



# Plotly JS

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# Introduction

## Plotly.js

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### High-level, declarative charting library.

- Scientific grade.
  - Comparable in scope and features to MATLAB or Python's matplotlib
- Built on top of `D3.js` (SVG) and `stack.gl` (WebGL) backends
- Self-contained: based on a declarative JSON object

# Usage

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- Graph specification:
  - data and mapping (**tracks**):

```
var tracks = [{ x : [0, 1, 2, 3, 4],  
                y : [1, 2, 4, 8, 16],  
                type : "scatter" }];
```

- layout

```
var layout = { title:"Binary powers",  
               margin: { t: 30,  
                        l: 25, r:10,  
                        b: 30 } };
```

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- Drawing

```
Plotly.plot("plot-example", tracks, layout);
```

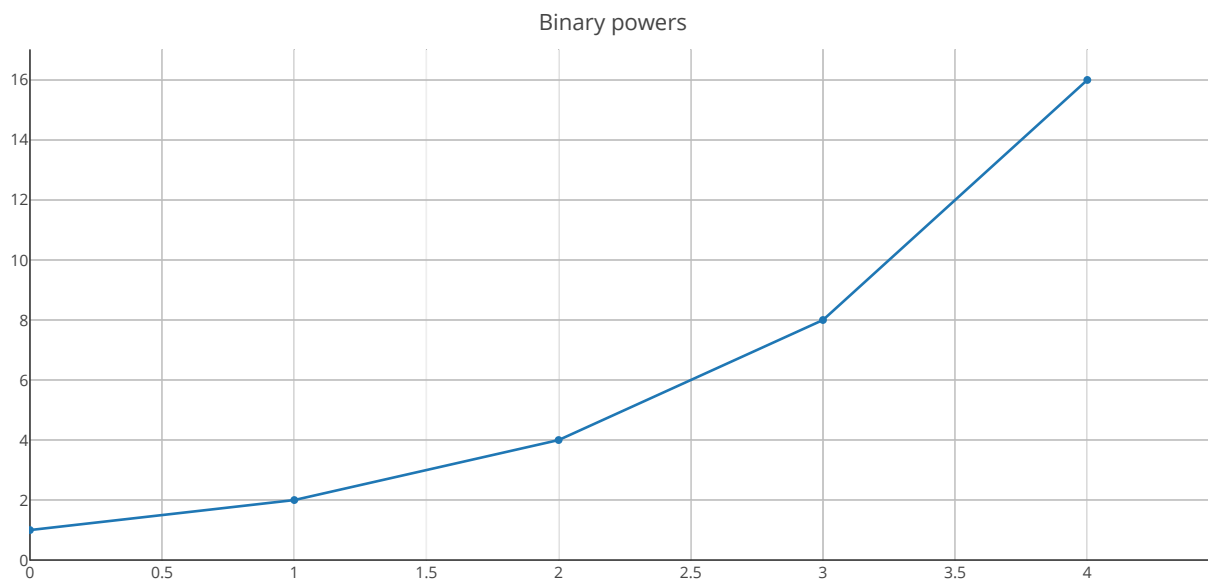
That is applied to an existing element with the given id

- The size of the graph can be specified in the HTML element, using CSS, or as part of the layout definition

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# Plot example

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## Plot types

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- Dot charts: `scatter`
- Bar charts: `bar`
  - Histograms: `histogram`
- Heatmap: `heatmap`
  - Histogram heatmap: `histogram2d`
- Box plot: `box`
- Area char: `area`

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- Countour plot: `contour`
    - Histogram contour: `histogram2dcontour`
  - Maps:
    - Dots: `scattergeo`
    - Choropleth : `choropleth`
  - Pie

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## Layout

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- Hover Text and Formatting
- Setting Graph Size
- Legends
- Setting the Title, Legend Entries, and Axis Titles
- Text and Font Styling
- Axes
- Text and Annotations

