Information Visualization

W04: Reading Data

Graduate School of System Informatics

Department of Computational Science

Naohisa Sakamoto　Akira Kageyama

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Schedule

- W01 4/12 Guidance
- W02 4/13 JavaScript Programming
- W03 4/19 Data and Tasks
- W04 4/20 Reading Data
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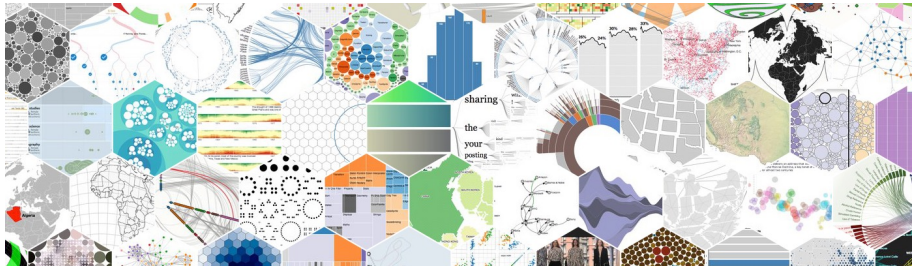
- W06 4/27 Creating Data Plot - Scatter plot
- W07 5/10 Visualization Idioms
- W08 5/11 Creating Data Plot - Bar/Pie/Line/Area chars

Getting Started with D3.js

- **D3: Data-Driven Documents**
  - A JavaScript library
  - Manipulating documents based on data
  - Creating data visualizations in the browser
  - Built on top of common web standards
    - HTML - Hyper Text Markup Language
      - DOM – Document Object Model
    - CSS - Cascading Style Sheets
    - SVG - Scalable Vector Graphics

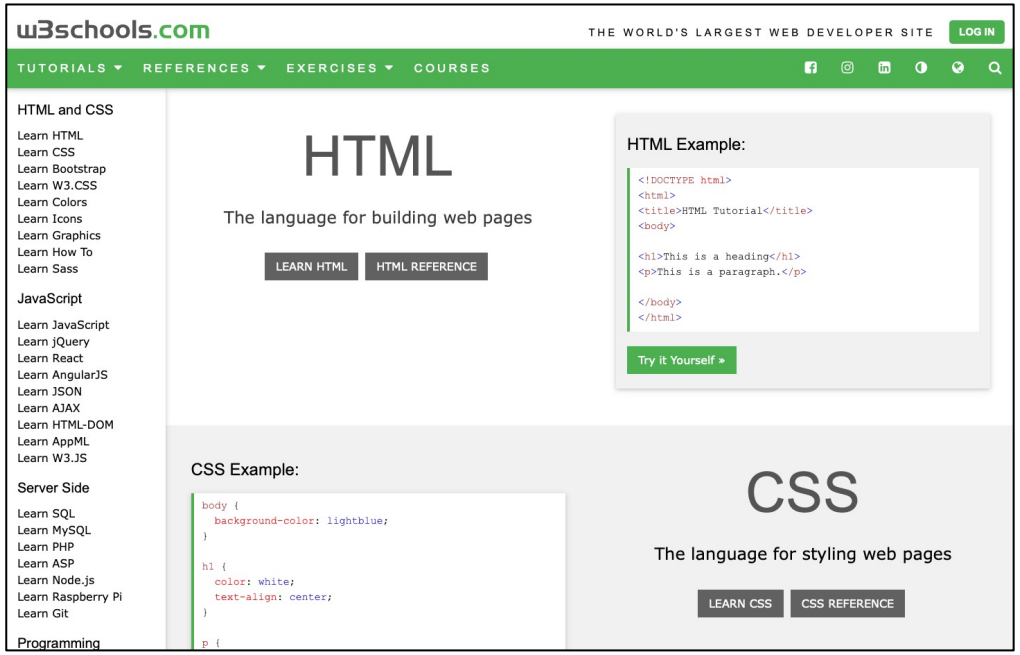


https://d3js.org

```
<html>
    <head>
        <title>HTML DOM</title>
    </head>
    <body>
        <p style="color:red;">Hello World</p>
        <svg width="500" height="500">
            <circle cx="50" cy="50" r="5"/>
        </svg>
    </body>
</html>
```

HTML, CSS, SVG

- **w3schools.com**
  - HTML: https://www.w3schools.com/html/default.asp
  - CSS: https://www.w3schools.com/css/default.asp
  - SVG: https://www.w3schools.com/graphics/svg_intro.asp



