Empirical Cumulative Distribution Plots in Python

How to add empirical cumulative distribution function (ECDF) plots.

plots

Overview

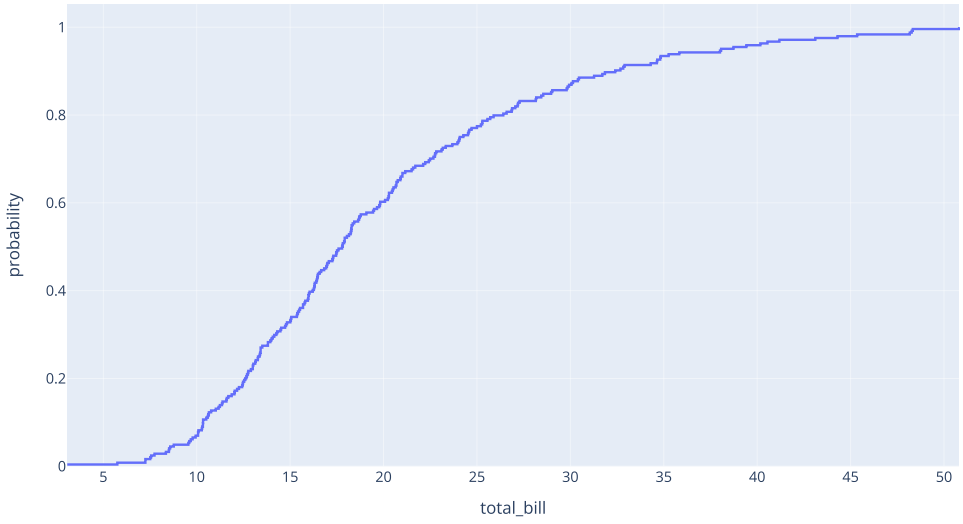
Empirical cumulative distribution function plots (https://en.wikipedia.org/wiki/Empirical_distribution_function) are a way to visualize the distribution of a variable, and Plotly Express has a built-in function, `px.ecdf()` to generate such plots. Plotly Express (/python/plotly-express/) is the easy-to-use, high-level interface to Plotly, which operates on a variety of types of data (/python/px-arguments/) and produces easy-to-style figures (/python/styling-plotly-express/).

Alternatives to ECDF plots for visualizing distributions include histograms (https://plotly.com/python/histograms/), violin plots (https://plotly.com/python/violin/), box plots (https://plotly.com/python/box-plots/) and strip charts (https://plotly.com/python/strip-charts/).

Simple ECDF Plots

Providing a single column to the x variable yields a basic ECDF plot.

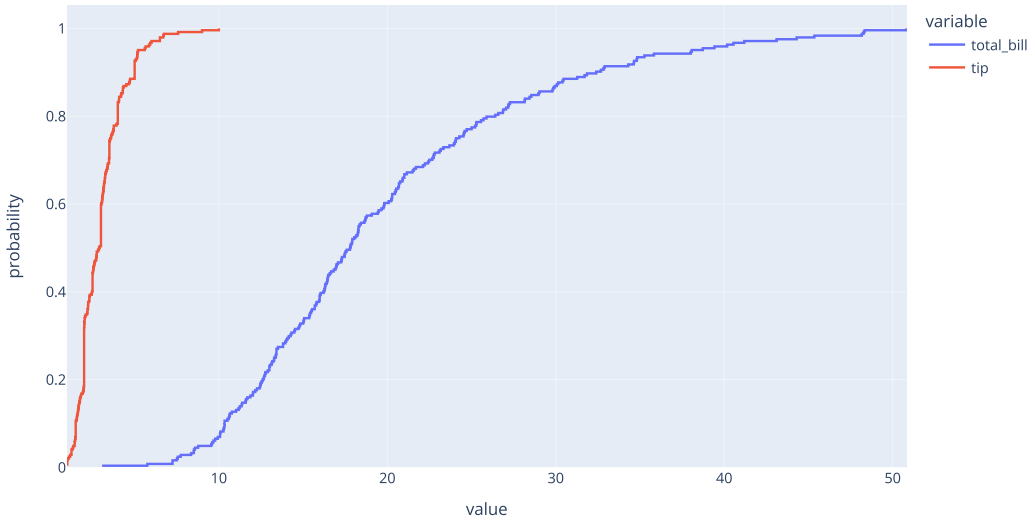
```
import plotly.express as px
df = px.data.tips()
fig = px.ecdf(df, x="total_bill")
fig.show()
```