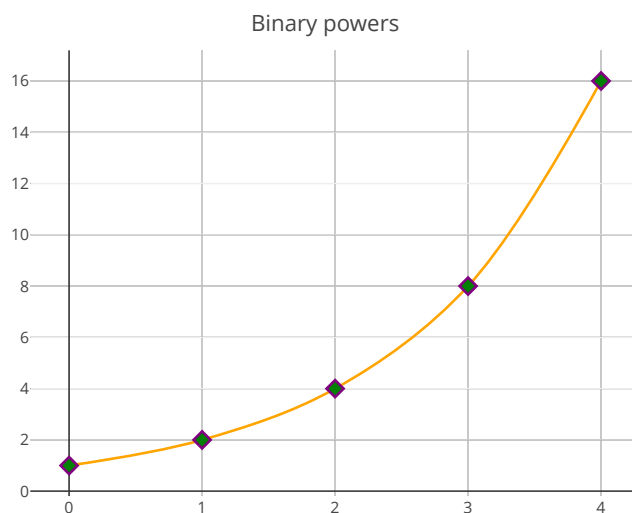
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# Examples

## Lines and dots plot

Main track attributes:

- **marker:**
  - **color**: green
  - **size**: 10
  - **symbol**: diamond
- **line:**
  - **color**: orange
  - **width**: s
  - **shape**: spline



```

tracks[0].marker= {line:{ color:"purple",
                        width:2, },
                  color: "green",
                  symbol:"diamond",
                  size: 10};
tracks[0].line={ color:"orange",
                 shape:"spline"};
layout.width=500;
layout.height=400;
Plotly.plot("dot",tracks,layout);

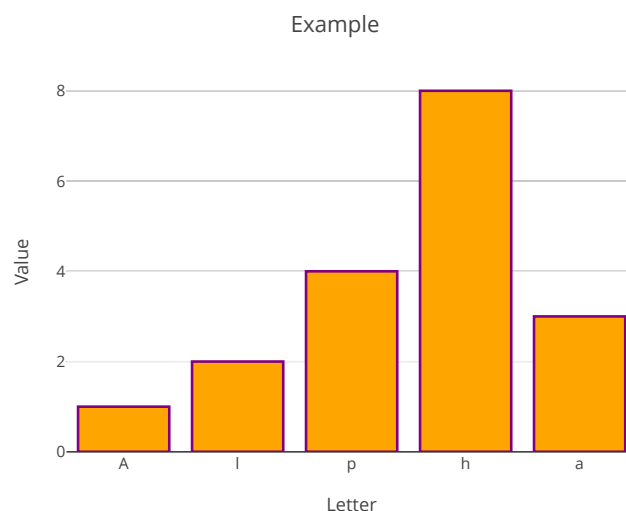
```

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## Bar plot

Main track attributes:

- `orientation`: `h` or `v`
- `marker`: the bar itself
  - `color` >orange<
  - `line`:
    - `width`
    - `color`



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```

data = [{ x: ['A', 'l', 'p', 'h', 'a'],
          y: [1, 2, 4, 8, 3],
          type: "bar",
          marker: { color: "orange",
                   line:{ color:"purple",
                          width: 2,
                        }}}];

layout = { title:"Example",
           margin: {l: 45, r:20, b: 50, t:60},
           width:500, height:400,
           xaxis: { title: "Letter"},
           yaxis: { title: "Value"}
          };

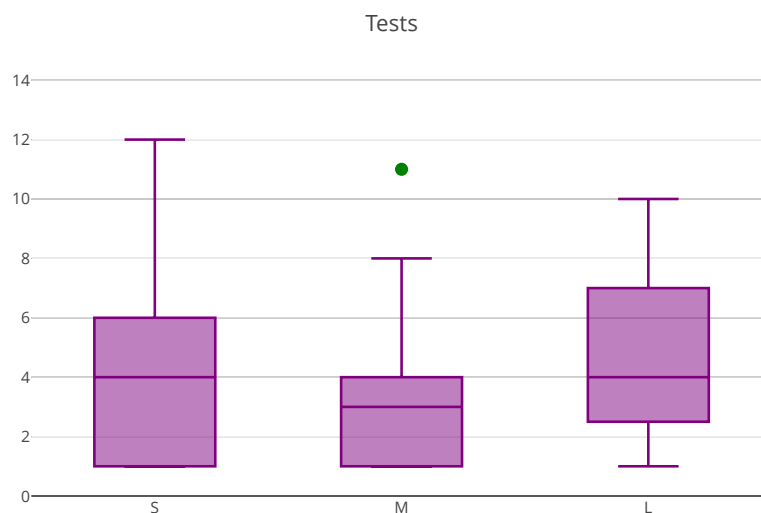
Plotly.plot("bar",data,layout);

```

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## Box plot

- `marker:`
  - `color`
- `line:`
  - `color`
  - `width`



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```
data = [{  y: nums,
           x: szCat,
           type : "box",
           marker : { color:"green", size:10 },
           line: { color:"purple" },
           name : "# test classes",
           boxpoints: "outliers"
         }];
layout = { title:"Tests",
           margin: {l: 25, r:10, b: 30, t:30 },
           yaxis: { range:[0,15]},
           width:600,
           height:400
         };
Plotly.plot("box",data,layout);
```

