MEDIUM_PURPLE_3	98			V		#875fd7	MediumPurple3
	IDX_SLATE_BLUE_1	99			V		#875fff	SlateBlue1
	IDX_YELLOW_4	100			V		#878700	Yellow4

continues on next page

Table 2 – continued from previous page

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
	IDX_WHEAT_4	101			V		#87875f	Wheat4
	IDX_GREY_53	102			V		#878787	Grey53
	IDX_LIGHT_SLATE_GREY	103			V		#8787af	LightSlateGrey
	IDX_MEDIUM_PURPLE	104			V		#8787d7	MediumPurple
	IDX_LIGHT_SLATE_BLUE	105			V		#8787ff	LightSlateBlue
	IDX_YELLOW_4	106			V		#87af00	Yellow4
	IDX_DARK_OLIVE_GREEN_3	107			V		#87af5f	DarkOliveGreen3
	IDX_DARK_SEA_GREEN	108			V		#87af87	DarkSeaGreen
	IDX_LIGHT_SKY_BLUE_3	109			V		#87afaf	LightSkyBlue3
	IDX_LIGHT_SKY_BLUE_3	110			V		#87afd7	LightSkyBlue3
	IDX_SKY_BLUE_2	111			V		#87afff	SkyBlue2
	IDX_CHARTREUSE_2	112			V		#87d700	Chartreuse2
	IDX_DARK_OLIVE_GREEN_3	113			V		#87d75f	DarkOliveGreen3
	IDX_PALE_GREEN_3	114			V		#87d787	PaleGreen3
	IDX_DARK_SEA_GREEN_3	115			V		#87d7af	DarkSeaGreen3
	IDX_DARK_SLATE_GRAY_3	116			V		#87d7d7	DarkSlateGray3
	IDX_SKY_BLUE_1	117			V		#87d7ff	SkyBlue1
	IDX_CHARTREUSE_1	118			V		#87ff00	Chartreuse1
	IDX_LIGHT_GREEN	119			V		#87ff5f	LightGreen
	IDX_LIGHT_GREEN	120			V		#87ff87	LightGreen
	IDX_PALE_GREEN_1	121			V		#87ffaf	PaleGreen1
	IDX_AQUAMARINE_1	122			V		#87ffd7	Aquamarine1
	IDX_DARK_SLATE_GRAY_1	123			V		#87ffff	DarkSlateGray1
	IDX_RED_3	124			V		#af0000	Red3
	IDX_DEEP_PINK_4	125			V		#af005f	DeepPink4
	IDX_MEDIUM_VIOLET_RED	126			V		#af0087	MediumVioletRed
	IDX_MAGENTA_3	127			V		#af00af	Magenta3
	IDX_DARK_VIOLET	128			V		#af00d7	DarkViolet
	IDX_PURPLE	129			V		#af00ff	Purple
	IDX_DARK_ORANGE_3	130			V		#af5f00	DarkOrange3
	IDX_INDIAN_RED	131			V		#af5f5f	IndianRed
	IDX_HOT_PINK_3	132			V		#af5f87	HotPink3
	IDX_MEDIUM_ORCHID_3	133			V		#af5faf	MediumOrchid3
	IDX_MEDIUM_ORCHID	134			V		#af5fd7	MediumOrchid
	IDX_MEDIUM_PURPLE_2	135			V		#af5fff	MediumPurple2
	IDX_DARK_GOLDENROD	136			V		#af8700	DarkGoldenrod
	IDX_LIGHT_SALMON_3	137			V		#af875f	LightSalmon3
	IDX_ROSY_BROWN	138			V		#af8787	RosyBrown
	IDX_GREY_63	139			V		#af87af	Grey63
	IDX_MEDIUM_PURPLE_2	140			V		#af87d7	MediumPurple2
	IDX_MEDIUM_PURPLE_1	141			V		#af87ff	MediumPurple1
	IDX_GOLD_3	142			V		#afaf00	Gold3
	IDX_DARK_KHAKI	143			V		#afaf5f	DarkKhaki
	IDX_NAVAJO_WHITE_3	144			V		#afaf87	NavajoWhite3
	IDX_GREY_69	145			V		#afafaf	Grey69
	IDX_LIGHT_STEEL_BLUE_3	146			V		#afafd7	LightSteelBlue3
	IDX_LIGHT_STEEL_BLUE	147			V		#afafff	LightSteelBlue
	IDX_YELLOW_3	148			V		#afd700	Yellow3
	IDX_DARK_OLIVE_GREEN_3	149			V		#afd75f	DarkOliveGreen3

continues on next page

Table 2 – continued from previous page

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
	IDX_DARK_SEA_GREEN_3	150			V		#afd787	DarkSeaGreen3
	IDX_DARK_SEA_GREEN_2	151			V		#afd7af	DarkSeaGreen2
	IDX_LIGHT_CYAN_3	152			V		#afd7d7	LightCyan3
	IDX_LIGHT_SKY_BLUE_1	153			V		#afd7ff	LightSkyBlue1
	IDX_GREEN_YELLOW	154			V		#afff00	GreenYellow
	IDX_DARK_OLIVE_GREEN_2	155			V		#afff5f	DarkOliveGreen2
	IDX_PALE_GREEN_1	156			V		#afff87	PaleGreen1
	IDX_DARK_SEA_GREEN_2	157			V		#afffaf	DarkSeaGreen2
	IDX_DARK_SEA_GREEN_1	158			V		#afffd7	DarkSeaGreen1
	IDX_PALE_TURQUOISE_1	159			V		#afffff	PaleTurquoise1
	IDX_RED_3	160			V		#d70000	Red3
	IDX_DEEP_PINK_3	161			V		#d7005f	DeepPink3
	IDX_DEEP_PINK_3	162			V		#d70087	DeepPink3
	IDX_MAGENTA_3	163			V		#d700af	Magenta3
	IDX_MAGENTA_3	164			V		#d700d7	Magenta3
	IDX_MAGENTA_2	165			V		#d700ff	Magenta2
	IDX_DARK_ORANGE_3	166			V		#d75f00	DarkOrange3
	IDX_INDIAN_RED	167			V		#d75f5f	IndianRed
	IDX_HOT_PINK_3	168			V		#d75f87	HotPink3
	IDX_HOT_PINK_2	169			V		#d75faf	HotPink2
	IDX_ORCHID	170			V		#d75fd7	Orchid
	IDX_MEDIUM_ORCHID_1	171			V		#d75fff	MediumOrchid1
	IDX_ORANGE_3	172			V		#d78700	Orange3
	IDX_LIGHT_SALMON_3	173			V		#d7875f	LightSalmon3
	IDX_LIGHT_PINK_3	174			V		#d78787	LightPink3
	IDX_PINK_3	175			V		#d787af	Pink3
	IDX_PLUM_3	176			V		#d787d7	Plum3
	IDX_VIOLET	177			V		#d787ff	Violet
	IDX_GOLD_3	178			V		#d7af00	Gold3
	IDX_LIGHT_GOLDENROD_3	179			V		#d7af5f	LightGoldenrod3
	IDX_TAN	180			V		#d7af87	Tan
	IDX_MISTY_ROSE_3	181			V		#d7afaf	MistyRose3
	IDX_THISTLE_3	182			V		#d7afd7	Thistle3
	IDX_PLUM_2	183			V		#d7afff	Plum2
	IDX_YELLOW_3	184			V		#d7d700	Yellow3
	IDX_KHAKI_3	185			V		#d7d75f	Khaki3
	IDX_LIGHT_GOLDENROD_2	186			V		#d7d787	LightGoldenrod2
	IDX_LIGHT_YELLOW_3	187			V		#d7d7af	LightYellow3
	IDX_GREY_84	188			V		#d7d7d7	Grey84
	IDX_LIGHT_STEEL_BLUE_1	189			V		#d7d7ff	LightSteelBlue1
	IDX_YELLOW_2	190			V		#d7ff00	Yellow2
	IDX_DARK_OLIVE_GREEN_1	191			V		#d7ff5f	DarkOliveGreen1
	IDX_DARK_OLIVE_GREEN_1	192			V		#d7ff87	DarkOliveGreen1
	IDX_DARK_SEA_GREEN_1	193			V		#d7ffaf	DarkSeaGreen1
	IDX_HONEYDEW_2	194			V		#d7ffd7	Honeydew2
	IDX_LIGHT_CYAN_1	195			V		#d7ffff	LightCyan1
	IDX_RED_1	196			V		#ff0000	Red1
	IDX_DEEP_PINK_2	197			V		#ff005f	DeepPink2
	IDX_DEEP_PINK_1	198			V		#ff0087	DeepPink1