Providing multiple columns leverage's Plotly Express' wide-form data support (https://plotly.com/python/wide-form/) to show multiple variables on the same plot.

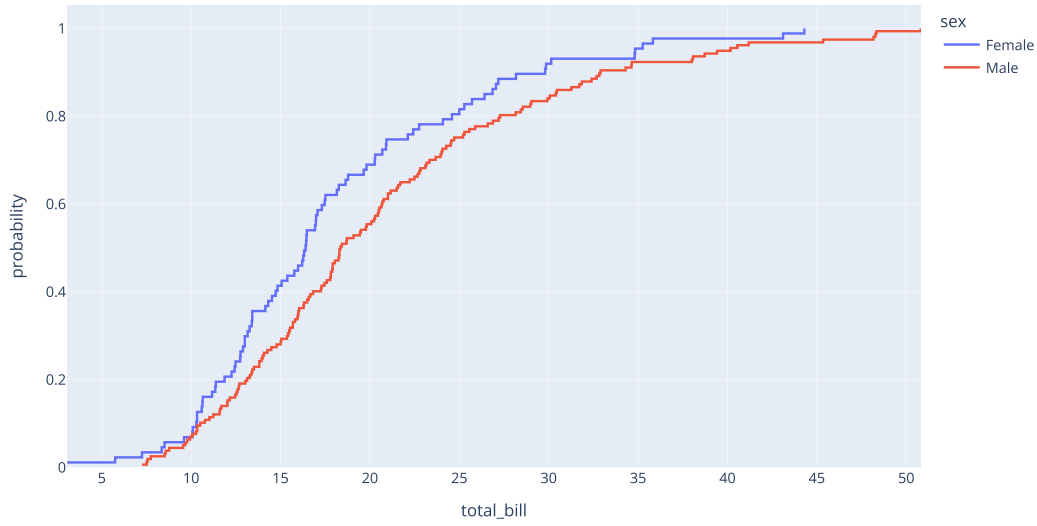
```
import plotly.express as px
df = px.data.tips()
fig = px.ecdf(df, x=["total_bill", "tip"])
fig.show()
```

plots



It is also possible to map another variable to the color dimension of a plot.

```
import plotly.express as px
df = px.data.tips()
fig = px.ecdf(df, x="total_bill", color="sex")
fig.show()
```