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## Maps

- `type: scattergeo`
- `lon` and `lat`

Projection type and limits  
are defined in the `layout`



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```

Plotly.plot("map", [{
  lat:[41.883,45.066],
  lon:[12.466,7.700],
  text:['Rome','Turin'],
  type:'scattergeo',
  mode:'markers', marker: {color:"black"}}],
{ margin: {l: 25, r:10, b: 20, t:30},
width:500, height:500,
geo : { projection: {type:"equirectangular"},
showocean: true, oceancolor: "azure",
showrivers: true,
scope:"europe", resolution: "50",
lataxis:{range:[35,48]},
lonaxis:{range:[6,19]}
});

```

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## Choropleth Map

- `type: choropleth`
- `z`: mapped to color



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```
Plotly.plot('choropleth', [{
  type: 'choropleth',
  locations: ['ITA', 'DEU', 'FRA', 'USA', 'CHN'],
  z: [2129, 3820, 2902, 17420, 10360],
  text: ['Italy', 'Germany', 'France', 'USA', 'China'],
  autocolorscale: true,
  hoverinfo: 'z+text',
  colorbar: {
    tickprefix: '$',
    title: 'GDP<br>Billions US$'
  }
}], { });
```

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## Configuration

# Common features

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A few attributes are common to most plot types:

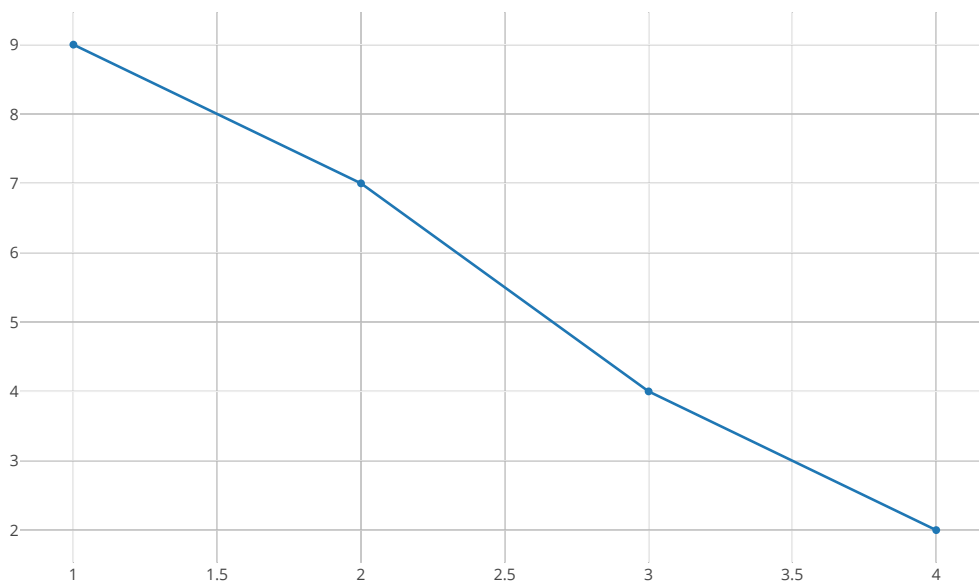
- `text`: individual points labels
- `hoverinfo`: `'x'`, `'y'`, `'z'`, `'text'`, `'name'` joined with a `+` OR `'all'` or `'none'`
  - e.g. `"x+text"`

```
Plotly.plot("example-common-features",  
  [{x:[1,2,3,4],y:[9,7,4,2],  
    text:["A","B","C","D"],  
    type:"scatter", hoverinfo:"y+text"}],  
  {width:900, height:600,  
});
```

