

## 1.3 Settling widgets in the window's interior

### Settling widgets

A familiarity with the `Button` widget allows us to show you some ways of putting the widgets (not only the buttons) inside windows. There are more of them than just `place()`, which you learned about in the previous section. To be precise, there are **three different methods**.

These methods are implemented by **geometry managers**.

`Place` is the most detailed one. It forces you to **precisely declare a widget's location**, pixel by pixel. It won't, however, protect you from some common mistakes causing the widgets to overlap each other or to place some of them, partially or fully, outside the window.

If you don't want to deploy the widgets manually and worry about possible conflicts and failures, you may entrust the whole problem to `tkinter`. It'll try to guess your intentions and to **find the best location** for each widget. Unfortunately, its assumptions may not live up to your expectations, and the final result can be really disappointing. This method of settling widgets is implemented by the `pack` geometry manager.

The `grid` geometry manager is in the middle, in between the other two geometry managers. It gives you a chance to express your **general wishes** and tries to deploy the widgets according to them. Note the word *general* – they aren't as precise as the ones used by `place`, but are far more detailed than those utilized by `pack`.

There is one very important aspect of the issue that must be mentioned here: **these managers cannot be mixed**. Only one of them can be used in one application, unless you want to turn your window into a big mess.

We're talking seriously about it. Don't take it as a joke.

The `place` geometry manager demands the usage of the `place()` method. Note: the method is invoked **from within the widget's object**, not the window, as the widget is always aware of the window it belongs to (it gets the information from the constructor's very first argument).

The most usable `place()` method parameters are as follows (all of them are passed as keyword arguments):

- `height=h` – the widget's desired **height** measured in pixels; if the parameter is omitted, the widget's height will be determined automatically;
- `width=w` – the widget's desired **width** measured in pixels; if the parameter is omitted, the widget's width will be determined automatically;
- `x=x` – the widget's top-left pixel's **horizontal coordinate** measured relative to the home window's top-left corner;
- `y=y` – the widget's top-left pixel's **vertical coordinate** measured relative to the home window's top-left corner.

Let's see them all in action.

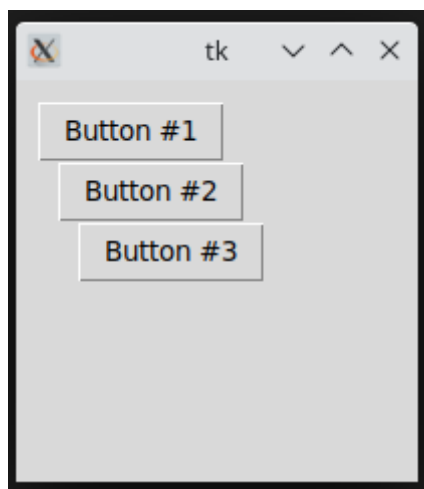
```
import tkinter as tk

window = tk.Tk()
button_1 = tk.Button(window, text="Button #1")
button_2 = tk.Button(window, text="Button #2")
button_3 = tk.Button(window, text="Button #3")
button_1.place(x=10, y=10)
button_2.place(x=20, y=40)
button_3.place(x=30, y=70)
```

```
window.mainloop()
```

The snippet we've prepared for you shows how the `place()` method works.

It places three buttons in a **cascade-like order**. Try to guess what these buttons will look like inside the window. Yes, this is what we expected, isn't it?



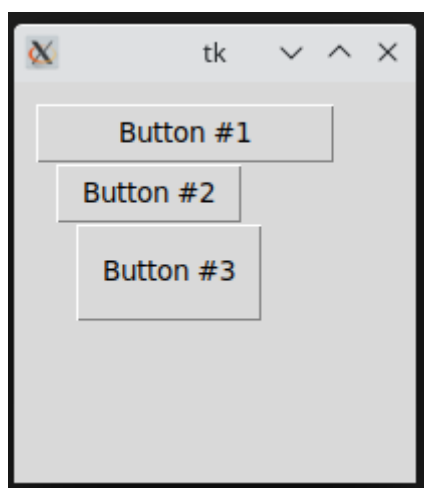
Now let's play with width and height for a moment.

