Advanced Course on Simulation Techniques 2

W07: Creating Data Plot - Scatter Plot

Graduate School of System Informatics

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Schedule

- W01 (10/05 Thu) : **Guidance**
- W02 (10/12 Thu) : JavaScript Programming
- W03 (10/19 Thu) : **Data and Task**
- W04 (10/26 Thu) : Reading Data *
- W05 (11/02 Thu) : **Marks and Channels**
- W06 (11/09 Thu) : **Visualization Idioms**
- W07 (11/16 Thu) : Creating Data Plot - Scatter Plot *
- W08 (11/30 Thu) : Creating Data Plot - Bar/Pie/Line/Area Chart

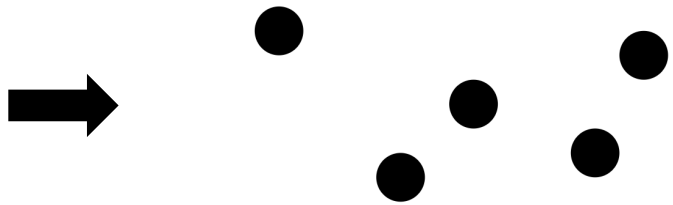
* remote learning

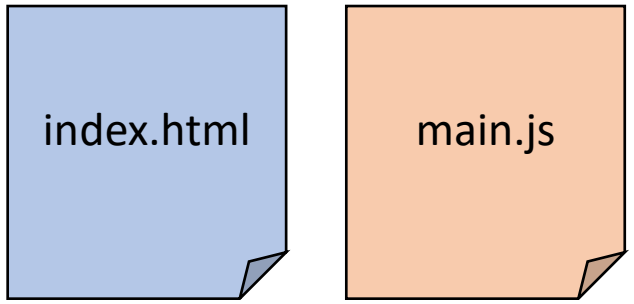
Scatter Plot

- **Drawing Points**
  - Data: W04/data.csv
  - D3: d3.v6.min.js (Version 6)
  - Separate JS file
    - index.html
    - main.js

```
x,y,r
20,20,10
100,50,10
70,80,10
170,30,10
150,70,10
```

CSV





HTML

JS

```
...
<script src="https://d3js.org/d3.v6.min.js"></script>
<script src="main.js"></script>
...
```

```
...
d3.csv("https://xxx.github.io/InfoVis2022/W04/data.csv")
...
```

Example 01

- **Drawing Points**
  - index.html
    - Use D3 v6
    - Specify main.js

w06_ex01_index.html

```
<html>
        <head>
                <title>W06: Example 01</title>
        </head>
        <body>
                <script src="https://d3js.org/d3.v6.min.js"></script>
                <script src="w06_ex01_main.js"></script>
        </body>
</html>
```

Example 01

- **Drawing Points**
  - main.js
    - Load the data
    - Call ShowScatterPlot function

w06_ex01_main.js

```
d3.csv("https://xxx.github.io/InfoVis2022/W04/data.csv")
    .then( data => {
        ShowScatterPlot(data);
    })
    .catch( error => {
        console.log( error );
    });
...
```

Example 01

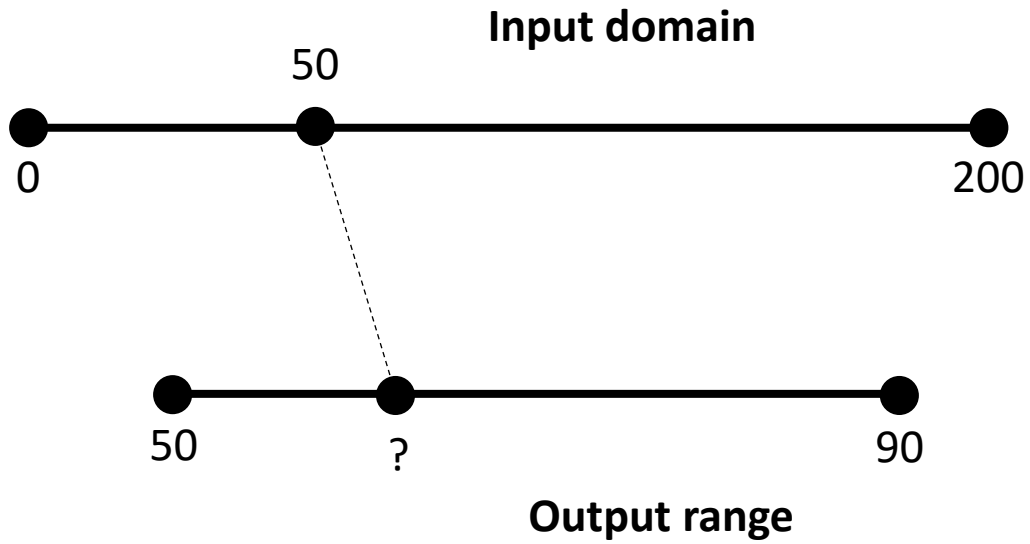
- **Drawing Points**
  - main.js
    - Load the data
    - Call ShowScatterPlot function

