EECS E6893 Big Data Analytics
HW4: Data visualization with web dashboard (Part 1)

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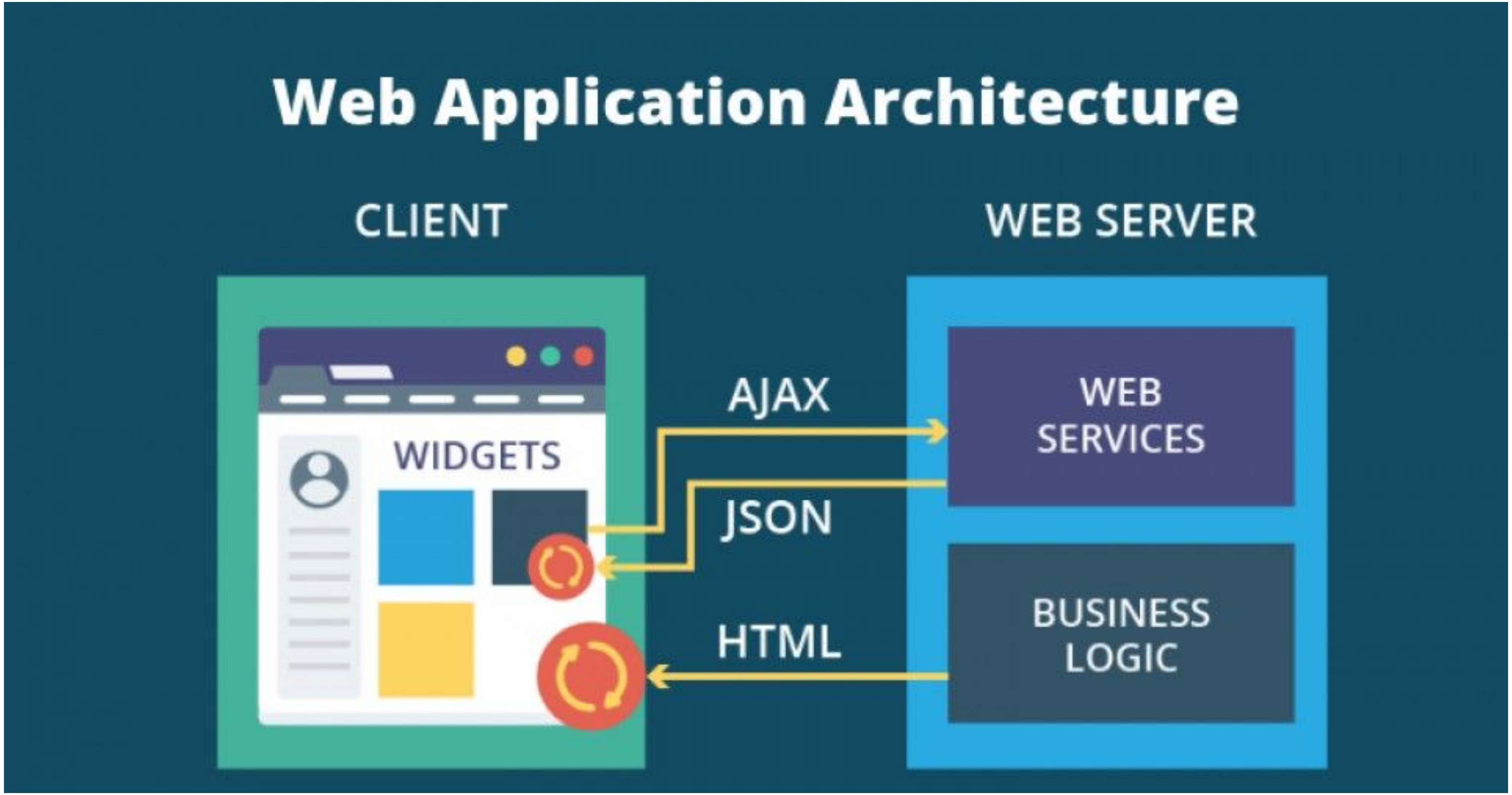
Agenda

- Introduction of Web Application
  - HTML, CSS and Javascript
  - 2 important things to know: SVG and DOM
- Using D3.js to do data visualization
- HW4 Part 1(35% of HW4)
  - Short-answer Questions
  - Draw a Simple Barchart

Web Application



Reference: https://hackr.io/blog/web-application-architecture-definition-models-types-and-more