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## Example common features

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# General configuration

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Optional 4th argument to `plot()`:

- `staticPlot`: makes a static (non-interactive) chart
- `displayModeBar`: show or hide the modal toolbar

## External data

# Loading external data resources

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- Provides functions to load data (using *D3.js*)
  - `Plotly.d3.json`
  - `Plotly.d3.csv`
- Both function accept two arguments:
  - the *URL* of the resource
  - a callback function with two arguments
    - an error condition (optional)
    - the data object

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## Load data from a JSON resource

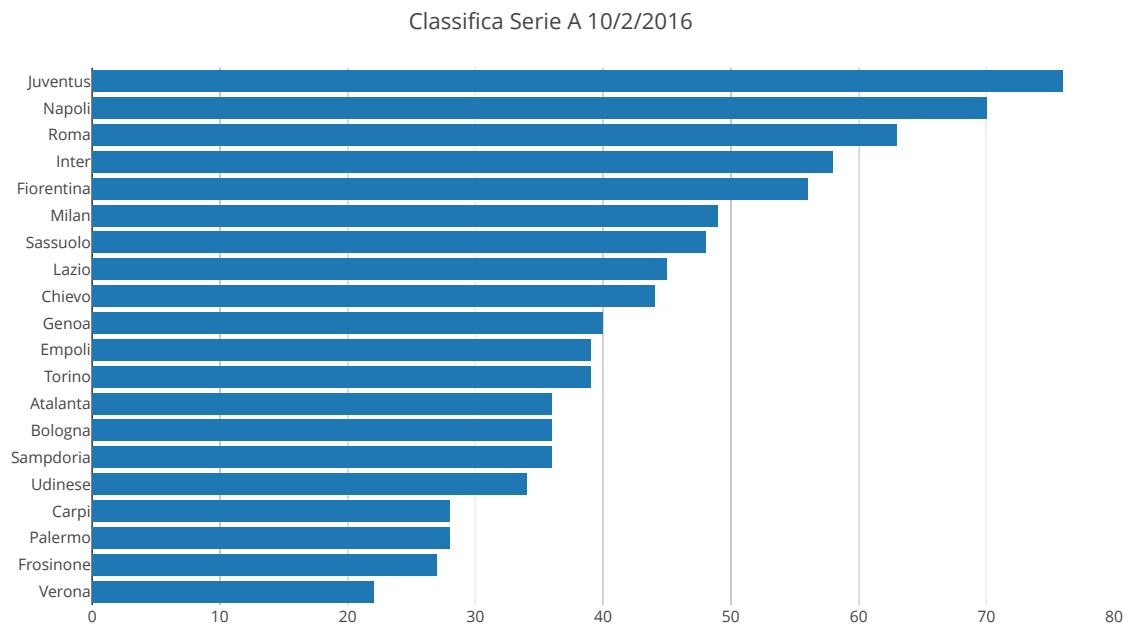
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```
var b='https://softeng.polito.it/courses/VIQ/datasets
var url=b+'/classifica20160310.json';
Plotly.d3.json(url, function(error, json) {
  if (error) return console.warn(error);
  var trace = {x:[],y:[],
                type:"bar",orientation:"h"};
  for(var i=0; i<json.data.length; ++i){
    trace.y.push(json.data[i][0]); // team name
    trace.x.push(+json.data[i][1]); // points
  }
  Plotly.plot("json-load",[trace],Alayout); });
```

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# JSON load

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## Load data from a CSV resource

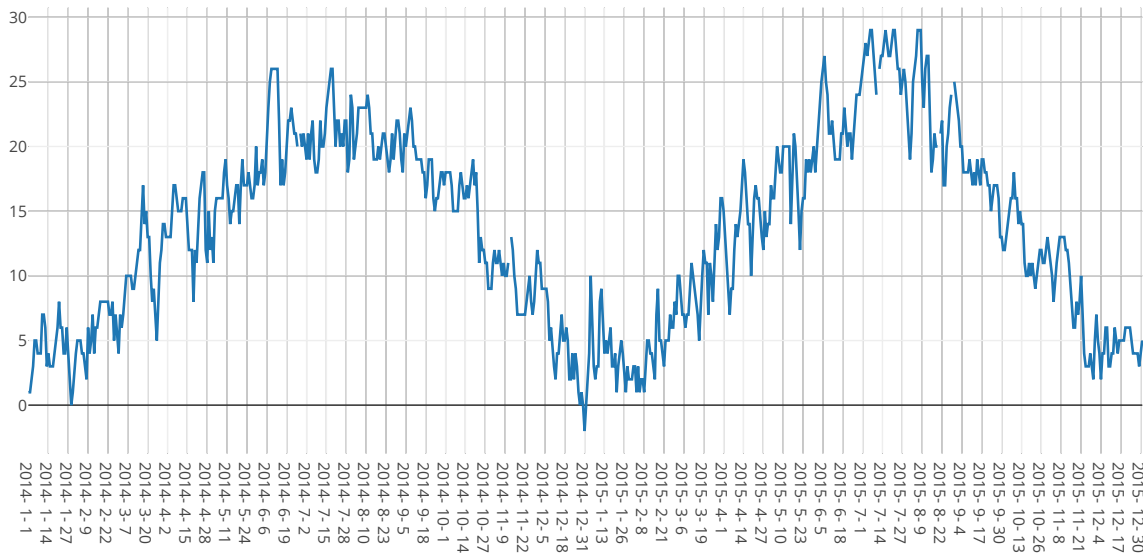
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```
var url=b+ '/MeteoTorino.csv';
Plotly.d3.csv(url, function(error,data) {
  if (error) return console.warn(error);
  var trace={x : [], y : [], type: "scatter"};
  var re=/[0-9+-]+/; // digits, +, or -
  for (var i = 0; i < data.length; i++) {
    row = data[i];
    trace.x.push(row[ 'Anno' ] + "-" +
                  row[ 'Mese' ] + "-" +
                  row[ 'Giorno' ]);
    trace.y.push(+ (re.exec(row[ 'T Media' ])[0])) ;
  }
  Plotly.plot( "csv-load", [trace], Mlayout);
});
```