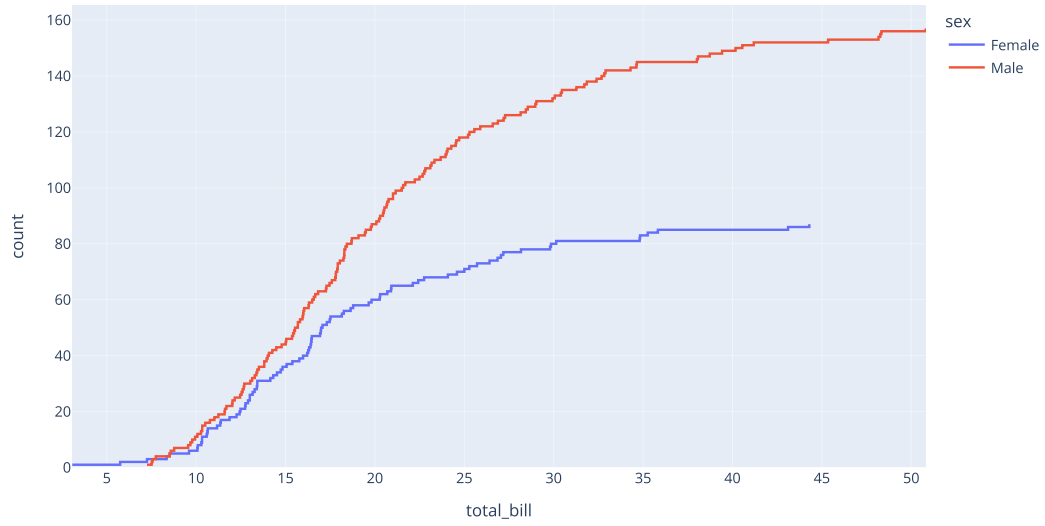


Configuring the Y axis

ows probability, but it is also possible to show raw counts by setting the ecdfnorm argument to None or to show percentages by setting it to

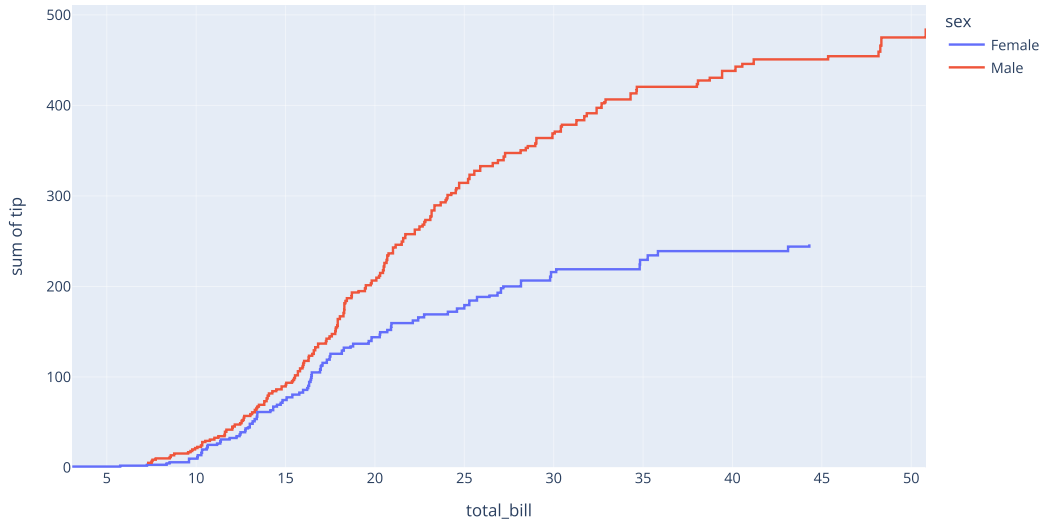
```
import plotly.express as px
df = px.data.tips()
fig = px.ecdf(df, x="total_bill", color="sex", ecdfnorm=None)
fig.show()
```

plots



If a `y` value is provided, the Y axis is set to the sum of `y` rather than counts.

```
import plotly.express as px
df = px.data.tips()
fig = px.ecdf(df, x="total_bill", y="tip", color="sex", ecdfnorm=None)
fig.show()
```