w06_ex01_main.js

```
...
function ShowScatterPlot(data) {
    var svg = d3.select("body").append("svg");
    svg.selectAll("circle")
       .data(data)
       .enter()
       .append("circle")
       .attr("cx", d => d.x)
       .attr("cy", d => d.y)
       .attr("r", d => d.r);
};
```

Scales

- **Linear scaling**
  - d3.scaleLinear
    - Transform an input interval (**domain**) into a new interval (**range**)




```
const linear_scale = d3.scaleLinear()
        .domain( [0, 200] )
        .range( [50, 90] );

const input = 50;
const output = linear_scale( 50 );
```

Example 02

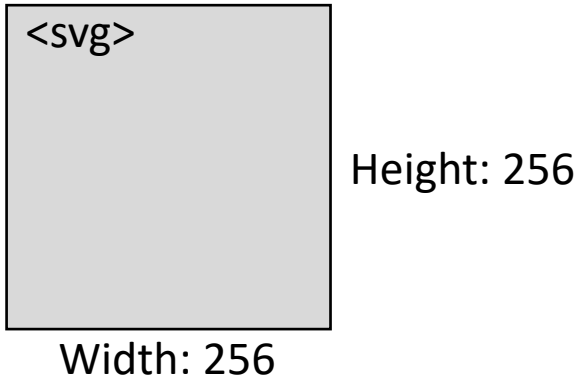
- **Linear Scaling**
  - Scaling x and y axes

w06_ex02_main.js

```
d3.csv("https://xxx.github.io/InfoVis2022/W04/data.csv")
    .then( data => {
        // Convert strings to numbers
        data.forEach( d => { d.x = +d.x; d.y = +d.y; });
        ShowScatterPlot(data);
    })
    .catch( error => {
        console.log( error );
    });
...
```

Example 02

- **Linear Scaling**
  - SVG drawing region
    - Width: 256
    - Height: 256

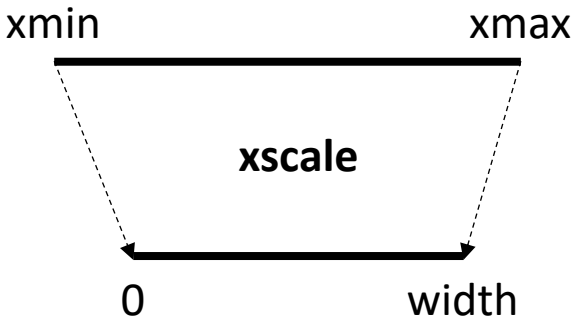


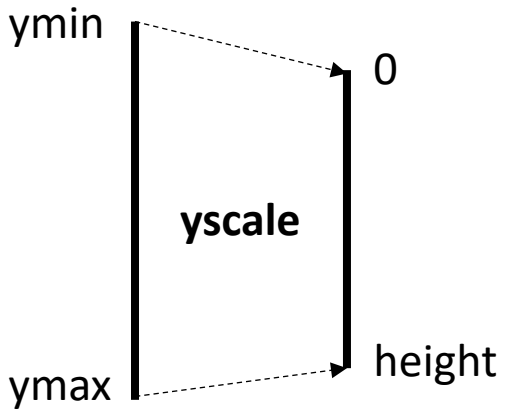
w06_ex02_main.js

```
const width = 256;
const height = 256;
var svg = d3.select("body").append("svg")
    .attr('width', width)
    .attr('height', height);
```