continues on next page

Table 2 – continued from previous page

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
	IDX_DEEP_PINK_1	199			V		#ff00af	DeepPink1
	IDX_MAGENTA_2	200			V		#ff00d7	Magenta2
	IDX_MAGENTA_1	201			V		#ff00ff	Magenta1
	IDX_ORANGE_RED_1	202			V		#ff5f00	OrangeRed1
	IDX_INDIAN_RED_1	203			V		#ff5f5f	IndianRed1
	IDX_INDIAN_RED_1	204			V		#ff5f87	IndianRed1
	IDX_HOT_PINK	205			V		#ff5faf	HotPink
	IDX_HOT_PINK	206			V		#ff5fd7	HotPink
	IDX_MEDIUM_ORCHID_1	207			V		#ff5fff	MediumOrchid1
	IDX_DARK_ORANGE	208			V		#ff8700	DarkOrange
	IDX_SALMON_1	209			V		#ff875f	Salmon1
	IDX_LIGHT_CORAL	210			V		#ff8787	LightCoral
	IDX_PALE_VIOLET_RED_1	211			V		#ff87af	PaleVioletRed1
	IDX_ORCHID_2	212			V		#ff87d7	Orchid2
	IDX_ORCHID_1	213			V		#ff87ff	Orchid1
	IDX_ORANGE_1	214			V		#ffaf00	Orange1
	IDX_SANDY_BROWN	215			V		#ffaf5f	SandyBrown
	IDX_LIGHT_SALMON_1	216			V		#ffaf87	LightSalmon1
	IDX_LIGHT_PINK_1	217			V		#ffafaf	LightPink1
	IDX_PINK_1	218			V		#ffafd7	Pink1
	IDX_PLUM_1	219			V		#ffafff	Plum1
	IDX_GOLD_1	220			V		#ffd700	Gold1
	IDX_LIGHT_GOLDENROD_2	221			V		#ffd75f	LightGoldenrod2
	IDX_LIGHT_GOLDENROD_2	222			V		#ffd787	LightGoldenrod2
	IDX_NAVAJO_WHITE_1	223			V		#ffd7af	NavajoWhite1
	IDX_MISTY_ROSE_1	224			V		#ffd7d7	MistyRose1
	IDX_THISTLE_1	225			V		#ffd7ff	Thistle1
	IDX_YELLOW_1	226			V		#ffff00	Yellow1
	IDX_LIGHT_GOLDENROD_1	227			V		#ffff5f	LightGoldenrod1
	IDX_KHAKI_1	228			V		#ffff87	Khaki1
	IDX_WHEAT_1	229			V		#ffffaf	Wheat1
	IDX_CORNSILK_1	230			V		#ffffd7	Cornsilk1
	IDX_GREY_100	231			V		#ffffff	Grey100
	IDX_GREY_3	232			V		#080808	Grey3
	IDX_GREY_7	233			V		#121212	Grey7
	IDX_GREY_11	234			V		#1c1c1c	Grey11
	IDX_GREY_15	235			V		#262626	Grey15
	IDX_GREY_19	236			V		#303030	Grey19
	IDX_GREY_23	237			V		#3a3a3a	Grey23
	IDX_GREY_27	238			V		#444444	Grey27
	IDX_GREY_30	239			V		#4e4e4e	Grey30
	IDX_GREY_35	240			V		#585858	Grey35
	IDX_GREY_39	241			V		#626262	Grey39
	IDX_GREY_42	242			V		#6c6c6c	Grey42
	IDX_GREY_46	243			V		#767676	Grey46
	IDX_GREY_50	244			V		#808080	Grey50
	IDX_GREY_54	245			V		#8a8a8a	Grey54
	IDX_GREY_58	246			V		#949494	Grey58
	IDX_GREY_62	247			V		#9e9e9e	Grey62

continues on next page

Table 2 – continued from previous page

	Name	INT	SEQ	SPN	CLR	STY	RGB code	XTerm name
	IDX_GREY_66	248			V		#a8a8a8	Grey66
	IDX_GREY_70	249			V		#b2b2b2	Grey70
	IDX_GREY_74	250			V		#bcbcbc	Grey74
	IDX_GREY_78	251			V		#c6c6c6	Grey78
	IDX_GREY_82	252			V		#d0d0d0	Grey82
	IDX_GREY_85	253			V		#dadada	Grey85
	IDX_GREY_89	254			V		#e4e4e4	Grey89
	IDX_GREY_93	255			V		#eeeeee	Grey93

[3] First 16 colors are effectively the same as colors in *default* 16-color mode and share with them the same color values (and depend on terminal color scheme as well).

[4] XTerm name list contains duplicates; variable names for these were slightly modified (different numbers at the end) to avoid namespace conflicts. All non-matching names are displayed using **bold** font.