Client-side of Web

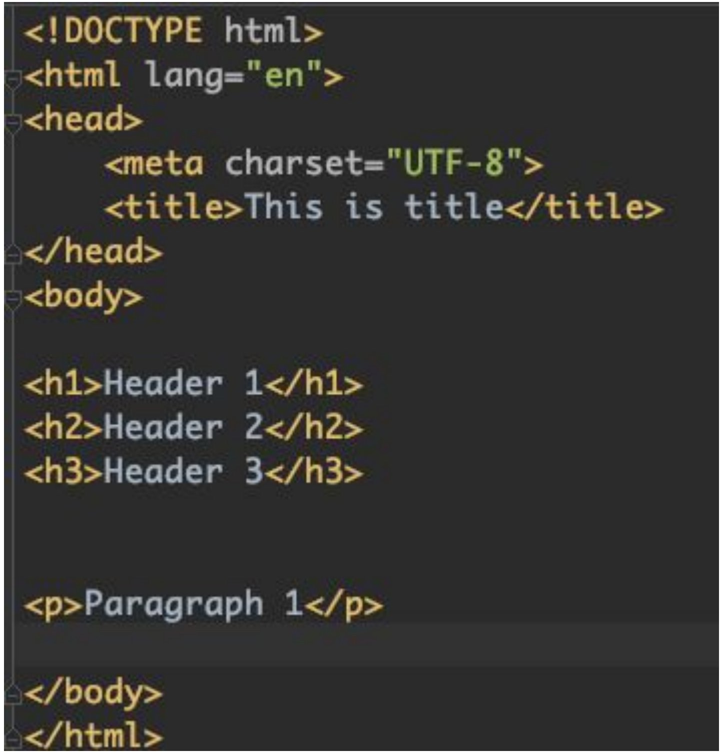
- HTML, CSS and JS are the parts of all websites that users directly interact with.
- HTML provides the *basic structure* of sites, which is enhanced and modified by other technologies like CSS and JavaScript.
- CSS is used to control *presentation, formatting, and layout*.
- JavaScript is used to control the *behavior* of different elements.

Reference: https://tutorial.techaltum.com/webdesigning.html

WEB DESIGNING
TECHALTUM
HTML (Structure)
CSS (Presentation)
Javascript (functionality)
tutorial.techaltum.com

Reference: https://tutorial.techaltum.com/webdesigning.html

HTML

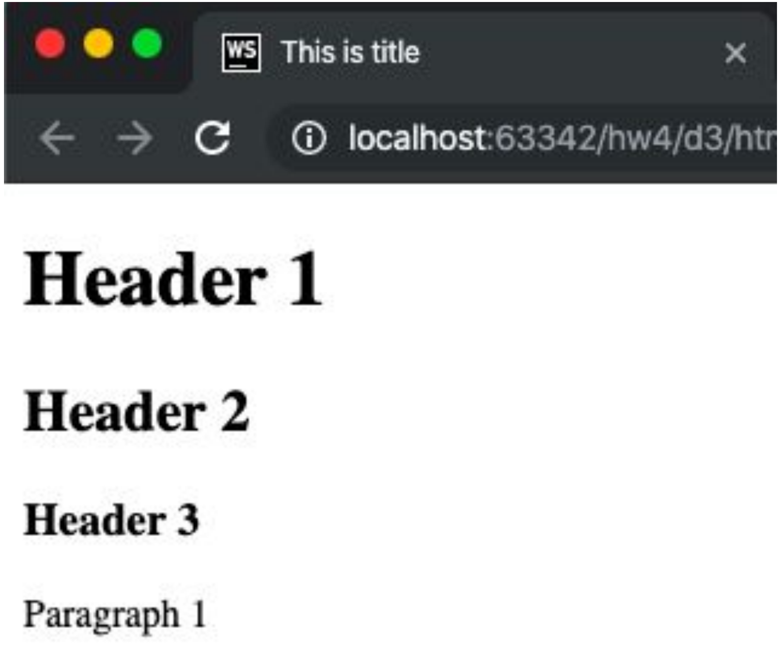


```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <title>This is title</title>
</head>
<body>

<h1>Header 1</h1>
<h2>Header 2</h2>
<h3>Header 3</h3>


<p>Paragraph 1</p>

</body>
</html>
```