Example 02

- **Linear Scaling**
  - Scaling x and y axes



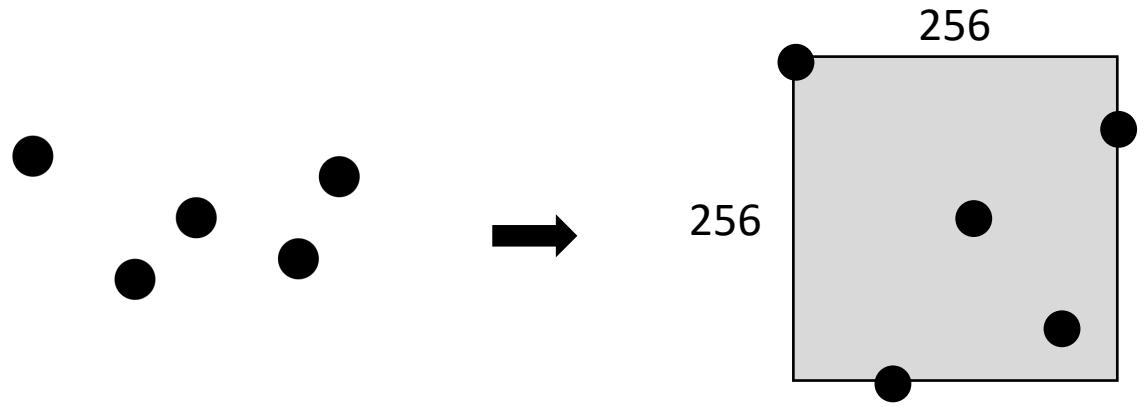


w06_ex02_main.js

```
var xscale = d3.scaleLinear()
    .domain( [d3.min(data, d => d.x), d3.max(data, d => d.x)] )
    .range( [0, width] );

var yscale = d3.scaleLinear()
    .domain( [d3.min(data, d => d.y), d3.max(data, d => d.y)] )
    .range( [0, height] );
```