1.4.2 *Indexed* mode palette

								000 #000000	001 #800000	002 #008000	003 #808000
004 #000080	005 #800080	006 #008080	007 #c0c0c0								
008 #808080	009 #ff0000	010 #00ff00	011 #ffff00	012 #0000ff	013 #ff00ff	014 #00ffff	015 #ffffff				
016 #000000	022 #005f00	028 #008700	034 #00af00	040 #00d700	046 #00ff00	082 #5fff00	076 #5fd700	070 #5faf00	064 #5f8700	058 #5f5f00	052 #5f0000
017 #00005f	023 #005f5f	029 #00875f	035 #00af5f	041 #00d75f	047 #00ff5f	083 #5fff5f	077 #5fd75f	071 #5faf5f	065 #5f875f	059 #5f5f5f	053 #5f005f
018 #000087	024 #005f87	030 #008787	036 #00af87	042 #00d787	048 #00ff87	084 #5fff87	078 #5fd787	072 #5faf87	066 #5f8787	060 #5f5f87	054 #5f0087
019 #0000af	025 #005faf	031 #0087af	037 #00afaf	043 #00d7af	049 #00ffaf	085 #5fffaf	079 #5fd7af	073 #5fafaf	067 #5f87af	061 #5f5faf	055 #5f00af
020 #0000d7	026 #005fd7	032 #0087d7	038 #00afd7	044 #00d7d7	050 #00ffd7	086 #5fffd7	080 #5fd7d7	074 #5fafd7	068 #5f87d7	062 #5f5fd7	056 #5f00d7
021 #0000ff	027 #005fff	033 #0087ff	039 #00afff	045 #00d7ff	051 #00ffff	087 #5fffff	081 #5fd7ff	075 #5fafff	069 #5f87ff	063 #5f5fff	057 #5f00ff
093 #8700ff	099 #875fff	105 #8787ff	111 #87afff	117 #87d7ff	123 #87ffff	159 #afffff	153 #afd7ff	147 #afafff	141 #af87ff	135 #af5fff	129 #af00ff
092 #8700d7	098 #875fd7	104 #8787d7	110 #87afd7	116 #87d7d7	122 #87ffd7	158 #afffd7	152 #afd7d7	146 #afafd7	140 #af87d7	134 #af5fd7	128 #af00d7
091 #8700af	097 #875faf	103 #8787af	109 #87afaf	115 #87d7af	121 #87ffaf	157 #afffaf	151 #afd7af	145 #afafaf	139 #af87af	133 #af5faf	127 #af00af
090 #870087	096 #875f87	102 #878787	108 #87af87	114 #87d787	120 #87ff87	156 #afff87	150 #afd787	144 #afaf87	138 #af8787	132 #af5f87	126 #af0087
089 #87005f	095 #875f5f	101 #87875f	107 #87af5f	113 #87d75f	119 #87ff5f	155 #afff5f	149 #afd75f	143 #afaf5f	137 #af875f	131 #af5f5f	125 #af005f
088 #870000	094 #875f00	100 #878700	106 #87af00	112 #87d700	118 #87ff00	154 #afff00	148 #afd700	142 #afaf00	136 #af8700	130 #af5f00	124 #af0000
160 #d70000	166 #d75f00	172 #d78700	178 #dfaf00	184 #dfdf00	190 #dfff00	226 #ffff00	220 #ffdf00	214 #ffaf00	208 #ff8700	202 #ff5f00	196 #ff0000
161 #d7005f	167 #d75f5f	173 #d7875f	179 #dfaf5f	185 #dfdf5f	191 #dfff5f	227 #ffff5f	221 #ffdf5f	215 #ffaf5f	209 #ff875f	203 #ff5f5f	197 #ff005f
162 #d70087	168 #d75f87	174 #d78787	180 #dfaf87	186 #dfdf87	192 #dfff87	228 #ffff87	222 #ffdf87	216 #ffaf87	210 #ff8787	204 #ff5f87	198 #ff0087
163 #d700af	169 #d75faf	175 #d787af	181 #dfafaf	187 #dfdfaf	193 #dfffaf	229 #ffffaf	223 #ffdfaf	217 #ffafaf	211 #ff87af	205 #ff5faf	199 #ff00af
164 #d700d7	170 #d75fd7	176 #d787d7	182 #dfafdf	188 #dfdfdf	194 #dfffdf	230 #ffffdf	224 #ffdfdf	218 #ffafdf	212 #ff87df	206 #ff5fdf	200 #ff00df
165 #d700ff	171 #d75fff	177 #d787ff	183 #dfafff	189 #dfdfff	195 #dfffff	231 #ffffff	225 #ffdfff	219 #ffafff	213 #ff87ff	207 #ff5fff	201 #ff00ff
232 #080808	233 #121212	234 #1c1c1c	235 #262626	236 #303030	237 #3a3a3a	238 #444444	239 #4e4e4e	240 #585858	241 #626262	242 #6c6c6c	243 #767676
244 #808080	245 #8a8a8a	246 #949494	247 #9e9e9e	248 #a8a8a8	249 #b2b2b2	250 #bcbcbc	251 #c6c6c6	252 #d0d0d0	253 #dadada	254 #e4e4e4	255 #eeeeee

Sources

1. https://en.wikipedia.org/wiki/ANSI_escape_code
2. https://www.tweaking4all.com/software/linux-software/xterm-color-cheat-sheet/
3. https://www.ditig.com/256-colors-cheat-sheet

1.5 Formatters and Filters

The library contains @TODO

1.5.1 Auto-float formatter

1.5.2 Prefixed-unit formatter

1.5.3 Time delta formatter

```
from pytermor import Style, color, ColorRGB
from pytermor import renderer
from pytermor.util import time_delta

seconds_list = [2, 10, 60, 2700, 32340, 273600, 4752000, 864000000]
max_len_list = [3, 6, 10]

custom_stylesheet = time_delta.TimeDeltaStylesheet(
    default=Style(bg_color=0x202028),
    digit=Style(0x3333000, 'yellow'),
    unit=Style(fg_color='green', bg_color=0x202028, underlined=True),
    overflow=Style(fg_color=color.BLACK, bg_color='hi_red', bold=True),
)
for max_len in max_len_list:
    formatter = time_delta.registry.find_matching(max_len)
    formatter.stylesheet = custom_stylesheet

renderer.SGRRenderer.set_as_default()
for seconds in seconds_list:
    for max_len in max_len_list:
        formatter = time_delta.registry.get_by_max_len(max_len)
        print(formatter.format(seconds, True), end=' ')
    print()
```

1.5.4 *StringFilters*

1.5.5 Standard Library extensions

@TODO

CHAPTER

TWO

API DOCS

2.1 color

@TODO

class pytermor.color.**Color**(*hex_value: Optional[int] = None*)

Abstract superclass for other Colors.

abstract classmethod find_closest(*hex_value: int*) → *Color*

Wrapper for *_ColorMap.find_closest()*.

Parameters
hex_value – Integer color value in 0xFFFFFF format.