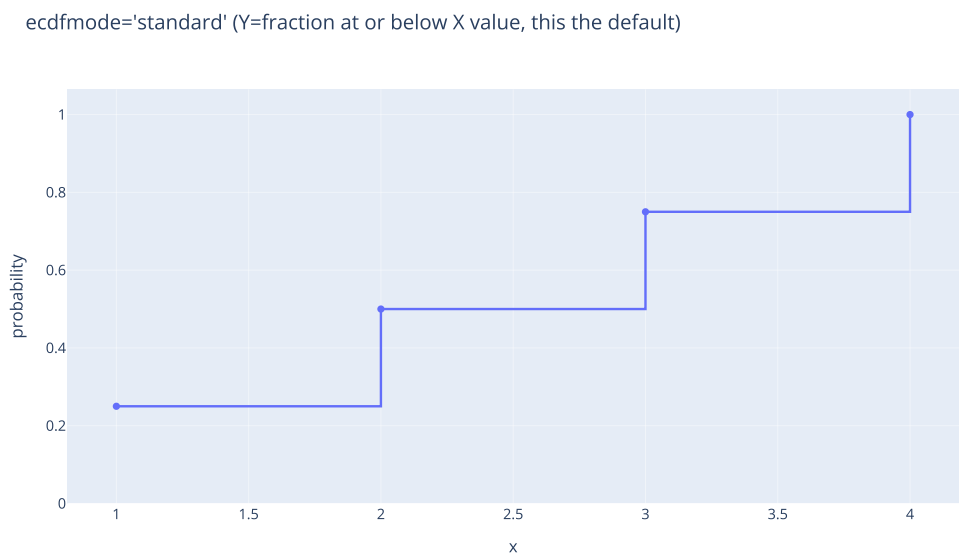


Reversed and Complementary CDF plots

epresents the fraction of the data that is *at or below* the value on on the X axis. Setting ecdfmode to "reversed" reverses this, with the Y axis
of the data *at or above* the X value. Setting ecdfmode to "complementary" plots 1-ECDF, meaning that the Y values represent the fraction of
the the X value.

efault), the right-most point is at 1 (or the total count/sum, depending on `ecdfnorm`) and the right-most point is above 0.

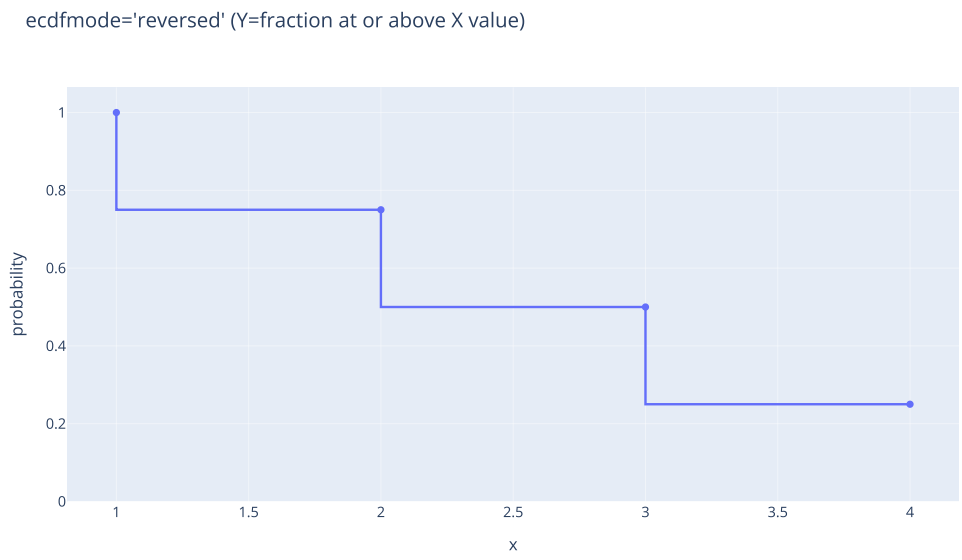
```
import plotly.express as px
fig = px.ecdf(df, x=[1,2,3,4], markers=True, ecdfmode="standard",
              title="ecdfmode='standard' (Y=fraction at or below X value, this the default)")
fig.show()
```