Example 02

- **Linear Scaling**
  - Draw circles

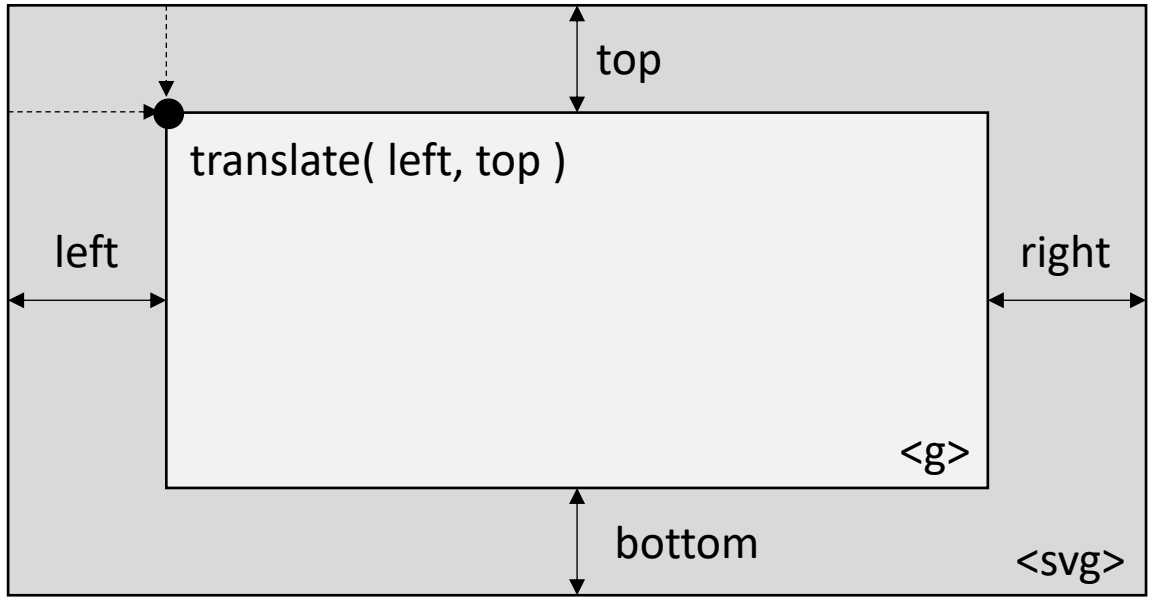


w06_ex02_main.js

```
svg.selectAll("circle")
    .data(data)
    .enter()
    .append("circle")
    .attr("cx", d => xscale(d.x))
    .attr("cy", d => yscale(d.y))
    .attr("r", d => d.r);
```

Margin Convention

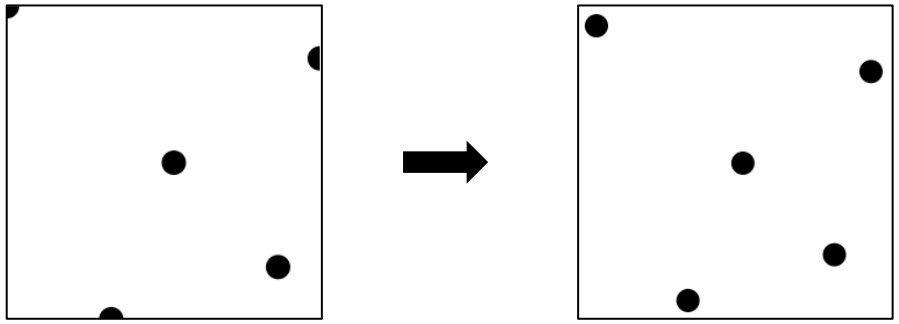
- **Margins**
  - Specified as an object
    - Top, right, bottom, left




```
// Margins
const m = {
    top: x, right: x, bottom: x, left: x };

// 'svg' and 'g' elements
var svg = d3.select("body").append("svg")
    .attr('width', width)
    .attr('height', height);
    .append('g')
    .attr('transform', `translate(${m.left},
${m.top})`);
```

Example 03

- **Margins**
  - Draw circles inside the region specified with margins

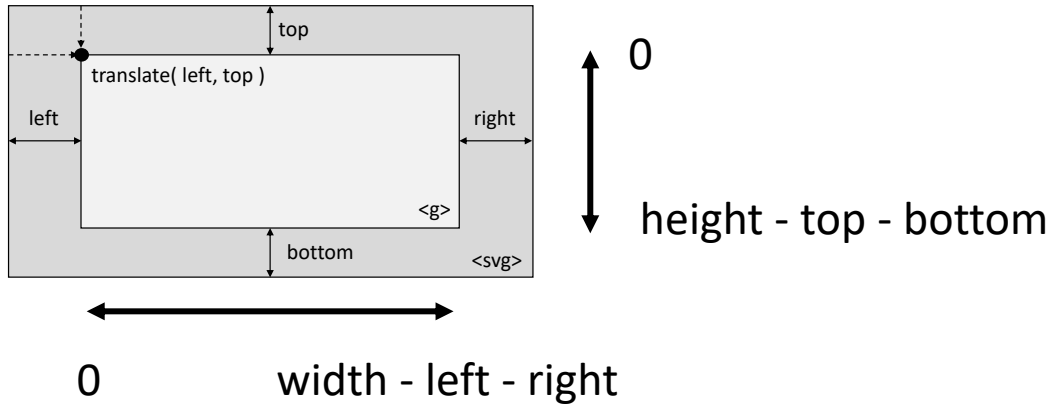


w06_ex03_main.js

```
const width = 256;
const height = 256;
const margin = {top: 10, right: 10, bottom: 10, left: 10};
var svg = d3.select("body").append("svg")
    .attr('width', width)
    .attr('height', height)
    .append('g')
    .attr('transform', `translate(${margin.left}, ${margin.top})`);
```