Returns
Nearest found color of specified type.

abstract classmethod get_default() → *Color*

Returns
Fallback instance of *Color* inheritor (if registries are empty).

static hex_value_to_channels(*hex_value: int*) → Tuple[int, int, int]

Transforms hex_value in 0xFFFFFF format into tuple of three integers corresponding to *red*, *blue* and *green* channel value respectively. Values are in [0; 255] range.

```
>>> Color.hex_value_to_channels(0x80ff80)
(128, 255, 128)
>>> Color.hex_value_to_channels(0x000001)
(0, 0, 1)
```

abstract to_sgr_default(*bg: bool*) → *SequenceSGR*

abstract to_sgr_indexed(*bg: bool*) → *SequenceSGR*

abstract to_sgr_rgb(*bg: bool*) → *SequenceSGR*

property formatted_hex_value: str

property hex_value: int | None

class pytermor.color.**ColorDefault**(*hex_value: int*, *code_fg: int*, *code_bg: int*)

Bases: *Color*

classmethod find_closest(*hex_value: int*) → *ColorDefault*

Wrapper for *_ColorMap.find_closest()*.

Parameters
hex_value – Integer color value in `0xFFFFFF` format.

Returns
Nearest found *ColorDefault* instance.

```
>>> ColorDefault.find_closest(0x660000)
ColorDefault[fg=31, bg=41, 0x800000]
```

classmethod get_default() → *ColorDefault*

Returns
Fallback instance of *Color* inheritor (if registries are empty).

static hex_value_to_channels(*hex_value: int*) → Tuple[int, int, int]

Transforms `hex_value` in `0xFFFFFF` format into tuple of three integers corresponding to *red*, *blue* and *green* channel value respectively. Values are in [0; 255] range.

```
>>> Color.hex_value_to_channels(0x80ff80)
(128, 255, 128)
>>> Color.hex_value_to_channels(0x000001)
(0, 0, 1)
```

to_sgr_default(*bg: bool*) → *SequenceSGR*

to_sgr_indexed(*bg: bool*) → *SequenceSGR*

to_sgr_rgb(*bg: bool*) → *SequenceSGR*

property formatted_hex_value: str

property hex_value: int | None

class pytermor.color.**ColorIndexed**(*hex_value: int*, *code: int*, *name: Optional[str] = None*)

Bases: *Color*

classmethod find_closest(*hex_value: int*) → *ColorIndexed*

Wrapper for *_ColorMap.find_closest()*.

Parameters
hex_value – Integer color value in `0xFFFFFF` format.

Returns
Nearest found *ColorIndexed* instance.

```
>>> ColorIndexed.find_closest(0x000000)  # @FIXME
ColorIndexed[code=16, 0x000000]
```

classmethod get_default() → *ColorIndexed*

Returns
Fallback instance of *Color* inheritor (if registries are empty).

static hex_value_to_channels(*hex_value: int*) → Tuple[int, int, int]

Transforms `hex_value` in `0xFFFFFF` format into tuple of three integers corresponding to *red*, *blue* and *green* channel value respectively. Values are in [0; 255] range.

```
>>> Color.hex_value_to_channels(0x80ff80)
(128, 255, 128)
>>> Color.hex_value_to_channels(0x000001)
(0, 0, 1)
```

to_sgr_default(*bg: bool*) → *SequenceSGR*

to_sgr_indexed(*bg: bool*) → *SequenceSGR*

to_sgr_rgb(*bg: bool*) → *SequenceSGR*

property formatted_hex_value: str

property hex_value: int | None

class pytermor.color.**ColorRGB**(*hex_value: Optional[int] = None*)

Bases: *Color*

classmethod find_closest(*hex_value: int*) → *ColorRGB*

Wrapper for *_ColorMap.find_closest()*. *ColorRGB*-type color map doesn't involve caching and searching, it just checks if instance with same hex value was already created, and returns it if it was, or returns a fresh new instance with required color value. In second case color map also puts new instance into its lookup table.

Parameters
hex_value – Integer color value in `0xFFFFFF` format.

Returns
Existing *ColorRGB* instance or newly created one.

```
>>> existing_color1 = ColorRGB(0x660000)
>>> existing_color2 = ColorRGB(0x660000)
>>> existing_color1 == existing_color2
True
>>> existing_color1 is existing_color2  # different instances
False
>>> existing_color1 == ColorRGB.find_closest(0x660000)
True
>>> existing_color1 is ColorRGB.find_closest(0x660000)  # same instance
True
```

classmethod get_default() → *ColorRGB*

Returns
Fallback instance of *Color* inheritor (if registries are empty).

static hex_value_to_channels(*hex_value: int*) → Tuple[int, int, int]

Transforms `hex_value` in `0xFFFFFF` format into tuple of three integers corresponding to *red*, *blue* and *green* channel value respectively. Values are in [0; 255] range.

```
>>> Color.hex_value_to_channels(0x80ff80)
(128, 255, 128)
```

(continues on next page)

(continued from previous page)

```
>>> Color.hex_value_to_channels(0x000001)
(0, 0, 1)
```

to_sgr_default(*bg: bool*) → *SequenceSGR*

to_sgr_indexed(*bg: bool*) → *SequenceSGR*

to_sgr_rgb(*bg: bool*) → *SequenceSGR*

property formatted_hex_value: str

property hex_value: int | None

class pytermor.color.**_ColorMap**(*parent_type: TypeColor*)

Bases: Generic[*TypeColor*]

Class contains a dictionary of registred *Colors* indexed by hex code along with cached nearest color search results to avoid unnecessary instance copies and search repeating.

add_to_map(*color: TypeColor*)

Called in *Color*-type class constructors. Add a new element in color lookup table if it wasn't there, and then drop cached search results as they are most probably useless after registering a new color (i.e. now there will be better result for at least one cached value).

Parameters
color – *Color* instance being created.

find_closest(*hex_value: int*) → TypeColor

Search for nearest to hex_value registered color. Is used by *SGRRenderer* to find supported color alternatives in case user's terminal is incapable of operating in better mode. For example, renderer will try to pick most suitable *indexed* colors instead of *RGB* colors if it ensures that terminal doesn't support True Color mode.

Parameters
hex_value – Rendering color RGB value.

Returns
Nearest to hex_value registered Color. Type is equal to parent *Color* type. If no colors of required type were created (table and cache are empty), invokes *get_default()* Color method.

pytermor.color.**NOOP**

Special instance of *Color* class always rendering into empty string.

pytermor.color.**TypeColor**

Any non-abstract *Color* type for *_ColorMap* generic.

alias of TypeVar('TypeColor', ColorDefault, ColorIndexed, ColorRGB)

Attention: Preset constants are omitted from API doc pages to improve readability and avoid duplication. Summary list of all presets can be found in *Color and attribute preset list* section of the guide.

2.2 intcode

Module with SGR param integer codes, contains a complete or almost complete list of reliably working ones.

Suitable for *Span* and *SequenceSGR* default constructors.