Look, we've added some arguments to the previous snippet. Two buttons (b1 and b2) should look different now – can we be sure of it?

```
import tkinter as tk

window = tk.Tk()
button_1 = tk.Button(window, text="Button #1")
button_2 = tk.Button(window, text="Button #2")
button_3 = tk.Button(window, text="Button #3")
button_1.place(x=10, y=10, width=150)
button_2.place(x=20, y=40)
button_3.place(x=30, y=70, height=50)
window.mainloop()
```

Yes, we can!



As you can see, using `place()` gives you full control over the window's image. There is only one important but – full control means full responsibility. Sometimes it's better to share the responsibility among two parts – e.g.,

you and the `grid()` geometry controller.

`grid()` sees the window's area as a... grid. This means that the whole of the window's interior is divided into a number of **columns** of equal width and a number of **rows** of equal height.

The **grid itself is not visible** – the distribution is modeled inside the manager and you are only able to know its effects i.e., the widget's final arrangement.

You're not obliged to declare the number of rows and columns in advance – `grid()` finds the proper numbers for you. Let's try it.

The most commonly used `grid()` method parameters are gathered below (as, previously, all of them are passed as keyword arguments):

- `column=c` – deploys the widget in the column number `c`; note: the columns' numbers start from zero, and if you omit this argument, the manager will assume 0 (the left-most column)
- `row=r` – deploys the widget in the row number `r`; if you omit this argument, the manager will assume the first free row starting from the top;
- `columnspan=cs` – determines how many neighboring columns the widget occupies; the parameter defaults to 1 (the widget won't cross a single grid's cell)
- `rowspan=rs` – works as `columnspan` but refers to rows.

Let's see them all in action.

```
import tkinter as tk

window = tk.Tk()
button_1 = tk.Button(window, text="Button #1")
button_2 = tk.Button(window, text="Button #2")
button_3 = tk.Button(window, text="Button #3")
button_1.grid(row=0, column=0)
button_2.grid(row=1, column=1)
button_3.grid(row=2, column=2)
window.mainloop()
```

Analyze the snippet in the editor and determine the resulting number of columns and rows. That's essential if you want to imagine the resulting window's appearance.

Are you ready to solve the puzzle? Did you imagine the window that way?



We're sure you did. Look. The window is divided into **nine cells**: three rows and three columns. The buttons are settled on the **grid's diagonal**.

Now we're going to affect the buttons' relation to the cells' boundaries.

Can you see what we changed in the code?

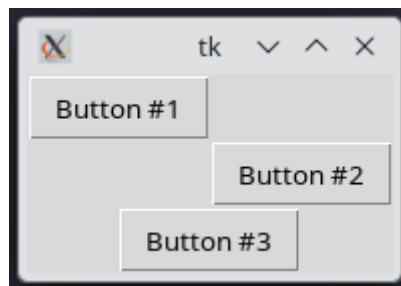
```
import tkinter as tk
```

```
window = tk.Tk()
button_1 = tk.Button(window, text="Button #1")
button_2 = tk.Button(window, text="Button #2")
button_3 = tk.Button(window, text="Button #3")
button_1.grid(row=0, column=0)
button_2.grid(row=1, column=1)
button_3.grid(row=2, column=0, columnspan=2)
window.mainloop()
```

Yes, we modified the third `grid()` invocation a bit. We wanted to deploy the button inside the cell located in the third (actually, the lowest) row and the first (the left-most) column, but we also did something else - we wanted the widget to span across two horizontally neighboring cells.

We admit that this puzzle is somewhat harder than the previous ones. Don't rush through this - think it over carefully.

Here's the solution.



Note: the manager noticed that the total number of columns is actually two, not three as in the previous code. This is why the window looks different.

The third, fully automatic geometry manager is named `pack()` as it **packs subsequent widgets** into the window's interior. This means that the **order** in which the widgets are packed **matters** - in contrast to `grid()` and `place()`.

Let's take a look at it.