D3.js

- **Template**

```
<html>
    <head>

    </head>

    <body>
        <script src="d3.js"></script>

        <script>
                JavaScript code ...
        </script>

    </body>
</html>
```

D3.js

- **Template**
  - Download the D3.js library (d3.js)
    - https://d3js.org
    - https://github.com/d3/d3

```
<script src="d3.js"></script>
<script src="d3.min.js"></script>
```

  - Refer to the library on the web

```
<script src="https://d3js.org/d3.v4.min.js"></script>      (version 4)
<script src="https://d3js.org/d3.v5.min.js"></script>      (version 5)
<script src="https://d3js.org/d3.v6.min.js"></script>      (version 6)
```

DOM Manipulation

- **DOM Tree**

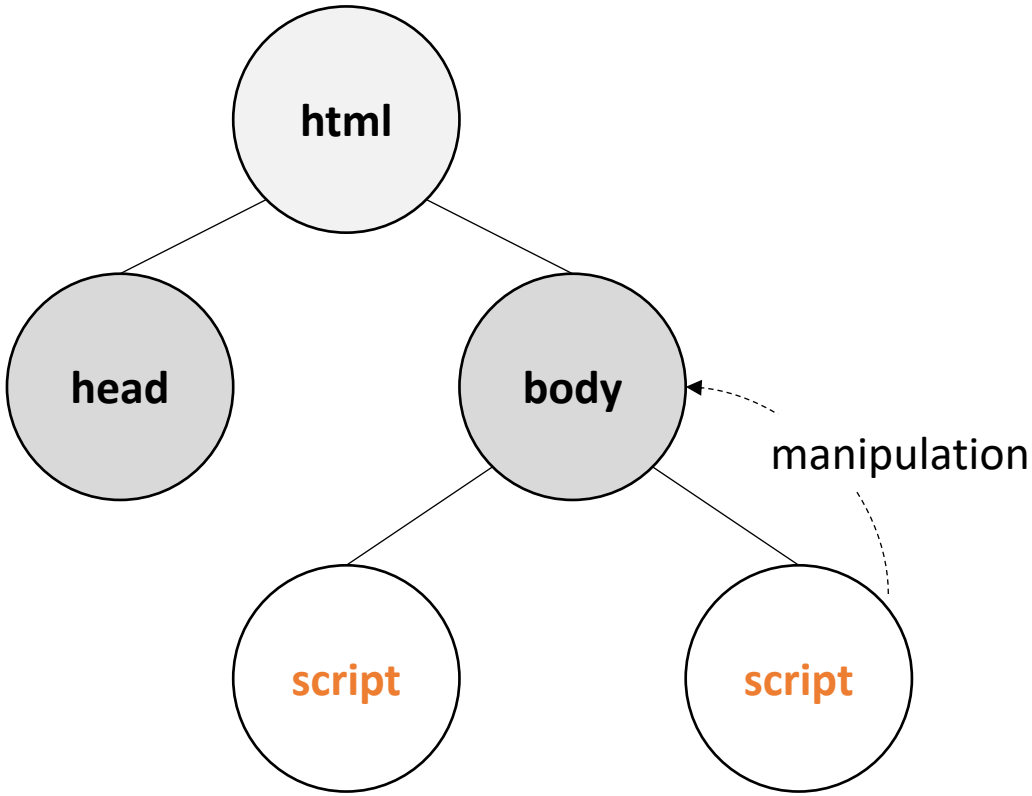
```
<html>
    <head>

    </head>

    <body>
        <script src="d3.js"></script>

        <script>
                JavaScript code ...
        </script>

    </body>
</html>
```



Example 01

- **DOM Manipulation**
  - "Hello D3!"

w04_ex01.html

```
<html>
	<head>
		<title>W04: Example 01</title>
	</head>
	<body>
		<script src="https://d3js.org/d3.v4.min.js"></script>
		<script>
			d3.select("body").append("span").text("Hello D3!");
		</script>
	</body>
</html>
```

Example 02

- **DOM Manipulation**
  - Changing styles

w04_ex02.html

```
var span = d3.select("body").append("span");
span.text("Hello D3!");
span.style("font-size","50px");
span.style("font-weight","bold");
```

```
var span = d3.select("body").append("span");
span.text("Hello D3!")
    .style("font-size","50px")
    .style("font-weight","bold");
```

Example 03

- **DOM Manipulation**
  - Selecting elements

w04_ex03.html

```
<body>
        <p>Hello D3! A</p>
        <p>Hello D3! B</p>
        <p>Hello D3! C</p>
        <script src="https://d3js.org/d3.v4.min.js"></script>
        <script>
                var p = d3.select("body").select("p");
                p.style("font-weight","bold");
        </script>
</body>
```