Attention: Preset constants are omitted from API doc pages to improve readability and avoid duplication. Summary list of all presets can be found in *Color and attribute preset list* section of the guide.

2.3 renderer

Module contains different output formatters. By default *SGRRenderer* is used.

There is a module-level variable *default_renderer* that is used by *Style.render()* method. Default renderer can be changed by calling `set_as_default()` class method of another renderer. Alternatively, you can use renderer's own class method `render()`.

```
>>> DebugRenderer.set_as_default()
>>> Style('red').render('_text_')
'[31m_text_[39m'
>>> NoOpRenderer.render(Style('red'), 'text')
'text'
```

class pytermor.renderer.**DebugRenderer**

Bases: *_Renderer*

classmethod render(*style:* Style, *text: str*) → str

classmethod set_as_default()

Set renderer as default for *Style.render()* invocations.

class pytermor.renderer.**HtmlRenderer**

Bases: *_Renderer*

classmethod render(*style:* Style, *text: str*) → str

classmethod set_as_default()

Set renderer as default for *Style.render()* invocations.

class pytermor.renderer.**NoOpRenderer**

Bases: *_Renderer*

classmethod render(*style:* Style, *text: str*) → str

Special renderer type that does nothing with the input string and just returns it as is.

```
>>> NoOpRenderer.render(Style(0xff00ff), 'text')
'text'
```

Parameters

- **style** – Style to ignore.
- **text** – Input string.

Returns
Input string without changes.

classmethod set_as_default()

Set renderer as default for *Style.render()* invocations.

class pytermor.renderer.**SGRRenderer**

Bases: *_Renderer*

Default renderer that *Style.render()* invokes. Transforms *Color* instances defined in `style` argument into ANSI control sequence characters and merges them with input string.

classmethod render(*style:* Style, *text: str*)

Render `text` with `style` applied as ANSI control sequences.

Automatically determines terminal capabilities and maps RGB colors to closest *indexed* colors if terminal doesn't support RGB output. In case terminal doesn't support even 256 colors, falls back to *default* colors, searching for closest counterparts in 16-color table.

Type of output `SequenceSGR` depends on type of *Color* variables in `style` argument. Keeping all that in mind, let's summarize:

1. *ColorRGB* can be rendered as True Color sequence, indexed sequence and default (16-color) sequence depending on terminal capabilities.
2. *ColorIndexed* can be rendered as indexed sequence or default sequence.
3. *ColorDefault* will be rendered as default-color sequence.

Parameters

- **style** – Style to apply.
- **text** – Input string.

Returns
Input string enclosed in SGR sequences.

classmethod set_as_default()

Set renderer as default for *Style.render()* invocations.

class pytermor.renderer.**TmuxRenderer**

Bases: *_Renderer*

abstract classmethod render(*style:* Style, *text: str*) → str

classmethod set_as_default()

Set renderer as default for *Style.render()* invocations.

class pytermor.renderer.**_Renderer**

abstract classmethod render(*style:* Style, *text: str*) → str

classmethod set_as_default()

Set renderer as default for *Style.render()* invocations.

pytermor.renderer.**default_renderer**

alias of *SGRRenderer*

2.4 sequence

Module contains definitions for low-level ANSI escape sequences handling.

Each preset defined below is a valid argument for *Span* and *SequenceSGR* default constructors (case-insensitive):

```
Span(sequence.BG_GREEN, sequence.UNDERLINED)
```

class pytermor.sequence.**SequenceSGR**(**params: int*)

Bases: *_AbstractSequenceCSI*

Class representing SGR-type escape sequence with varying amount of parameters.

SequenceSGR with zero params was specifically implemented to translate into empty string and not into `e[m`, which would have made sense, but also would be very entangling, as this sequence is equivalent of `e[0m` – hard reset sequence. The empty-string-sequence is predefined as *NOOP*.

It's possible to add of one SGR sequence to another:

```
>>> SequenceSGR(31) + SequenceSGR(1) == SequenceSGR(31, 1)
True
```

encode() → str

Build up actual byte sequence and return as an ASCII-encoded string.

classmethod regexp() → str

property params: List[int]

Return internal params as array.

class pytermor.sequence.**_AbstractSequence**(**params: int*)

Common ancestor of all possible escape sequenes.

abstract encode() → str

Build up actual byte sequence and return as an ASCII-encoded string.

property params: List[int]

Return internal params as array.

class pytermor.sequence.**_AbstractSequenceCSI**(**params: int*)

Bases: *_AbstractSequence*

Class representing CSI-type ANSI escape sequence. All subtypes of this sequence have something in common - they all start with `e[`.

abstract encode() → str

Build up actual byte sequence and return as an ASCII-encoded string.

classmethod regexp() → str

property params: List[int]

Return internal params as array.

pytermor.sequence.**build**(**args: str | int |* SequenceSGR) → *SequenceSGR*

Create new *SequenceSGR* with specified `args` as params.

Resulting sequence param order is same as an argument order.

Each sequence param can be specified as:

- string key (see *span*)
- integer param value (from *intcode*)
- existing SequenceSGR instance (params will be extracted).

Examples:

```
>>> build('yellow', 'bold')
SGR[33;1]
>>> build(91, 7)
SGR[91;7]
>>> build(HI_CYAN, UNDERLINED)
SGR[96;4]
```

pytermor.sequence.**color_indexed**(*color: int*, *bg: bool = False*) → *SequenceSGR*

Wrapper for creation of *SequenceSGR* that sets foreground (or background) to one of 256-color pallete value.

Parameters

- **color** – Index of the color in the pallete, 0 – 255.
- **bg** – Set to *True* to change the background color (default is foreground).

Returns

SequenceSGR with required params.

pytermor.sequence.**color_rgb**(*r: int*, *g: int*, *b: int*, *bg: bool = False*) → *SequenceSGR*

Wrapper for creation of *SequenceSGR* operating in True Color mode (16M). Valid values for *r*, *g* and *b* are in range [0; 255]. This range linearly translates into [`0x00`; `0xFF`] for each channel. The result value is composed as `#RRGGBB`. For example, sequence with color of `#FF3300` can be created with:

```
color_rgb(255, 51, 0)
```

Parameters

- **r** – Red channel value, 0 – 255.
- **g** – Blue channel value, 0 – 255.
- **b** – Green channel value, 0 – 255.
- **bg** – Set to *True* to change the background color (default is foreground).

Returns

SequenceSGR with required params.

pytermor.sequence.**NOOP = SGR[]**

Special sequence in case where you *have to* provide one or another SGR, but do not want any control sequence to be actually included.

- `NOOP.encode()` returns empty string.
- `NOOP.params` returns empty list.

```
>>> NOOP.encode()
''
>>> NOOP.params
[]
```

New in version 1.8.

pytermor.sequence.**RESET = SGR[0]**

Resets all attributes and colors.