Example 03

- **Margins**
  - Modify the scaling ranges

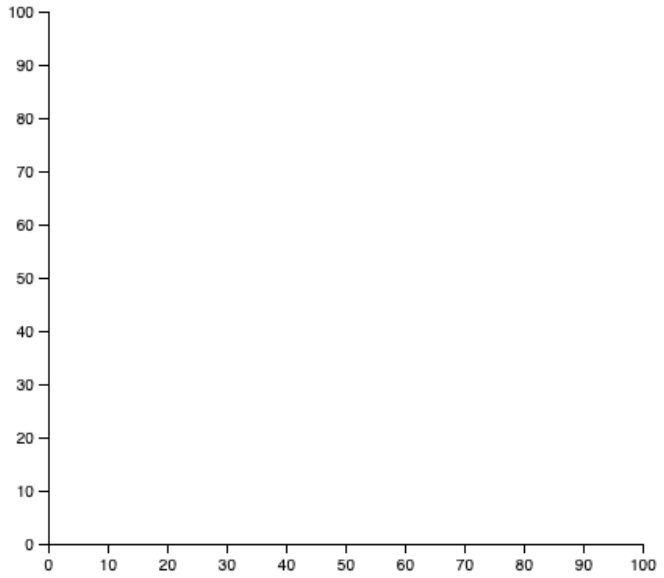


w06_ex03_main.js

```
var xscale = d3.scaleLinear()
    .domain( [d3.min(data, d => d.x), d3.max(data, d => d.x)] )
    .range( [0, width - margin.left - margin.right] );

var yscale = d3.scaleLinear()
    .domain( [d3.min(data, d => d.y), d3.max(data, d => d.y)] )
    .range( [0, height - margin.top - margin.bottom] );
```

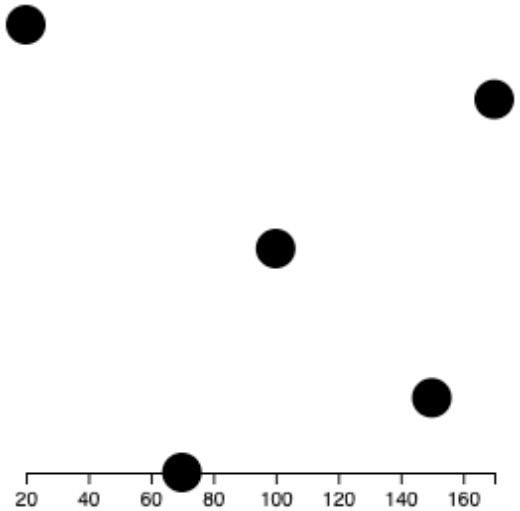
Axis

- **Drawing Axes**
  - d3.axisTop, d3.axisBottom, d3.axisLeft, d3.axisRight



Example 04

- **Drawing Axes**
  - Add a x-axis at the bottom of the region
  - Modify the margin of the region



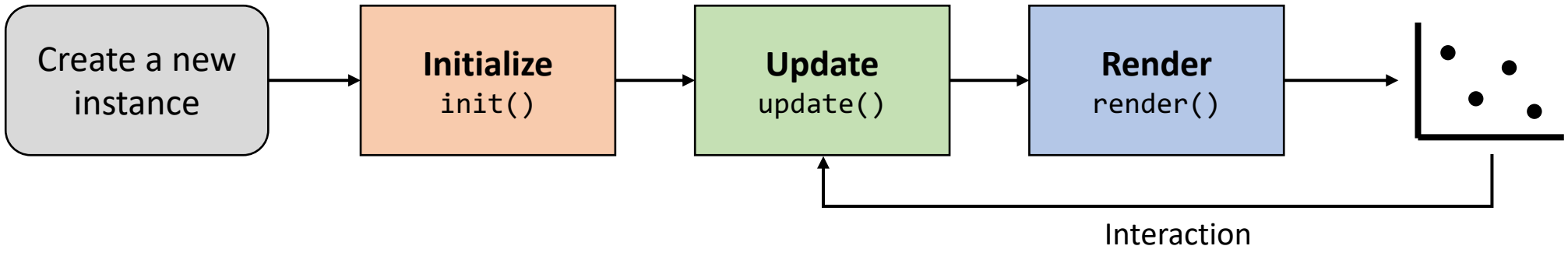
w06_ex04_main.js

```
var xaxis = d3.axisBottom( xscale )
    .ticks(6);

svg.append('g')
    .attr('transform', `translate(0, ${height - margin.top - margin.bottom})`)
    .call( xaxis );
```