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# CSV Load

Temperature medie a Torino



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## Example Choropleth from CSV

```
Plotly.d3.csv(b+' /EUElections.csv', (err, rows)=>{
  let unpack = (rows, key) =>
    rows.map(row => row[key]);
  let data = [{
    type: 'choropleth',
    locationmode: 'country names',
    locations: unpack(rows, 'Country'),
    z: rows.map(r=> r['2019']/100 ),
    text: rows.map( r => r['2019'] + '%'),
    hoverinfo:"location+text",
    autocolorscale: true,
    colorbar: { tickformat:"%" }
  }];
  Plotly.plot('csv-load-choropleth', data, EUlayout);
});
```

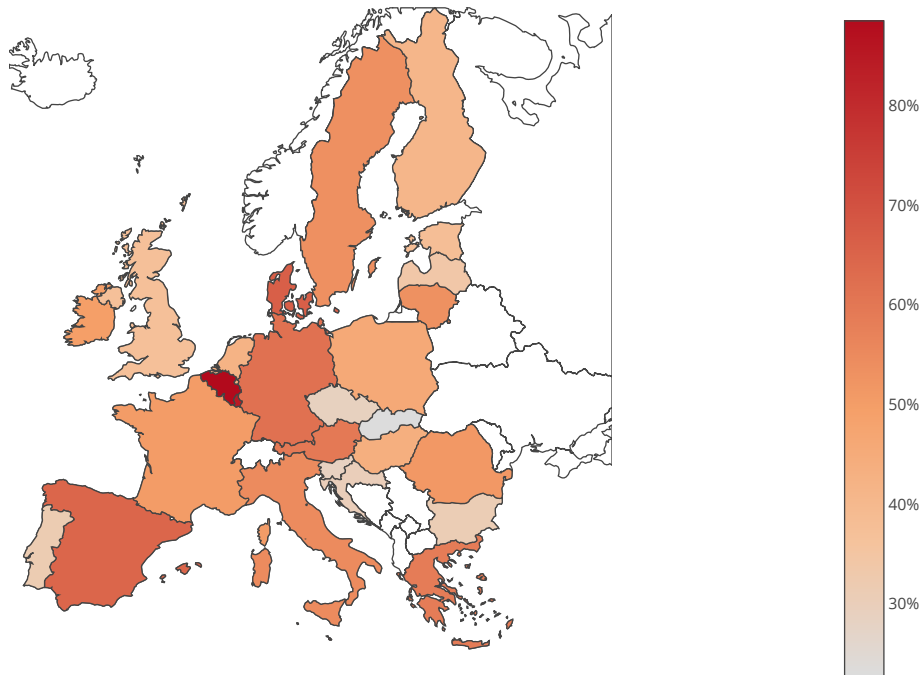
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# CSV load choropleth