Attention: Preset constants are omitted from API doc pages to improve readability and avoid duplication. Summary list of all presets can be found in *Color and attribute preset list* section of the guide.

2.5 span

Module introducing *Span* low-level abstractions. The key difference beetween them and Sequences is that sequence can *open* text style and also *close*, or terminate it. As for Spans – they always do both; typical use-case of *Span* is to wrap some text in opening SGR and closing one.

class pytermor.span.**Span**(**opening_params: str | int | SequenceSGR*)

Create a *Span* with specified control sequence(s) as an opening sequence and **automatically compose** second (closing) sequence that will terminate attributes defined in the first one while keeping the others (*soft* reset).

Resulting sequence param order is same as an argument order.

Each argument can be specified as:

- string key (name of any constant defined in *intcode*, case-insensitive)
- integer param value (defined in *intcode*)
- existing *SequenceSGR* instance (params will be extracted).

```
>>> Span('red', 'bold')
Span[SGR[31;1], SGR[39;22]]
>>> Span(intcode.GREEN)
Span[SGR[32], SGR[39]]
>>> Span(93, 4)
Span[SGR[93;4], SGR[39;24]]
>>> Span(sequence.BG_BLACK + sequence.RED)
Span[SGR[40;31], SGR[49;39]]
```

Parameters

opening_params – string keys, integer codes or existing SequenceSGR instances to build Span from.

__call__(*text: Optional[Any] = None*) → str

Can be used instead of *wrap()* method.

```
>>> RED('text') == RED.wrap('text')
True
```

classmethod new(*opening_seq: Optional[SequenceSGR] = None*, *closing_seq: Optional[SequenceSGR] = None*, *hard_reset_after: bool = False*) → *Span*

Create new *Span* with explicitly specified opening and closing sequences.

Note: *closing_seq* gets overwritten with *sequence.RESET* if hard_reset_after is *True*.

Parameters

- **opening_seq** – Starter sequence, in general determening how *Span* will actually look like.
- **closing_seq** – Finisher SGR sequence.
- **hard_reset_after** – Terminate *all* formatting after this span.

wrap(*text: Optional[Any] = None*) → str

Wrap given `text` string with `SGRs` defined on initialization – *opening_seq* on the left, *closing_seq* on the right. `str(text)` will be invoked for all argument types with the exception of *None*, which will be replaced with an empty string.

Parameters

text – String to wrap.

Returns

`text` enclosed in instance's `SGRs`, if any.

property closing_seq: *SequenceSGR*

Return closing SGR sequence instance.

property closing_str: **str**

Return closing SGR sequence encoded.

property opening_seq: *SequenceSGR*

Return opening SGR sequence instance.

property opening_str: **str**

Return opening SGR sequence encoded.

pytermor.span.**NOOP = Span[SGR[], SGR[]]**

Special *Span* in cases where you *have to* select one or another *Span*, but do not want any control sequence to be actually included.

- `NOOP(string)` or `NOOP.wrap(string)` returns `string` without any modifications;
- `NOOP.opening_str` and `NOOP.closing_str` are empty strings;
- `NOOP.opening_seq` and `NOOP.closing_seq` both returns *sequence.NOOP*.

```
>>> NOOP('text')
'text'
>>> NOOP.opening_str
''
>>> NOOP.opening_seq
SGR[]
```

Attention: Preset constants are omitted from API doc pages to improve readability and avoid duplication. Summary list of all presets can be found in *Color and attribute preset list* section of the guide.

2.6 style

High-level abstraction defining text colors and attributes.

class pytermor.style.**Style**(*fg_color: str | int | Color = None*, *bg_color: str | int | Color = None*, *blink: bool = False*, *bold: bool = False*, *crosslined: bool = False*, *dim: bool = False*, *double_underlined: bool = False*, *inversed: bool = False*, *italic: bool = False*, *overlined: bool = False*, *underlined: bool = False*)

Create a new `Style()`.

Key difference between `Styles` and `Spans` or `SGRs` is that `Styles` describe colors in RGB format and therefore support output rendering in several different formats (see *renderer*).

Both `fg_color` and `bg_color` can be specified as:

1. *Color* instance or library preset;
2. key code – name of for any of aforementioned presets, case-insensitive;
3. integer color value in hexademical RGB format.

```
>>> Style('green', bold=True)
Style[fg=008000, no bg, bold]
>>> Style(bg_color=0x0000ff)
Style[no fg, bg=0000ff]
>>> Style(color.IDX_DEEP_SKY_BLUE_1, color.IDX_GREY_93)
Style[fg=00afff, bg=eeeeee]
```

Parameters

- **fg_color** – Foreground (i.e., text) color.
- **bg_color** – Background color.
- **blink** – Blinking effect; *supported by limited amount of Renderers*.
- **bold** – Bold or increased intensity.
- **crosslined** – Strikethrough.
- **dim** – Faint, decreased intensity.
- **double_underlined** – Faint, decreased intensity.
- **inversed** – Swap foreground and background colors.
- **italic** – Italic.
- **overlined** – Overline.
- **underlined** – Underline.

render(*text: Optional[Any] = None*) → str

Returns `text` with all attributes and colors applied.

By default uses *SequenceSGR* renderer, that means that output will contain ANSI escape sequences.

class pytermor.style.**Stylesheet**(*default: Optional[Style] = None*)

2.7 util

Package containing a set of formatters for prettier output, as well as utility classes for removing some of the boilerplate code when dealing with escape sequences.

pytermor.util.**format_thousand_sep**(*value: int | float*, *separator=' '*)

Returns input `value` with integer part splitted into groups of three digits, joined then with `separator` string.

```
>>> format_thousand_sep(260341)
'260 341'
>>> format_thousand_sep(-9123123123.55, ',')
'-9,123,123,123.55'
```

2.7.1 auto_float

pytermor.util.auto_float.**format_auto_float**(*value: float*, *req_len: int*, *allow_exponent_notation: bool = True*) → str

Dynamically adjust decimal digit amount and format to fill up the output string with as many significant digits as possible, and keep the output length strictly equal to *req_len* at the same time.

```
>>> format_auto_float(0.016789, 5)
'0.017'
>>> format_auto_float(0.167891, 5)
'0.168'
>>> format_auto_float(1.567891, 5)
'1.568'
>>> format_auto_float(12.56789, 5)
'12.57'
>>> format_auto_float(123.5678, 5)
'123.6'
>>> format_auto_float(1234.567, 5)
' 1235'
>>> format_auto_float(12345.67, 5)
'12346'
```

For cases when it's impossible to fit a number in the required length and rounding doesn't help (e.g. 12 500 000 and 5 chars) algorithm switches to scientific notation and the result looks like '1.2e7'.

When exponent form is disabled, there are two options for value that cannot fit into required length:

1) if absolute value is less than 1, zeros will be displayed ('0.0000');
2) in case of big numbers (like 10^9) ValueError will be raised instead.