Reusable Component

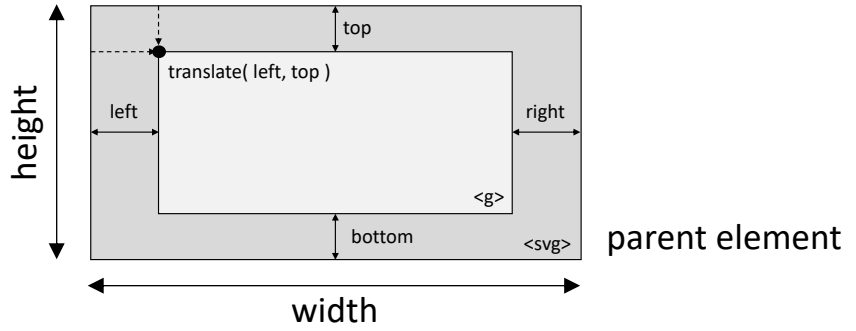
- **ScatterPlot Class**
  - Visualization pipeline
    - **Initialize**: Create SVG elements and static components
    - **Update**: Update visual elements
    - **Render**: Map data to visual elements

```
class ScatterPlot {
    constructor() { ... }
    init() { ... }
    update() { ... }
    render() { ... }
    ...
}
```



Example 05

- **ScatterPlot Class**
  - **constructor**(config, data)
    - config = {parent, width, height, margin}
      - margin = {top, right, bottom, left}

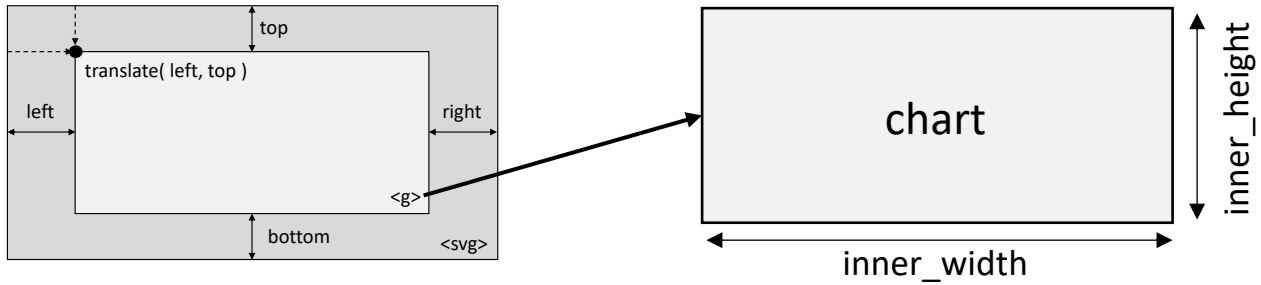


w06_ex05_main.js

```
constructor( config, data ) {
    this.config = {
        parent: config.parent,
        width: config.width || 256,
        height: config.height || 256,
        margin: config.margin || {top:10, right:10, bottom:10, left:10}
    }
    this.data = data;
    this.init();
}
```

Example 05

- **ScatterPlot Class**
  - **init()**
    - Initialize drawing region
      - svg and chart

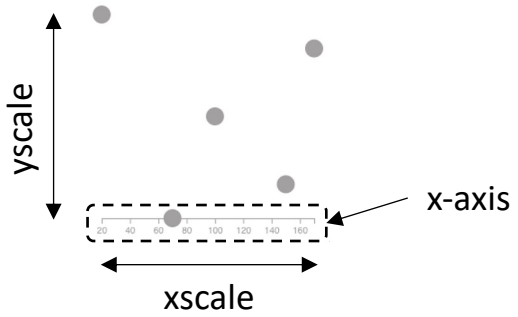


w06_ex05_main.js

```
init() {
    let self = this;

    self.svg = d3.select( self.config.parent )
        .attr('width', self.config.width)
        .attr('height', self.config.height);

    self.chart = self.svg.append('g')
        .attr('transform',
              `translate(${self.config.margin.left}, ${self.config.margin.top})`);

    self.inner_width = self.config.width - self.config.margin.left - self.config.margin.right;
    self.inner_height = self.config.height - self.config.margin.top - self.config.margin.bottom;
    ...
```