plots

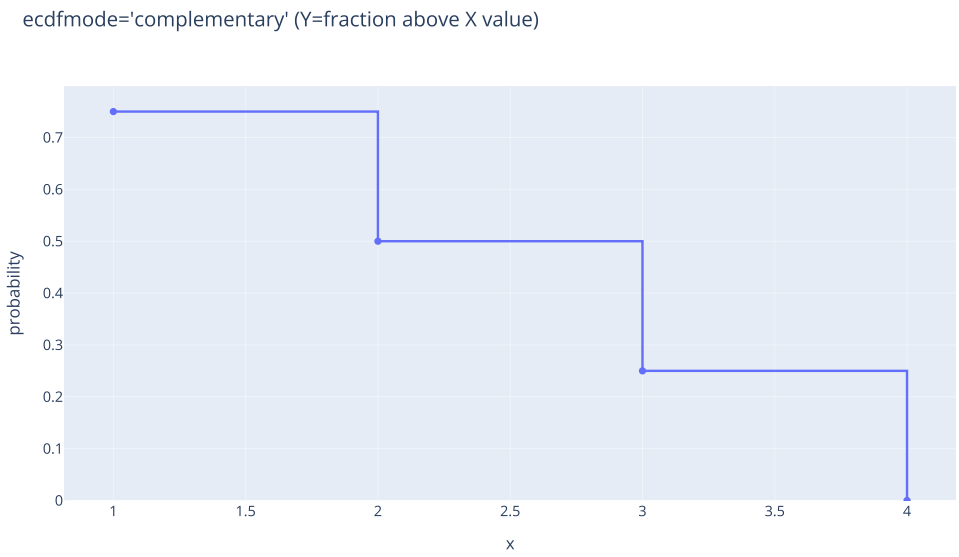
In `reversed` mode, the right-most point is at 1 (or the total count/sum, depending on `ecdfnorm`) and the left-most point is above 0.

```
import plotly.express as px
fig = px.ecdf(df, x=[1,2,3,4], markers=True, ecdfmode="reversed",
              title="ecdfmode='reversed' (Y=fraction at or above X value)")
fig.show()
```



In complementary mode, the right-most point is at 0 and no points are at 1 (or the total count/sum) per the definition of the CCDF as 1-ECDF, which has no point at 0.

```
import plotly.express as px
fig = px.ecdf(df, x=[1,2,3,4], markers=True, ecdfmode="complementary",
              title="ecdfmode='complementary' (Y=fraction above X value)")
fig.show()
```

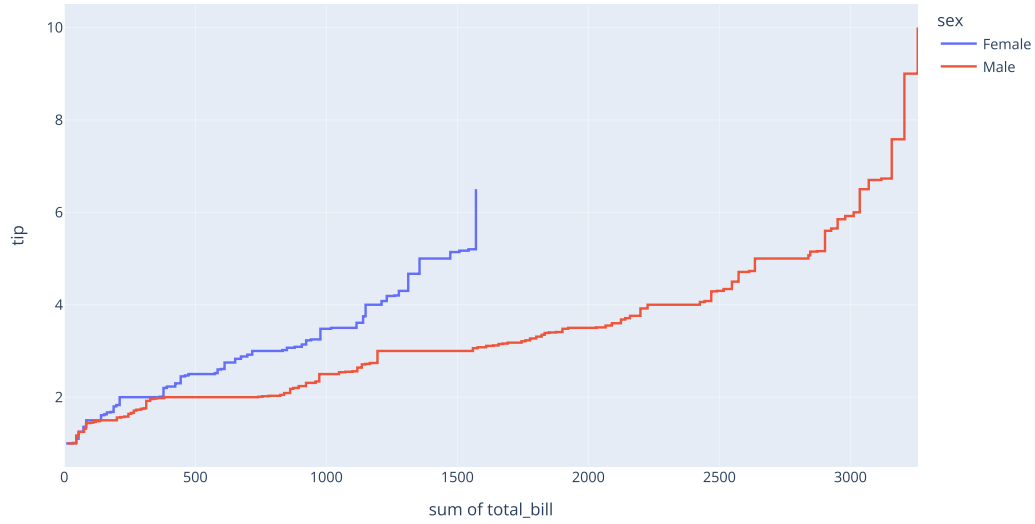


plots

Orientation

By default, plots are oriented vertically (i.e. the variable is on the X axis and counted/summed upwards), but this can be overridden with the `orientation` argument.

```
import plotly.express as px
df = px.data.tips()
fig = px.ecdf(df, x="total_bill", y="tip", color="sex", ecdfnorm=None, orientation="h")
fig.show()
```