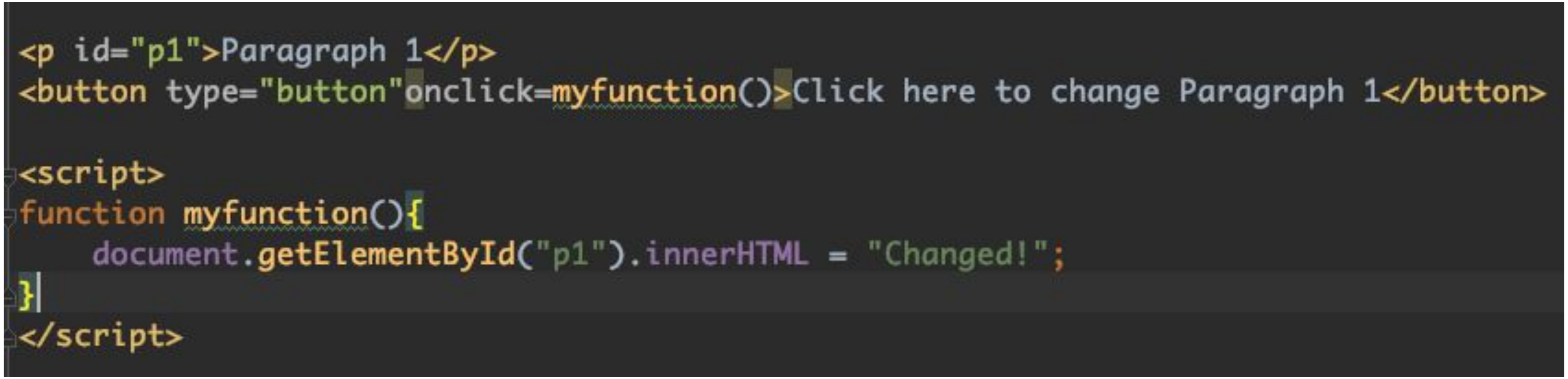
Header 1

Header 2

Header 3

Paragraph 1

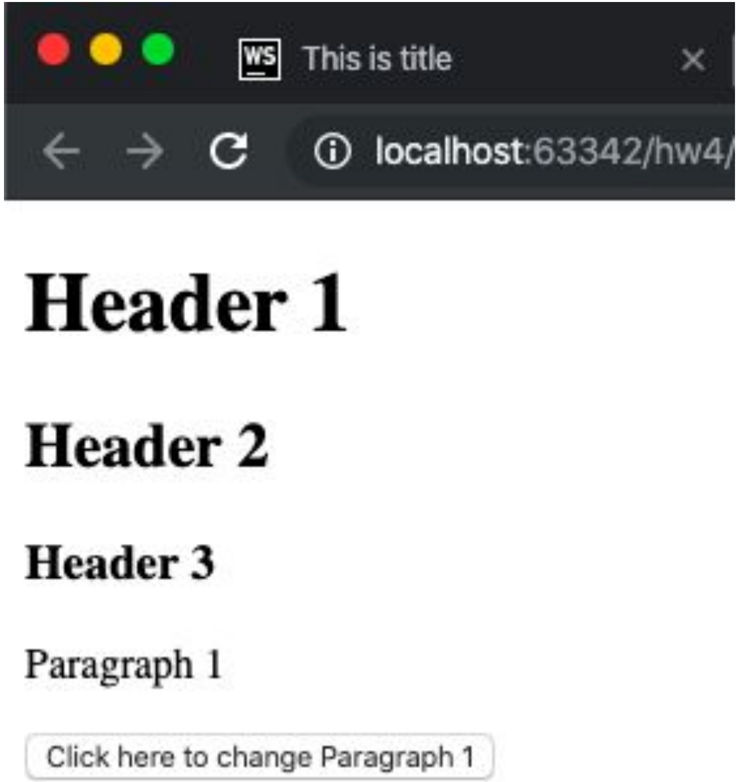
Javascript



```
<p id="p1">Paragraph 1</p>
<button type="button"onclick=myfunction()>Click here to change Paragraph 1</button>

<script>
function myfunction(){
    document.getElementById("p1").innerHTML = "Changed!";
}
</script>
```