Parameters

- **value** – Value to format
- **req_len** – Required output string length
- **allow_exponent_notation** – Enable/disable exponent form.

Returns

Formatted string of required length

Raises
ValueError –

New in version 1.7.

2.7.2 prefixed_unit

class pytermor.util.prefixed_unit.**PrefixedUnitFormatter**(*max_value_len: int*, *integer_input: bool = False*, *unit: str = None*, *unit_separator: str = None*, *mcoef: float = 1000.0*, *prefixes: List[str | None] = None*, *prefix_zero_idx: int = None*)

Formats `value` using settings passed to constructor. The main idea of this class is to fit into specified string length as much significant digits as it's theoretically possible by using multipliers and unit prefixes to indicate them.

You can create your own formatters if you need fine tuning of the output and customization. If that's not the case, there are facade methods *format_si_metric()* and *format_si_binary()*, which will invoke predefined formatters and doesn't require setting up.

@TODO params

Parameters
prefix_zero_idx – Index of prefix which will be used as default, i.e. without multiplying coefficients.

New in version 1.7.

format(*value: float*) → str

Parameters
value – Input value

Returns
Formatted value

property max_len: int

Returns
Maximum length of the result. Note that constructor argument is *max_value_len*, which is different parameter.

pytermor.util.prefixed_unit.**format_si_binary**(*value: float*) → str

Format `value` as binary size (bytes, kbytes, Mbytes), max result length is *8* chars. Base is *1024*.

```
>>> format_si_binary(631)
'631 b'
>>> format_si_binary(1080)
'1.055 kb'
>>> format_si_binary(45200)
'44.14 kb'
>>> format_si_binary(1257800)
'1.200 Mb'
```

Parameters
value – Input value in bytes.

Returns
Formatted string with SI-prefix if necessary.

New in version 2.0.

pytermor.util.prefixed_unit.**format_si_metric**(*value: float*) → str

Format `value` as unitless value with SI-prefixes, max result length is *6* chars. Base is *1000*.

```
>>> format_si_metric(123.456)
'123'
>>> format_si_metric(1080)
'1.08 k'
>>> format_si_metric(45200)
'45.2 k'
>>> format_si_metric(1257800)
'1.26 M'
```

Parameters
value – Input value (unitless).

Returns
Formatted string with SI-prefix if necessary.

New in version 2.0.

pytermor.util.prefixed_unit.**PREFIXES_SI = ['y', 'z', 'a', 'f', 'p', 'n', '', 'm', None, 'k', 'M', 'G', 'T', 'P', 'E', 'Z', 'Y']**

Prefix presets used by default module formatters. Can be useful if you are building your own formatter.

pytermor.util.prefixed_unit.**PREFIX_ZERO_SI = 8**

Index of prefix which will be used as default, i.e. without multiplying coefficients.

2.7.3 time_delta

Module for time difference formatting (e.g. "4 days 15 hours", "8h 59m").

Supports several output lengths and can be customized even more.

class pytermor.util.time_delta.**TimeDeltaFormatter**(*units: List[TimeUnit]*, *allow_negative: bool*, *unit_separator: Optional[str] = None*, *plural_suffix: Optional[str] = None*, *stylesheet: Optional[TimeDeltaStylesheet] = None*, *overflow_msg: str = 'OVERFLOW'*)

Formatter for time intervals. Key feature of this formatter is ability to combine two units and display them simultaneously, e.g. return "3h 48min" instead of "228 mins" or "3 hours", etc.

You can create your own formatters if you need fine tuning of the output and customization. If that's not the case, there is a facade method *format_time_delta()* which will select appropriate formatter automatically.

Example output:

```
"10 secs", "5 mins", "4h 15min", "5d 22h"
```

format(*seconds: float*, *always_max_len: bool = False*) → str

Format the requested amount of seconds and apply styles to the result as defined in current formatter's *stylesheet*. Default `stylesheet` contains "noop" spans only and thus no styles will be applied.

Parameters

- **seconds** – Input value.
- **always_max_len** – If result string is less than *max_len* it will be returned as is, unless this flag is set to *True*. In that case output string will be padded with spaces on the left side so that resulting length would be always equal to maximum length.

Returns
Formatted string with applied styles if they are defined, raw string otherwise.

format_raw(*seconds: float*) → str | None

Format the requested amount of seconds as raw string without styling.

Parameters
seconds – Input value.

Returns
Formatted string or *None* on overflow (if input value is too big for the current formatter to handle).

property max_len: int

This property cannot be set manually, it is computed on initialization automatically.

Returns
Maximum possible output string length.

property stylesheet: *TimeDeltaStylesheet*

class pytermor.util.time_delta.**TimeDeltaStylesheet**(*default: Optional[Style] = None*, *digit: Optional[Style] = None*, *unit: Optional[Style] = None*, *overflow: Optional[Style] = None*)

Bases: *Stylesheet*

class pytermor.util.time_delta.**TimeUnit**(*name: 'str'*, *in_next: 'int' = None*, *custom_short: 'str' = None*, *collapsible_after: 'int' = None*, *overflow_afer: 'int' = None*)

collapsible_after: int = None

custom_short: str = None

in_next: int = None

name: str

overflow_afer: int = None

pytermor.util.time_delta.**format_time_delta**(*seconds: float*, *max_len: Optional[int] = None*) → str

Format time delta using suitable format (which depends on `max_len` argument). Key feature of this formatter is ability to combine two units and display them simultaneously, e.g. return "3h 48min" instead of "228 mins" or "3 hours",

There are predefined formatters with output length of 3, 4, 6 and 10 characters. Therefore, you can pass in any value from 3 inclusive and it's guarenteed that result's length will be less or equal to required length. If *max_len* is omitted, longest registred formatter will be used.

```
>>> format_time_delta(10, 3)
'10s'
>>> format_time_delta(10, 6)
'10 sec'
```

(continues on next page)

(continued from previous page)

```
>>> format_time_delta(15350, 4)
'4 h'
>>> format_time_delta(15350)
'4h 15min'
```

Parameters

- **seconds** – Value to format
- **max_len** – Maximum output string length (total)

Returns

Formatted string

2.7.4 stdlib_ext

Some of the Python Standard Library methods rewritten for correct work with strings containing control sequences.

pytermor.util.stdlib_ext.**center_sgr**(*s: str*, *width: int*, *fillchar: str = ' '*) → str

SGR-formatting-aware implementation of `str.center`.

Return a centered string of length `width`. Padding is done using the specified fill character (default is a space).

pytermor.util.stdlib_ext.**ljust_sgr**(*s: str*, *width: int*, *fillchar: str = ' '*) → str

SGR-formatting-aware implementation of `str.ljust`.

Return a left-justified string of length `width`. Padding is done using the specified fill character (default is a space).

pytermor.util.stdlib_ext.**rjust_sgr**(*s: str*, *width: int*, *fillchar: str = ' '*) → str

SGR-formatting-aware implementation of `str.rjust`.