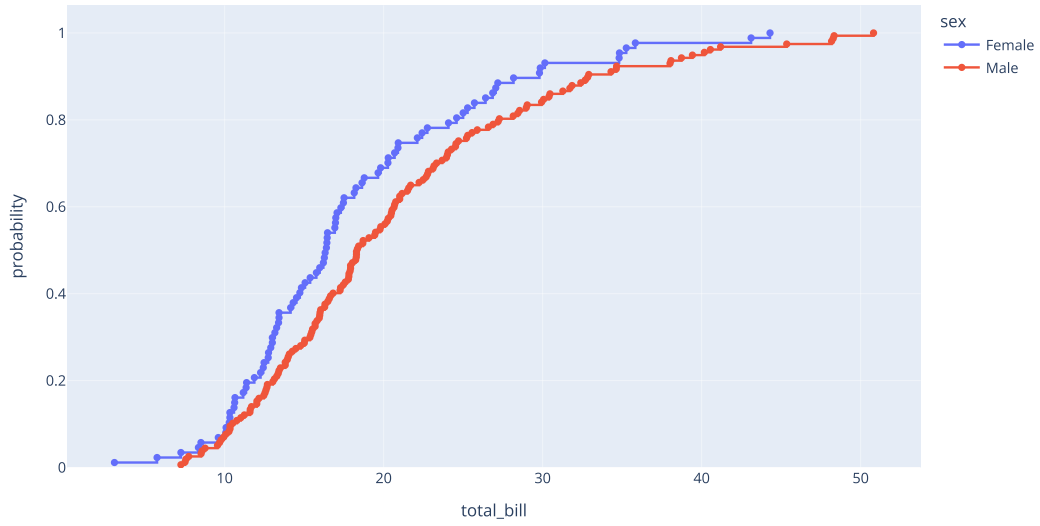


l/or Lines

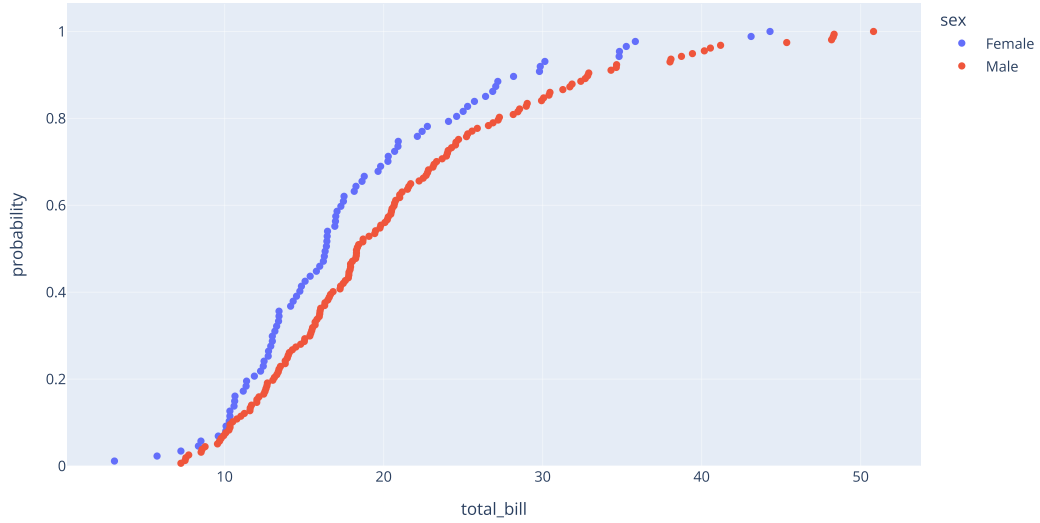
ECDF plots can be configured to show lines and/or markers.

```
import plotly.express as px
df = px.data.tips()
fig = px.ecdf(df, x="total_bill", color="sex", markers=True)
fig.show()
```

plots

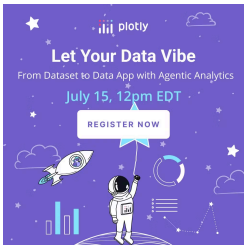



```
import plotly.express as px
df = px.data.tips()
fig = px.ecdf(df, x="total_bill", color="sex", markers=True, lines=False)
fig.show()
```