Example 03

- **DOM Manipulation**
  - Selecting elements

w04_ex03.html

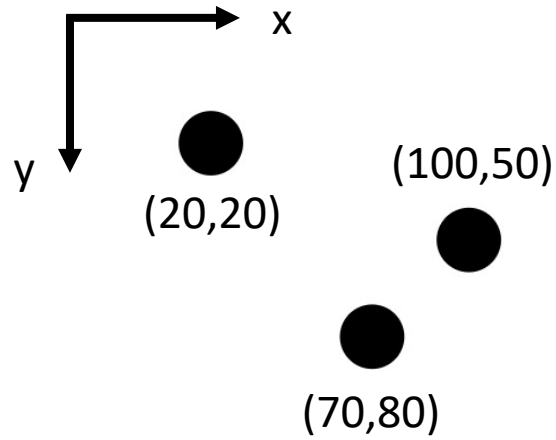
```
<body>
        <p>Hello D3! A</p>
        <p>Hello D3! B</p>
        <p>Hello D3! C</p>
        <script src="https://d3js.org/d3.v4.min.js"></script>
        <script>
                var p = d3.select("body").selectAll("p");
                p.style("font-weight","bold");
        </script>
</body>
```

Selections

- **.select(selector) or .selectAll(selector)**
- **Selectors**
  - "TagName"
    - `<TagName></TagName>`
    - **`select("TagName")`**
  - "#IDName"
    - `<TagName id="IDName"></TagName>`
    - **`select("#IDName")`**
  - ".ClassName"
    - `<TagName class="ClassName"></TagName>`
    - **`select(".ClassName")`**
  - "[AttributeName='Value']"
    - `<TagName AttributeName="Value"></TagName>`
    - **`Select("[AttributeName='Value']")`**

SVG

- **Drawing Points**
  - Three circles
    - Circle 1: center=(20,20), radius=10
    - Circle 2: center=(100,50), radius=10
    - Circle 3: center=(70,80), radius=10




```
<svg>
        <circle cx="20"  cy="20" r="10"></circle>
        <circle cx="100" cy="50" r="10"></circle>
        <circle cx="70"  cy="80" r="10"></circle>
</svg>
```

Example 04

- **Drawing Points**
  - Three circles

w04_ex04.html

```
<body>
        <svg>
            <circle cx="20"  cy="20" r="10"></circle>
            <circle cx="100" cy="50" r="10"></circle>
            <circle cx="70"  cy="80" r="10"></circle>
        </svg>
</body>
```

Example 05

- **Drawing Points**
  - Change circle colors

w04_ex05.html

```
<body>
        <svg>
            <circle cx="20"  cy="20" r="10"></circle>
            <circle cx="100" cy="50" r="10"></circle>
            <circle cx="70"  cy="80" r="10"></circle>
        </svg>
        <script src="https://d3js.org/d3.v4.min.js"></script>
        <script>
                d3.select("circle").style("fill","red");
        </script>
</body>
```

Example 06

- **Drawing Points**
  - Adding circles
  - Grouping

w04_ex06.html

```
<svg>
        <g>
                <circle cx="20"  cy="20" r="10"></circle>
                <circle cx="100" cy="50" r="10"></circle>
                <circle cx="70"  cy="80" r="10"></circle>
        </g>
        <g>
                <circle cx="170" cy="30" r="10"></circle>
                <circle cx="150" cy="70" r="10"></circle>
        </g>
</svg>
```

Example 07

- **Drawing Points**
  - Change circle colors for each group

w04_ex07.html

```
<script>
        d3.select("circle").style("fill","red");
</script>
```

```
        d3.selectAll("circle").style("fill","red");
```

```
        d3.select("g").style("fill","red");
```

```
        d3.selectAll("g").style("fill","red");
```

```
        d3.selectAll("g").select("circle").style("fill","red");
```

Example 08

- **Drawing Points**
  - Change circle colors for each group
    - Specify the group by using its id

w04_ex08.html

```
<g id="group1">
        ...
</g>
<g id="group2">
        ...
</g>
```

```
<script>
        var g = d3.select("#group1");
        g.selectAll("circle").style("fill","red");
</script>
```