The default `pack`'s operation tends to deploy all subsequent widgets in one column, one below the other. You can change this behavior to a limited extent by using the following parameters:

- `side=s` - forces the manager to pack the widgets in a specified **direction**, where `s` can be specified as:
  - `TOP` - the widget is packed toward the window's **top** (it's manager's default behavior)
  - `BOTTOM` - the widget is packed toward the window's **bottom**;
  - `LEFT` - toward the window's **left** boundary;
  - `RIGHT` - toward the window's **right** boundary;
- `fill=f` - suggests to the manager how to expand the widget if you want it to occupy more space than the default, while `f` should be specified as:
  - `NONE` - do not expand the widget (default behavior)
  - `X` - expand it in the **horizontal** direction;
  - `Y` - expand it in the **vertical** direction;
  - `BOTH` - expand it in **both** directions;

We want to warn you that the results produced by `pack()` can be extremely surprising, and you should spend some time on your own experimenting with all its vices.

We suggest you use it only as a temporary solution to help you get a working application quickly, but if you

want your application to look nice and to be legible and clear (of course, you would want that!) you'd better forget about `pack()` and use either `grid()` (in simpler cases) or `place()`.

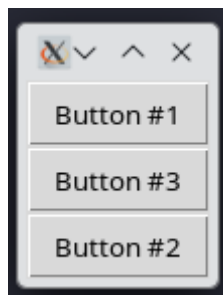
Let `pack()` show us what it can do for us. Look at the code in the editor.

```
import tkinter as tk

window = tk.Tk()
button_1 = tk.Button(window, text="Button #1")
button_2 = tk.Button(window, text="Button #2")
button_3 = tk.Button(window, text="Button #3")
button_1.pack()
button_2.pack()
button_3.pack()
window.mainloop()
```

As you can see, using `pack()` simplifies the code - you don't need to specify any coordinates - but that doesn't mean this will simplify the developer's life. You may expect that `pack()` will know how to handle your widgets, but sometimes its work results are like a lottery.

Let's look at the window we get. The window looks different.



Very different. For example, the window fits its size to the area occupied by the widgets. The buttons are located one after the other, from top to bottom.

Let's play a little game with `pack`'s arguments.

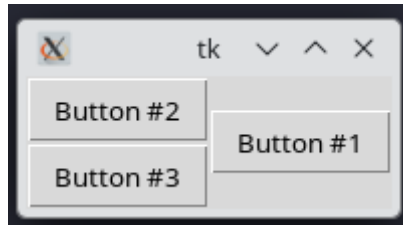
We've ordered `pack()` to push the `button_1` button to the right window's boundary.

```
import tkinter as tk

window = tk.Tk()
button_1 = tk.Button(window, text="Button #1")
button_2 = tk.Button(window, text="Button #2")
button_3 = tk.Button(window, text="Button #3")
button_1.pack(side=tk.RIGHT)
button_2.pack()
button_3.pack()
window.mainloop()
```

Can you predict the window's appearance? We admit that it may be difficult.

Is this what you expected?



No? Are you surprised? You have the right to be. Pack is the **least intuitive** geometry manager for sure, and you really need to spend some time testing its whims.

We have one more experiment left to carry out.

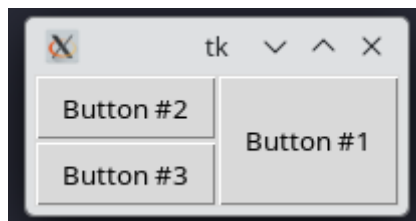
Note: we want the `button_1` button to be **filled (expanded)** in the **vertical** direction:

This puzzle is a bit easier than the previous one. Think for a moment.

```
import tkinter as tk

window = tk.Tk()
button_1 = tk.Button(window, text="Button #1")
button_2 = tk.Button(window, text="Button #2")
button_3 = tk.Button(window, text="Button #3")
button_1.pack(side=tk.RIGHT, fill=tk.Y)
button_2.pack()
button_3.pack()
window.mainloop()
```

Yes, you're right - this is the expected answer.



We think that there is one intriguing question that can be asked here and now: do these buttons have to be **gray**? It's boring. Very boring.

We're going to clear up this issue soon

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