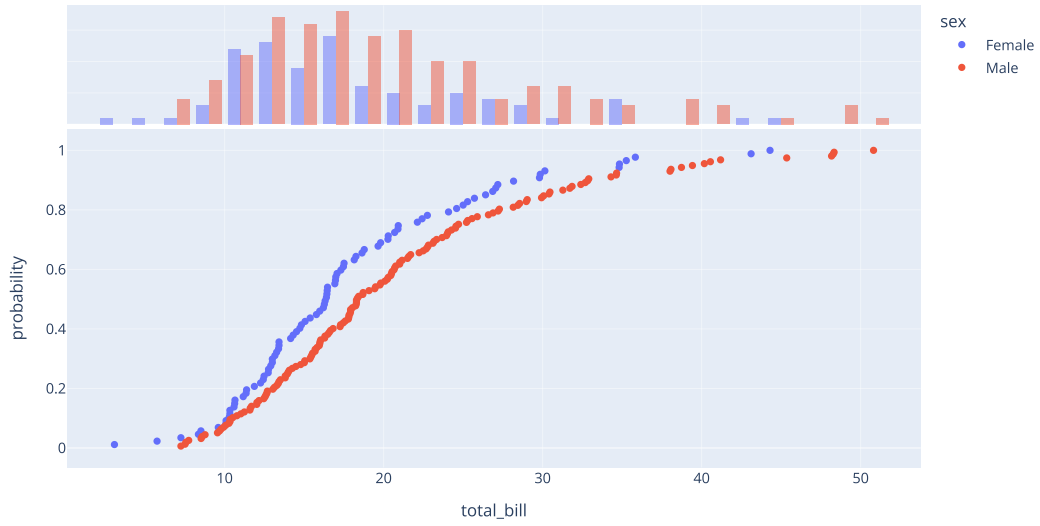
Marginal Plots

ECDF plots also support marginal plots (https://plotly.com/python/marginal-plots/)

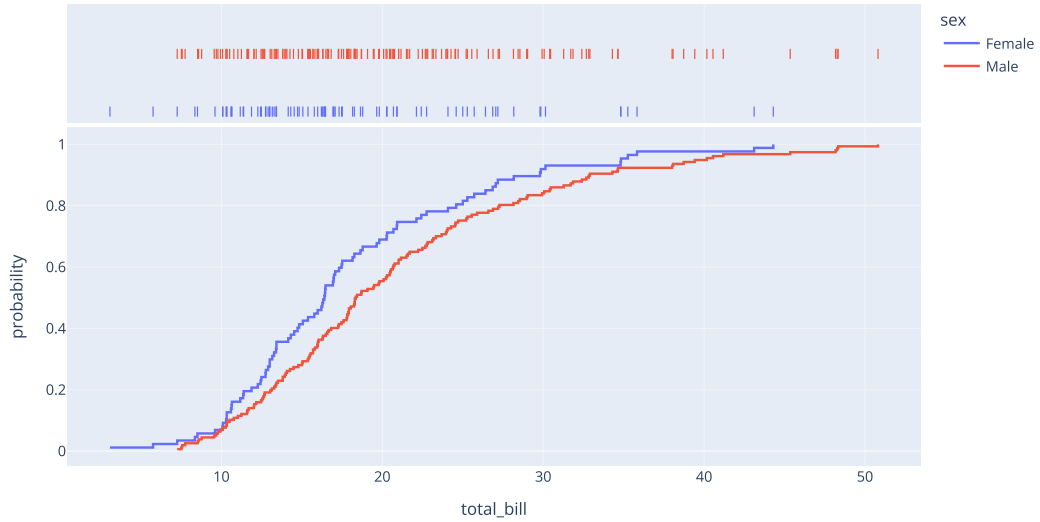


```
import plotly.express as px
df = px.data.tips()
fig = px.ecdf(df, x="total_bill", color="sex", markers=True, lines=False, marginal="histogram")
fig.show()
```