Example 09

- **Drawing Points**
  - Set the attribute

w04_ex09.html

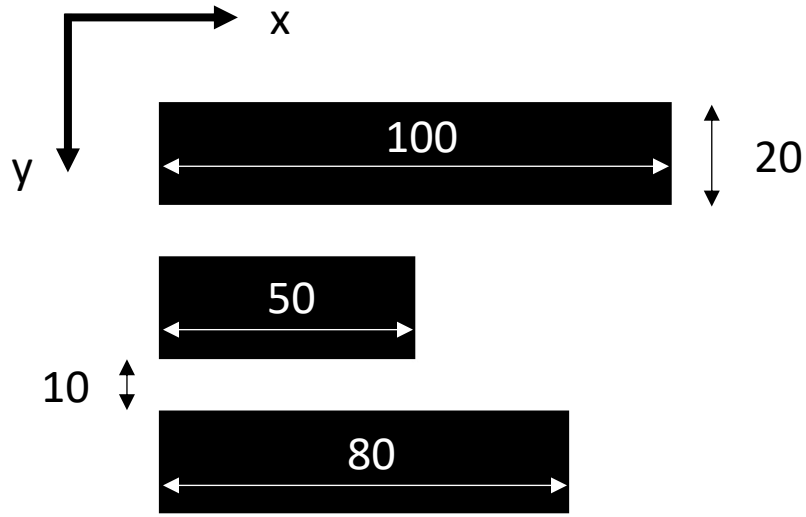
```
<script>
        var c = d3.select("circle");
        c.attr("r","20");
</script>
```

```
        var c = d3.select("circle");
        c.attr("r","20").style("fill","red");
```

```
        var g = d3.select("#group2");
        g.selectAll("circle").attr("r","20");
```

Data Binding

- **Horizontal Bars**
  - Three rectangles
    - SVG
      - Rect 1: x=10, y=10, width=100, height=20
      - Rect 2: x=10, y=40, width=50, height=20
      - Rect 3: x=10, y=70, width=80, height=20




```
<svg>
        <rect x="10" y="10" width="100" height="20"></rect>
        <rect x="10" y="40" width="50"  height="20"></rect>
        <rect x="10" y="70" width="80"  height="20"></rect>
</svg>
```

Example 10

- **Horizontal Bars**
  - Three rectangles

w04_ex10.html

```
<script>
        var svg = d3.select("body").append("svg");
        svg.append("rect")
           .attr("x","10")
           .attr("y","10")
           .attr("width","100")
           .attr("height","20");
        // x=10, y=40, width=50, height=20
        // x=10, y=70, width=80, height=20
</script>
```

Example 11

- **Horizontal Bars**
  - Binding data values: [100, 50, 80]

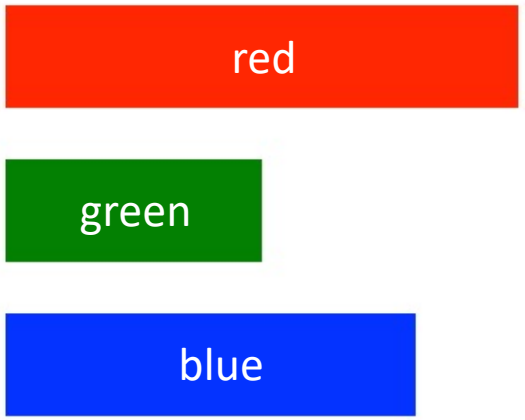
w04_ex11.html

```
<script>
        var data = [100,50,80];
        var padding = 10;
        var height = 20;
        var svg = d3.select("body").append("svg");

        svg.selectAll("rect").data(data).enter().append("rect")
           .attr("x", padding)
           .attr("y", function(d,i){ return padding + i * ( height + padding ); })
           .attr("width", function(d){ return d; })
           .attr("height", height);
</script>
```

Data Binding

- **Horizontal Bars**
  - Three color rectangles
    - Rect1: width=100, color='red'
    - Rect2: width=50, color='green'
    - Rect3: width=80, color='blue'




```
var data = [
     {width: 100, color: 'red'},
     {width: 50,  color: 'green'},
     {width: 80,  color: 'blue'}
];
```

Example 12

- **Horizontal Bars**
  - Binding data values: {width, color}

w04_ex12.html

```
var data = [
     {width: 100, color: 'red'},
     {width: 50,  color: 'green'},
     {width: 80,  color: 'blue'}];

...

svg.selectAll("rect").data(data).enter().append("rect")
   .attr("x", padding)
   .attr("y", function(d,i){ return padding + i * ( height + padding ); })
   .attr("width", function(d){ return d.width; })
   .attr("height", height)
   .style("fill", function(d){ return d.color; });
```