Return a right-justified string of length `width`. Padding is done using the specified fill character (default is a space).

2.7.5 string_filter

String filtering module.

Main idea is to provide a common interface for string filtering, that can make possible working with filters like with objects rather than with functions/lambdas.

class pytermor.util.string_filter.**ReplaceCSI**(*repl: AnyStr = ''*)

Bases: *StringFilter*[str]

Find all CSI seqs (i.e. `ESC[*`) and replace with given string. Less specific version of *ReplaceSGR*, as CSI consists of SGR and many other sequence subtypes.

Parameters

repl – Replacement, can contain regexp groups (see *apply_filters()*).

__call__(*s: AnyStr*) → AnyStr

Can be used instead of *apply()*

apply(*s: AnyStr*) → AnyStr

Apply filter to `s` string (or bytes).

class pytermor.util.string_filter.**ReplaceNonAsciiBytes**(*repl: AnyStr = b'?'*)

Bases: *StringFilter*[bytes]

Keep 7-bit ASCII bytes [0x00 - 0x7f], replace other to ?.

Parameters
repl – Replacement byte-string.

__call__(*s: AnyStr*) → AnyStr

Can be used instead of *apply()*

apply(*s: AnyStr*) → AnyStr

Apply filter to s string (or bytes).

class pytermor.util.string_filter.**ReplaceSGR**(*repl: AnyStr = ''*)

Bases: *StringFilter*[str]

Find all SGR seqs (e.g. ESC[1;4m) and replace with given string. More specific version of *ReplaceCSI*.

Parameters
repl – Replacement, can contain regexp groups (see *apply_filters()*).

__call__(*s: AnyStr*) → AnyStr

Can be used instead of *apply()*

apply(*s: AnyStr*) → AnyStr

Apply filter to s string (or bytes).

class pytermor.util.string_filter.**StringFilter**(*pattern: AnyStr*, *repl: AnyStr | Callable[[AnyStr | Match], AnyStr]*)

Bases: Generic

Common string modifier interface.

__call__(*s: AnyStr*) → AnyStr

Can be used instead of *apply()*

apply(*s: AnyStr*) → AnyStr

Apply filter to s string (or bytes).

class pytermor.util.string_filter.**VisualuzeWhitespace**(*repl: AnyStr = '·'*)

Bases: *StringFilter*[str]

Replace every invisible character with repl (default is ·), except newlines. Newlines are kept and get prepneded with same string.

```
>>> VisualuzeWhitespace().apply('A  B  C')
'A··B··C'
>>> apply_filters('1. D\n2. L ', VisualuzeWhitespace)
'1.·D·\n2.·L·'
```

__call__(*s: AnyStr*) → AnyStr

Can be used instead of *apply()*

apply(*s: AnyStr*) → AnyStr

Apply filter to s string (or bytes).

pytermor.util.string_filter.**apply_filters**(*s: AnyStr*, **args:* StringFilter*[AnyStr]* | *Type[*StringFilter*[AnyStr]]*) → AnyStr

Method for applying dynamic filter list to a target string/bytes. Example (will replace all ESC control characters to E and thus make SGR params visible):

```
>>> apply_filters(span.RED('test'), ReplaceSGR(r'E\2\3\5'))
'E[31mtestE[39m'
```

Note that type of s argument must be same as StringFilter parameterized type, i.e. *ReplaceNonAsciiBytes* is StringFilter[bytes] type, so you can apply it only to bytes-type strings.

Parameters

- **s** (*AnyStr*) – String to filter.
- **args** – *StringFilter* instance(s) or StringFilter class(es).

Returns

Filtered s.

CHAPTER

THREE

CHANGELOG

3.1 v2.0.0

- Complete library reorganization.
- Formatters rewrite.
- Unit tests for formatters.
- High-level abstractions *Color*, *Renderer* and *Style*.
- `pytest` and `coverage` integration.
- `sphinx` and `readthedocs` integraton.

3.2 v1.8.0

- `format_prefixed_unit` extended for working with decimal and binary metric prefixes.
- *format_time_delta* extended with new settings.
- Value rounding transferred from *format_auto_float* to `format_prefixed_unit`.
- Utility classes reorganization.
- Unit tests output formatting.
- *sequence.NOOP* SGR sequence and *span.NOOP* format.
- Max decimal points for *auto_float* extended from (2) to (max-2).

3.3 v1.7.4

- Added 3 formatters: `format_prefixed_unit`, *format_time_delta*, *format_auto_float*.

3.4 v1.7.3

- Added `span.BG_BLACK` format.

3.5 v1.7.2

- Added *ljust_sgr*, *rjust_sgr*, *center_sgr* util functions to align strings with SGRs correctly.

3.6 v1.7.1

- Print reset sequence as `\e[m` instead of `\e[0m`.

3.7 v1.7.0

- *Span* constructor can be called without arguments.
- Added SGR code lists.

3.8 v1.6.2

- Excluded `tests` dir from distribution package.

3.9 v1.6.1

- Ridded of `EmptyFormat` and `AbstractFormat` classes.
- Renamed `code` module to `sgr` because of conflicts in PyCharm debugger (`pydevd_console_integration.py`).

3.10 v1.5.0

- Removed excessive `EmptySequenceSGR` – default `SGR` class was specifically implemented to print out as empty string instead of `\e[m` if constructed without params.

3.11 v1.4.0

- *Span.wrap()* now accepts any type of argument, not only `str`.
- Rebuilt `Sequence` inheritance tree.
- Added equality methods for *SequenceSGR* and *Span* classes/subclasses.
- Added some tests for `fmt.*` and `seq.*` classes.

3.12 v1.3.2

- Added `span.GRAY` and `span.BG_GRAY` format presets.

3.13 v1.3.1

- Interface revisioning.

3.14 v1.2.1

- *opening_seq* and *closing_seq* properties for *Span* class.

3.15 v1.2.0

- `EmptySequenceSGR` and `EmptyFormat` classes.

3.16 v1.1.0

- Autoformat feature.

3.17 v1.0.0

- First public version.

This project uses Semantic Versioning – https://semver.org *(starting from 2.0.0)*

CHAPTER

FOUR

LICENSE

```
MIT License

Copyright (c) 2022 Aleksandr Shavykin

Permission is hereby granted, free of charge, to any person obtaining a copy
of this software and associated documentation files (the "Software"), to deal
in the Software without restriction, including without limitation the rights
to use, copy, modify, merge, publish, distribute, sublicense, and/or sell
copies of the Software, and to permit persons to whom the Software is
furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all
copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR
IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY,
FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE
AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER
LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM,
OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE
SOFTWARE.
```

PYTHON MODULE INDEX

p

INDEX

Symbols

A

B

C

D

E

F

G

H

I

L

M

N

O

P

R

S

T

V

W