Javascript

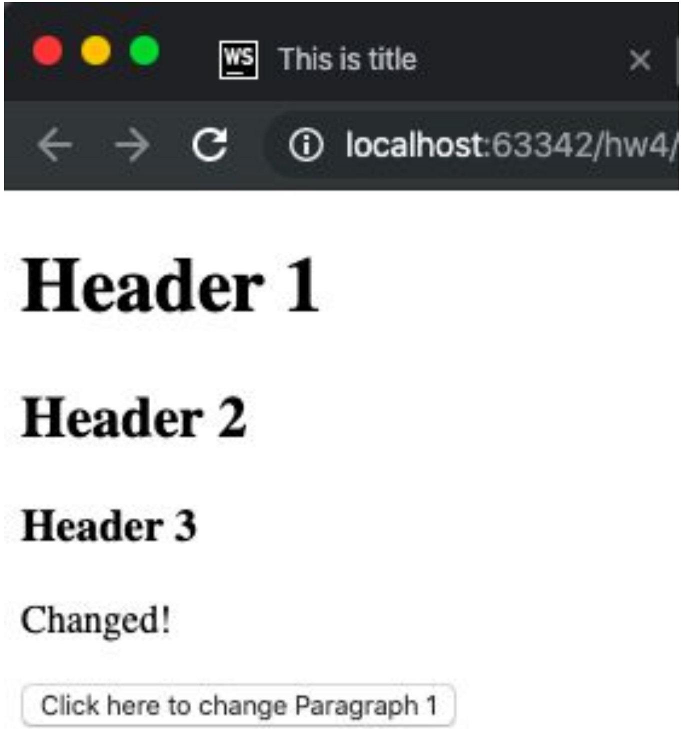


Header 1

Header 2

Header 3

Paragraph 1



Header 1

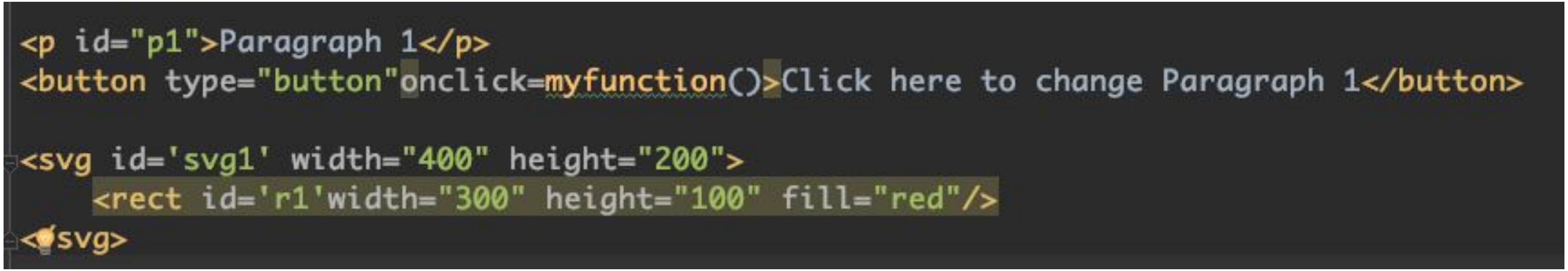
Header 2

Header 3

Changed!

SVG in HTML

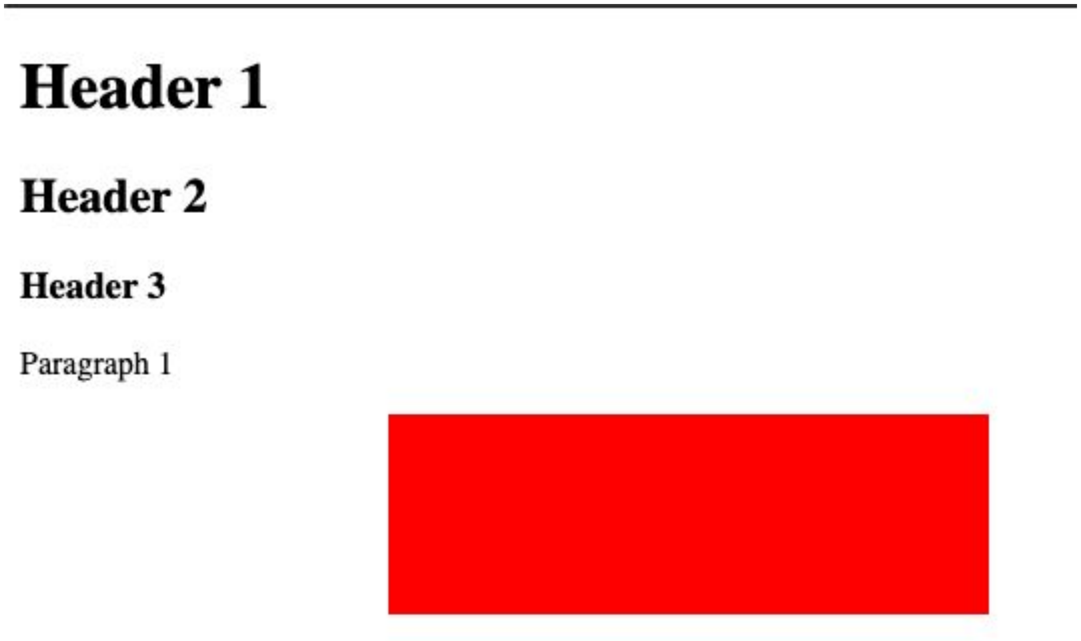
- SVG stands for Scalable Vector Graphics. It is used to define vector-based graphics for the Web
- **Every element and every attribute in SVG files can be animated**
- SVG integrates with other W3C standards such as the **DOM** and XSL



```
<p id="p1">Paragraph 1</p>
<button type="button"onclick=myfunction()>Click here to change Paragraph 1</button>

<svg id='svg1' width="400" height="200">
    <rect id='r1'width="300" height="100" fill="red"/>
</svg>
```