Example 05

- **ScatterPlot Class**
  - **init**()
    - Initialize scales and x-axis
      - xscale, yscale, xaxis, xaxis_group



w06_ex05_main.js

```
...
    self.xscale = d3.scaleLinear()
        .range( [0, self.inner_width] );

    self.yscale = d3.scaleLinear()
        .range( [0, self.inner_height] );

    self.xaxis = d3.axisBottom( self.xscale )
        .ticks(6);

    self.xaxis_group = self.chart.append('g')
        .attr('transform', `translate(0, ${self.inner_height})`);
}
```

Example 05

- **ScatterPlot Class**
  - **update**()
    - Update scaling domains
    - Call render()

w06_ex05_main.js

```
update() {
    let self = this;

    const xmin = d3.min( self.data, d => d.x );
    const xmax = d3.max( self.data, d => d.x );
    self.xscale.domain( [xmin, xmax] );

    const ymin = d3.min( self.data, d => d.y );
    const ymax = d3.max( self.data, d => d.y );
    self.yscale.domain( [ymin, ymax] );

    self.render();
}
```

Example 05

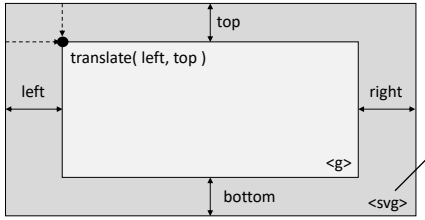
- **ScatterPlot Class**
  - render()
    - Draw circles
    - Draw x-axis

w06_ex05_main.js

```
render() {
    let self = this;

    self.chart.selectAll("circle")
        .data(self.data)
        .enter()
        .append("circle")
        .attr("cx", d => self.xscale( d.x ) )
        .attr("cy", d => self.yscale( d.y ) )
        .attr("r", d => d.r );

    self.xaxis_group
        .call( self.xaxis );
}
```

Example 05

- **Loading data**
  - Create and initialize scatterplot
  - Show scatterplot




```
<svg id="drawing_region"></svg>
```

w06_ex05_main.js

```
d3.csv("https://xxx.github.io/InfoVis2022/W04/data.csv")
    .then( data => {
        data.forEach( d => { d.x = +d.x; d.y = +d.y; });

        var config = {
            parent: '#drawing_region',
            width: 256,
            height: 256,
            margin: {top:10, right:10, bottom:20, left:10} };

        const scatter_plot = new ScatterPlot( config, data );
        scatter_plot.update();
    })
    .catch( error => { console.log( error ); } );
```

Example 05

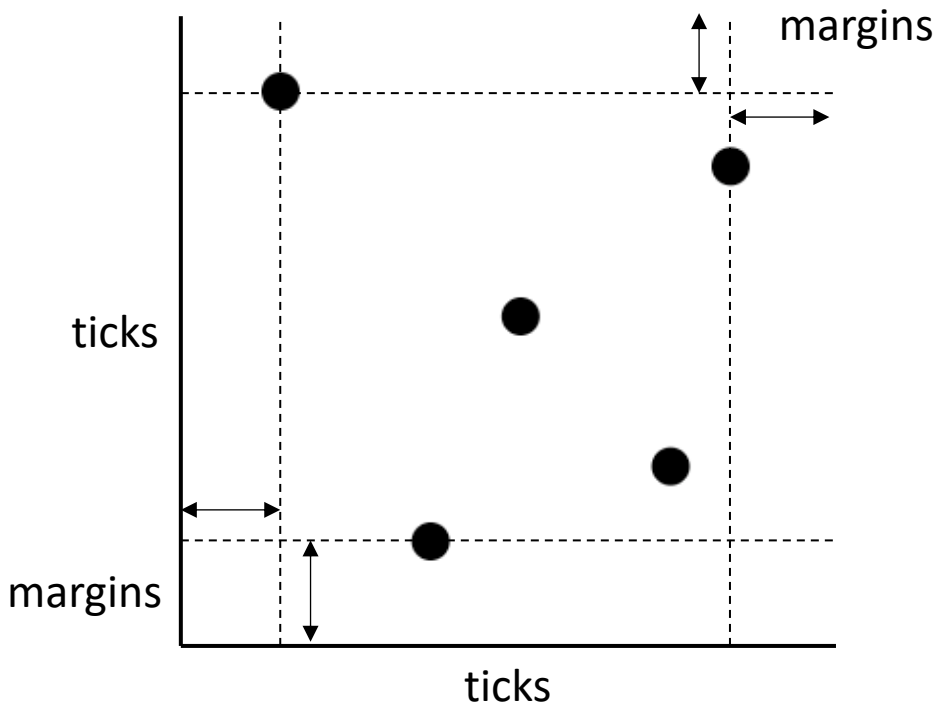
- **HTML**
  - Add empty SVG drawing region
  - Run w06_ex05_main.js