Data Loading

- **Drawing Points**
  - Loading data from an external file
  - Create data file in your github repository
    - Move to the working directory

```
$ cd ~/Work/InfoVis2022/W04
```

    - Create data.csv and upload it to the github repository

```
$ cat data.csv
x,y,r
20,20,10
100,50,10
70,80,10
170,30,10
150,70,10
```

```
$ git add data.csv
$ git commit –m "Add data.csv"
$ git push
```

Check your repository
https://xxx.github.io/InfoVis2022/W04/data.csv
(xxx: your GitHub ID)

Example 13

- **Drawing Points**
  - Loading CSV file
    - d3.csv(url, callback)

w04_ex13.html

```
var svg = d3.select("body").append("svg");
d3.csv("https://xxx.github.io/InfoVis2022/W04/data.csv",
       function(data){
           svg.selectAll("circle")
              .data(data)
              .enter()
              .append("circle")
              .attr("cx", function(d){ return d.x; })
              .attr("cy", function(d){ return d.y; })
              .attr("r", function(d){ return d.r; })
        } );
```

Example 14

- **Drawing Points**
  - Loading CSV file
    - d3.csv(url, callback)

w04_ex14.html

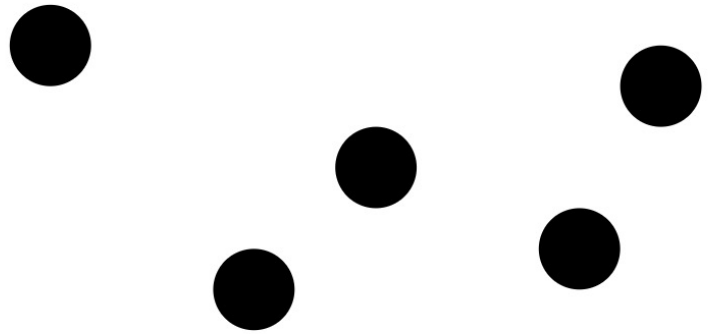
```
var svg = d3.select("body").append("svg");
d3.csv("https://xxx.github.io/InfoVis2022/W04/data.csv", draw );
function draw(data){
    svg.selectAll("circle")
       .data(data)
       .enter()
       .append("circle")
       .attr("cx", function(d){ return d.x; })
       .attr("cy", function(d){ return d.y; })
       .attr("r", function(d){ return d.r; })
} );
```

More Information

- **API Reference**
  - https://github.com/d3/d3/blob/master/API.md
- **Tutorial**
  - https://github.com/d3/d3/wiki/Tutorials
  - https://square.github.io/intro-to-d3/
  - https://alignedleft.com/tutorials/d3/
- **Example**
  - https://observablehq.com/@d3/gallery
  - https://www.d3-graph-gallery.com/index.html

Task 1

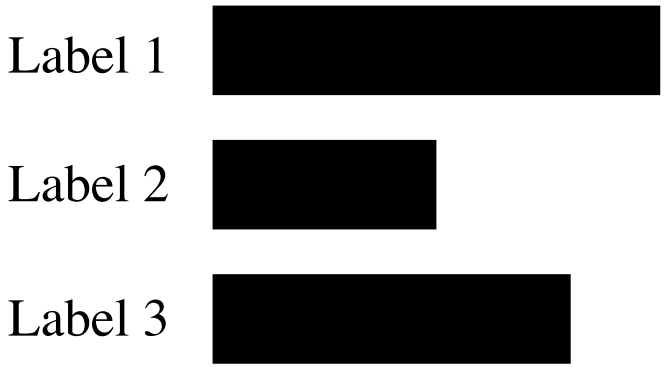
- **Assign colors for each point**
  - Load an external data file (ex. "w04_task1.csv")
  - Set all the colors by the data file
  - Upload the data file to your GitHub repository
  - Option
    - Add circles
    - Change circle position
    - Change circle radius
    - …



data.csv

Task 2

- **Assign labels for each bar**
  - Load an external data file (ex. "w04_task2.csv")
  - Set all the labels and the values (bar length) by the data file
  - Upload the data file to your GitHub repository
  - Option
    - Add bars
    - Change colors for each bar
    - Load other external data file available in the internet (OpenData)
      - Populations of each prefecture in Japan
      - Numbers of COVID-19 for each country
      - …



Polling

- **Take the poll**
  - Student ID Number
  - Name
  - URL to Task 1
  - URL to Task 2
- **Submission deadline**
  - **April 25 (Mon), 2022 by 23:59 JST**