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Voter Turnout in 2019 EU Parliament Elections

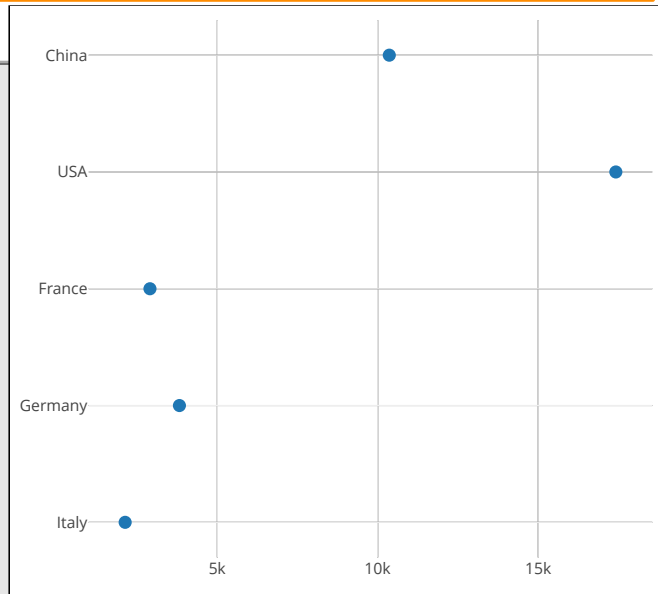


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## Additional features

# Dot plot

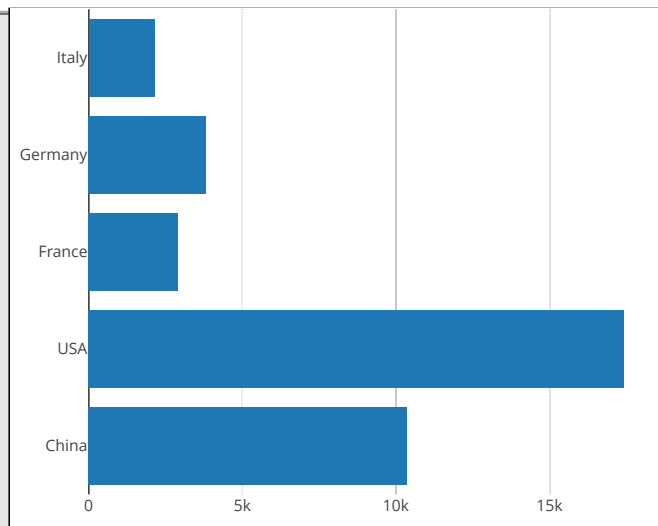
```
var traces = [{
  text: ['ITA', 'DEU', 'FRA',
        'USA', 'CHN'],
  x: [2129, 3820, 2902,
      17420, 10360],
  y: ['Italy', 'Germany',
      'France', 'USA',
      'China'],
  type: "scatter",
  mode: "markers",
  marker: {size: 10},
  hoverinfo: "text+x"
}];
layout = {margin: {t: 10, l: 60, r: 10, b: 30}};
Plotly.plot("dotPlot", traces, layout, cfgNB);
```