w06_ex05_index.html

```
<html>
    <head>
        <title>W06: Example 05</title>
    </head>
    <body>
       <svg id="drawing_region"></svg>
       <script src="https://d3js.org/d3.v6.min.js"></script>
       <script src="w06_ex05_main.js"></script>
    </body>
</html>
```

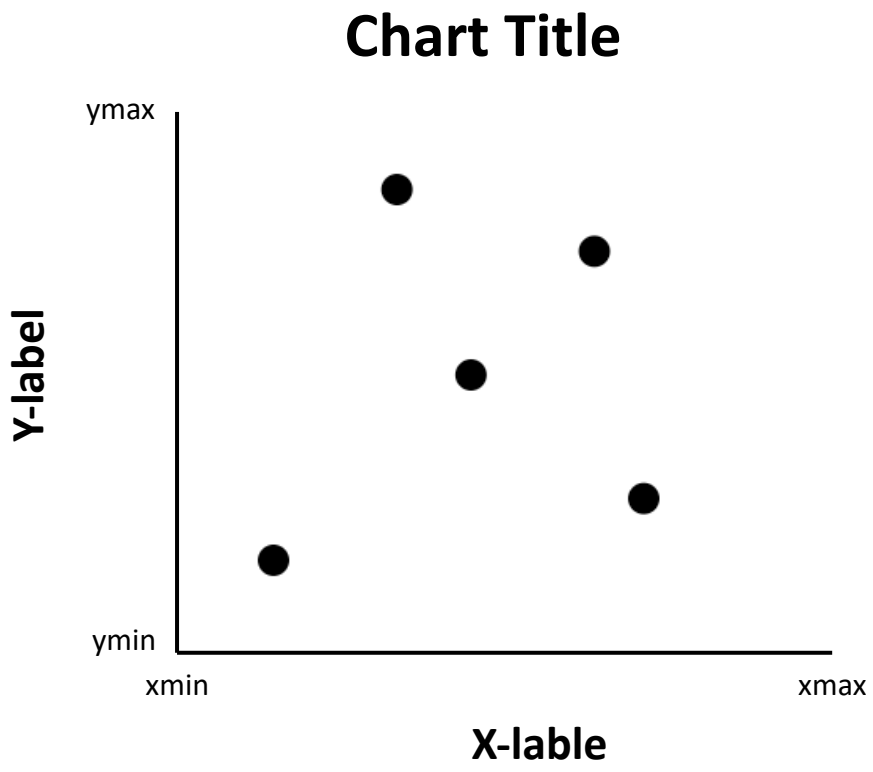
Task 1

- **Add y-axis to Example 05**
  - Load an external data file
    - Same data as W04 - Task1
    - Other new data
    - …
  - Add margins to each axis
  - Modify ticks for each axis
    - ticks
    - tickSize
    - tickPadding
    - …



Task 2

- **Add chart title and axis labels to Task 1**
  - Set origin to left-bottom
  - Modify font size and weight



Task Submission

- **Submit**
  - URL to Task 1
  - URL to Task 2
- **Deadline**
  - **Nov 22 (Wed), 2023 by 24:00 JST**