plots

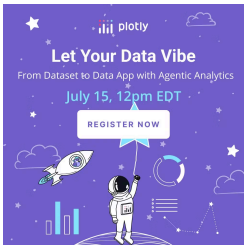



```
import plotly.express as px
df = px.data.tips()
fig = px.ecdf(df, x="total_bill", color="sex", marginal="rug")
fig.show()
```



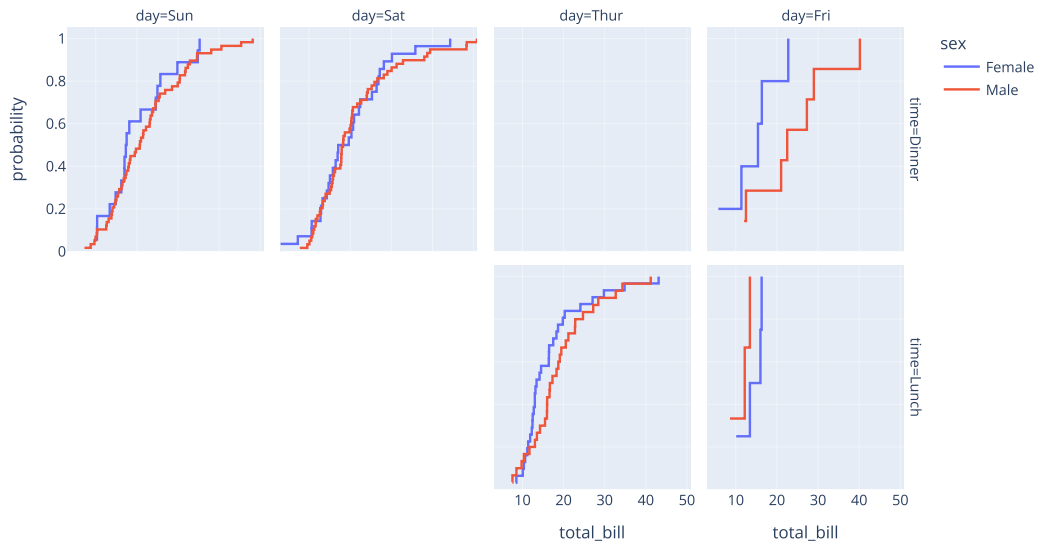
Facets

ECDF Plots also support faceting (https://plotly.com/python/facet-plots/)



```
import plotly.express as px
df = px.data.tips()
fig = px.ecdf(df, x="total_bill", color="sex", facet_row="time", facet_col="day")
fig.show()
```

plots



What About Dash?

Dash (https://dash.plot.ly/) is an open-source framework for building analytical applications, with no Javascript required, and it is tightly integrated with the Plotly graphing library.

Learn about how to install Dash at https://dash.plot.ly/installation (https://dash.plot.ly/installation).

Everywhere in this page that you see fig.show(), you can display the same figure in a Dash application by passing it to the figure argument of the Graph component (https://dash.plot.ly/dash-core-components/graph) from the built-in `dash_core_components` package like this:

```
import plotly.graph_objects as go # or plotly.express as px
fig = go.Figure() # or any Plotly Express function e.g. px.bar(...)
# fig.add_trace( ... )
# fig.update_layout( ... )

from dash import Dash, dcc, html

app = Dash()
app.layout = html.Div([
    dcc.Graph(figure=fig)
])

app.run(debug=True, use_reloader=False)  # Turn off reloader if inside Jupyter
```

plots