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# Horizontal Bar plot

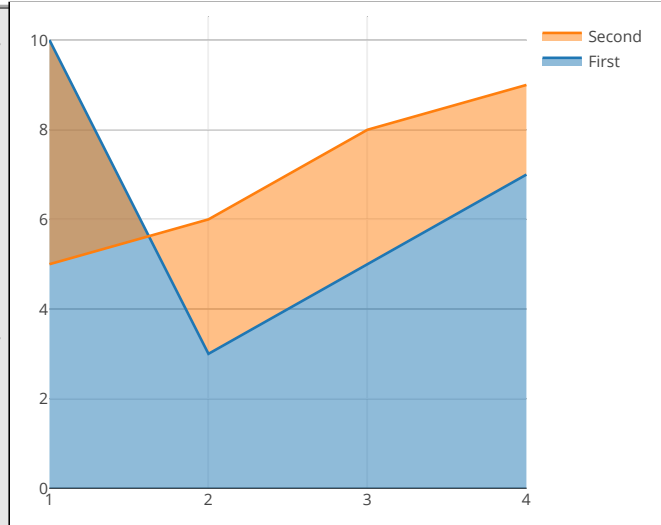
```
var traces = [{
  text: ['ITA', 'DEU', 'FRA',
        'USA', 'CHN'],
  x: [2129, 3820, 2902,
      17420, 10360],
  y: ['Italy', 'Germany',
      'France', 'USA',
      'China'],
  type: "bar",
  orientation: "h",
  hoverinfo: "text+x"
}];
layout = {margin: {t: 0, l: 60, r: 10, b: 30},
  yaxis: {autorange: 'reversed'}};
Plotly.plot("hbarPlot", traces, layout, cfgNB);
```



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# Area plot

```
traces = [{name:"First",
  x:[1,2,3,4],
  y:[10,3,5,7],
  type:"scatter",
  fill:"tozeroy",
  mode:"lines"
    }, {name:"Second",
  x:[1,2,3,4],
  y:[5,6,8,9],
  type:"scatter",
  fill:"tonexty",
  mode:"lines"}];
layout = {margin:{t:10,l:30,r:10, b:30}};
Plotly.plot("areaPlot",traces,layout);
```



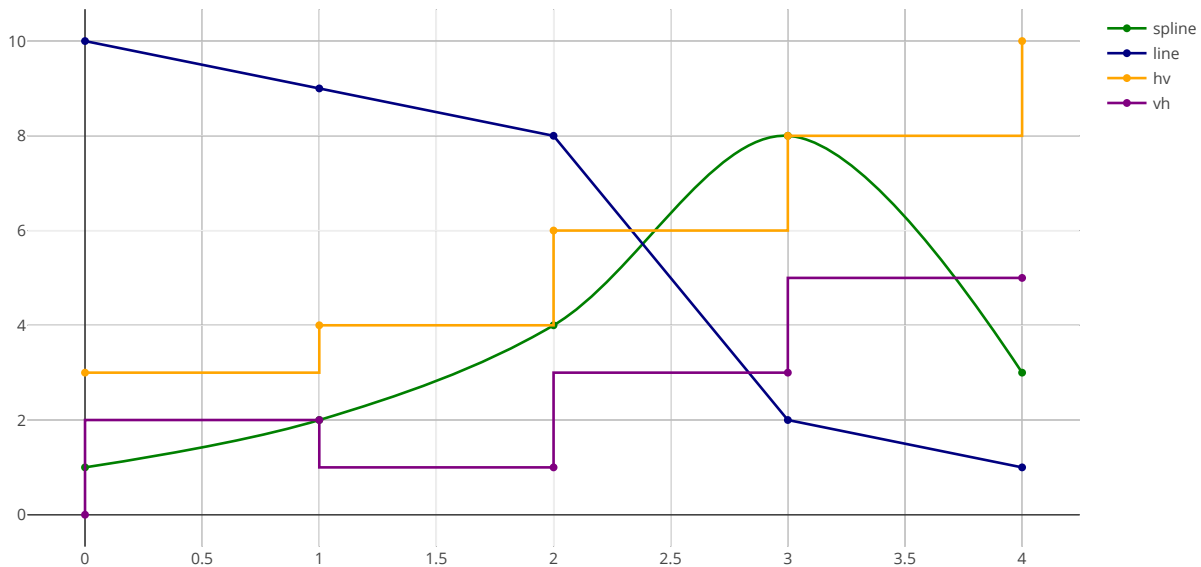
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# Line shapes

```
traces=[{name:"spline",type : "scatter",
y: [1, 2, 4, 8, 3],
line: {color:"green", shape: "spline"}},
{name:"line",type : "scatter",
y: [10, 9, 8, 2, 1],
line: {color: "navy", shape: "line"}},
{name:"hv",type : "scatter",
y: [3, 4, 6, 8, 10],
line: {color: "orange", shape: "hv"}},
{name:"vh",type : "scatter",
y: [0,2, 1, 3, 5],
line: {color: "purple", shape: "vh"} }];
layout = {margin:{t:10,l:30,r:10, b:30}};
Plotly.plot("line-shapes-example",traces,layout);
```

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# Line shapes example



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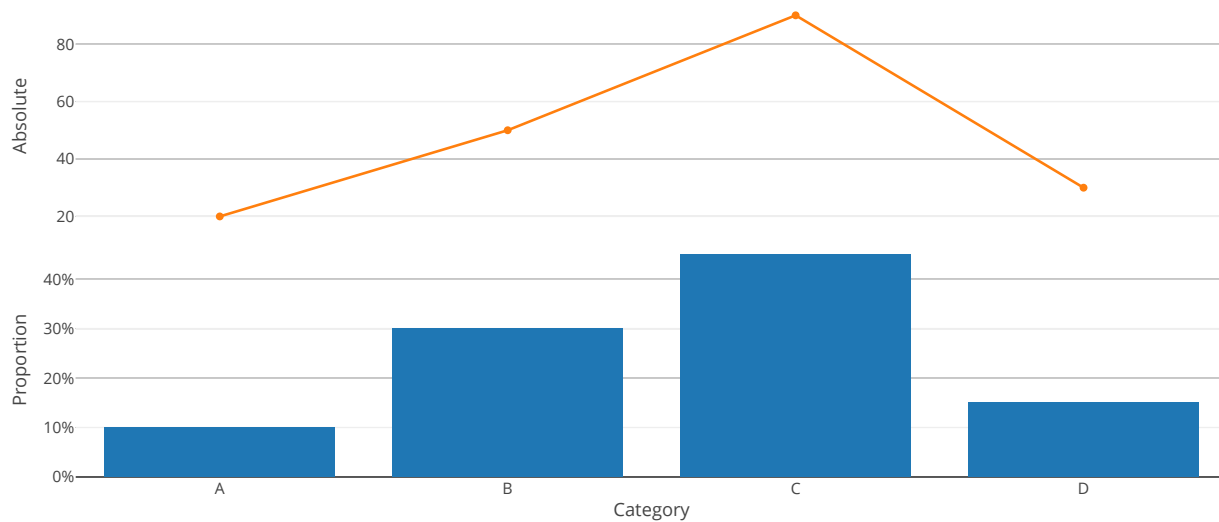
# Multiple graphs

```
var traces = [{type:"bar", x:["A","B","C","D"],
  y:[.10,.3,.45,.15]},
  { type:"scatter", x:["A","B","C","D"],
    y:[20,50,90,30], yaxis:"y2" } ];
var layout = {
  xaxis: {title:"Category", anchor:"y"},
  yaxis: {title:"Proportion", tickformat:"%",
    domain:[0,0.49]},
  yaxis2:{title:"Absolute",
    domain:[0.51,1]},
  margin:{t:50,b:35,r:1,l:60},
  showlegend: false
}
Plotly.plot("multiple-graphs-example",traces,layout);
```

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# Multiple graphs example

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## References

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- Plotly Reference: <https://plot.ly/javascript/reference/>
- Plotly.js Cheatsheet [https://images.plot.ly/plotly-documentation/images/plotly\\_js\\_cheat\\_sheet.pdf](https://images.plot.ly/plotly-documentation/images/plotly_js_cheat_sheet.pdf)
- Plotly a Cheatsheet: <http://softeng.polito.it/courses/VIQ/PlotlyCheatsheet.html>

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