SVG in HTML



Header 1

Header 2

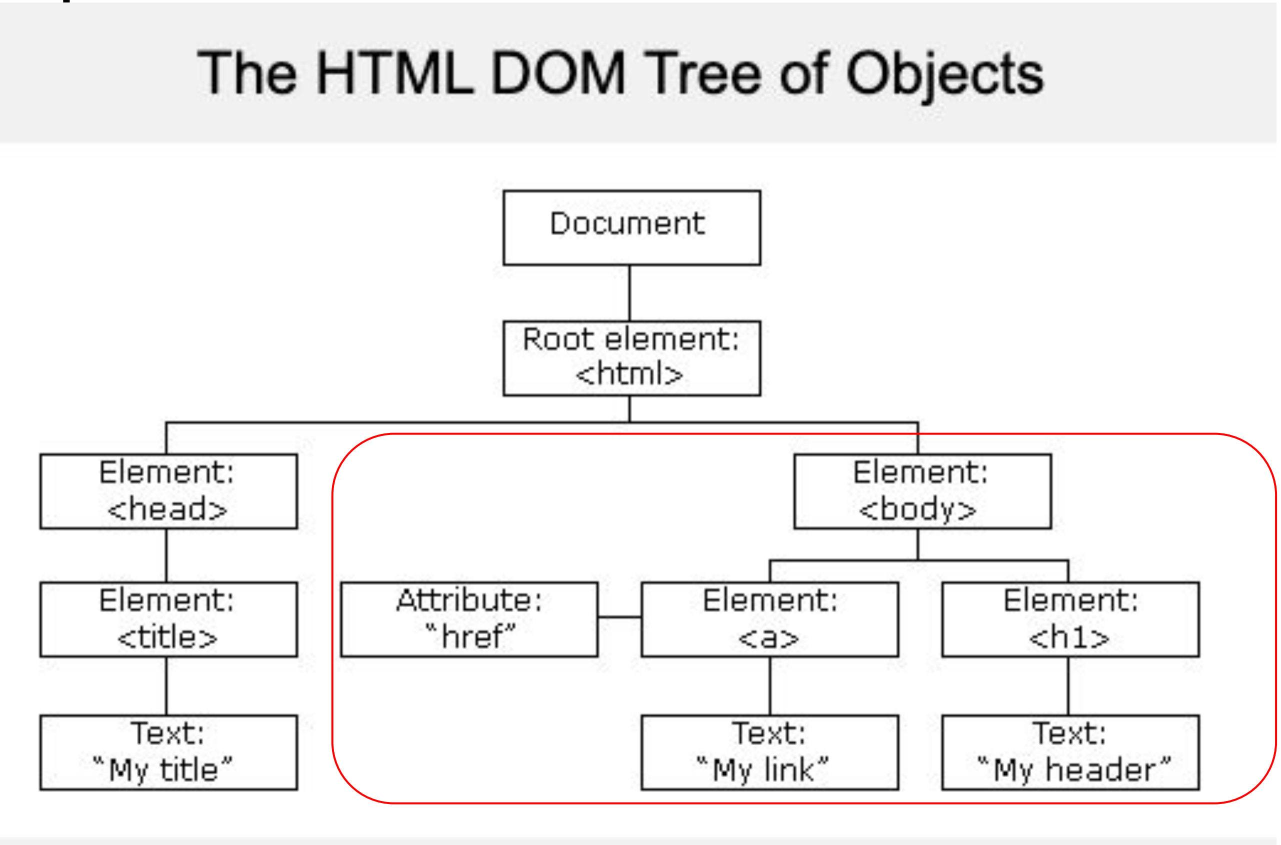
Header 3

Paragraph 1

Javascript HTML DOM

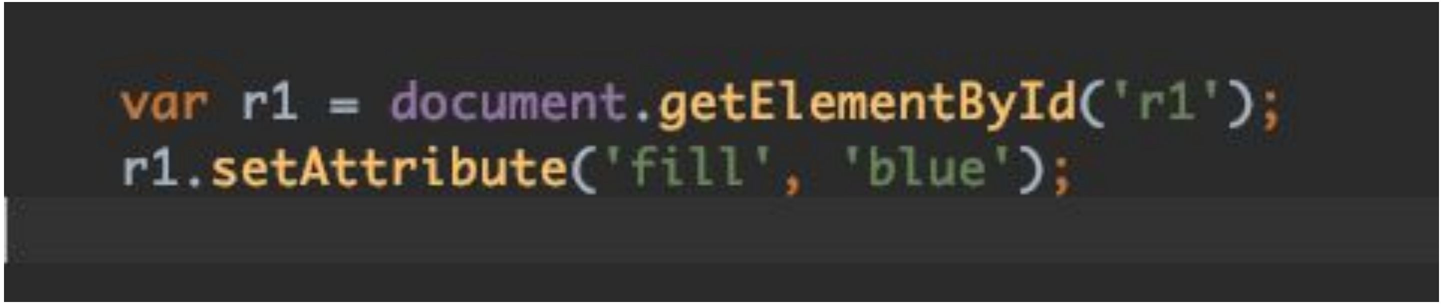
Document Object Model (DOM) is important: With the HTML DOM, JavaScript can **access and change** all the elements of an HTML document

Javascript HTML DOM



The HTML DOM Tree of Objects

What if we create a SVG elements and use DOM in Javascript to access its attributes?

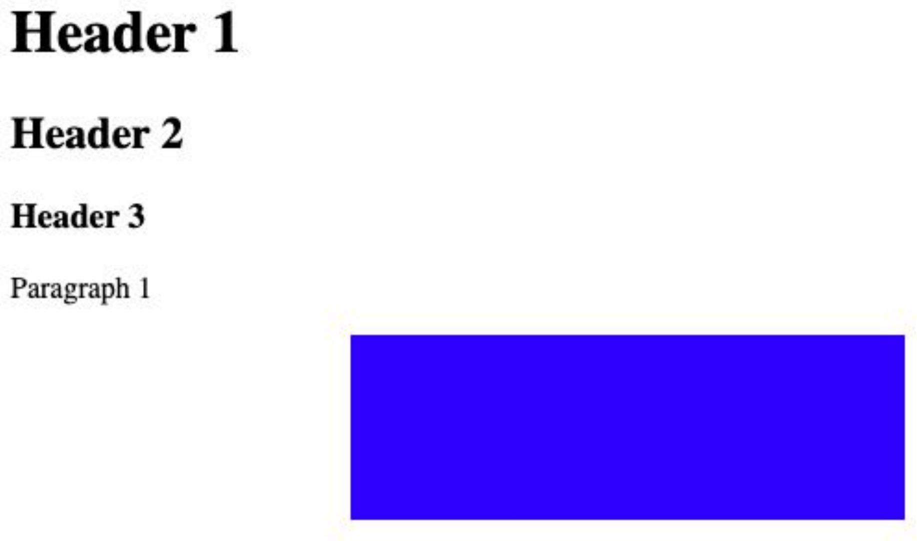


```
var r1 = document.getElementById('r1');
r1.setAttribute('fill', 'blue');
```

If we draw a series of SVG and texts based on data, and use DOM to control their attributes, then we get a simple charts!

- D3.js, a library to do this in a simple way

What if we create a SVG elements and use DOM in Javascript to access its attributes?



Header 1

Header 2

Header 3

Paragraph 1

If we draw a series of SVG and texts based on data, and use DOM to control their attributes, then we get a simple charts!

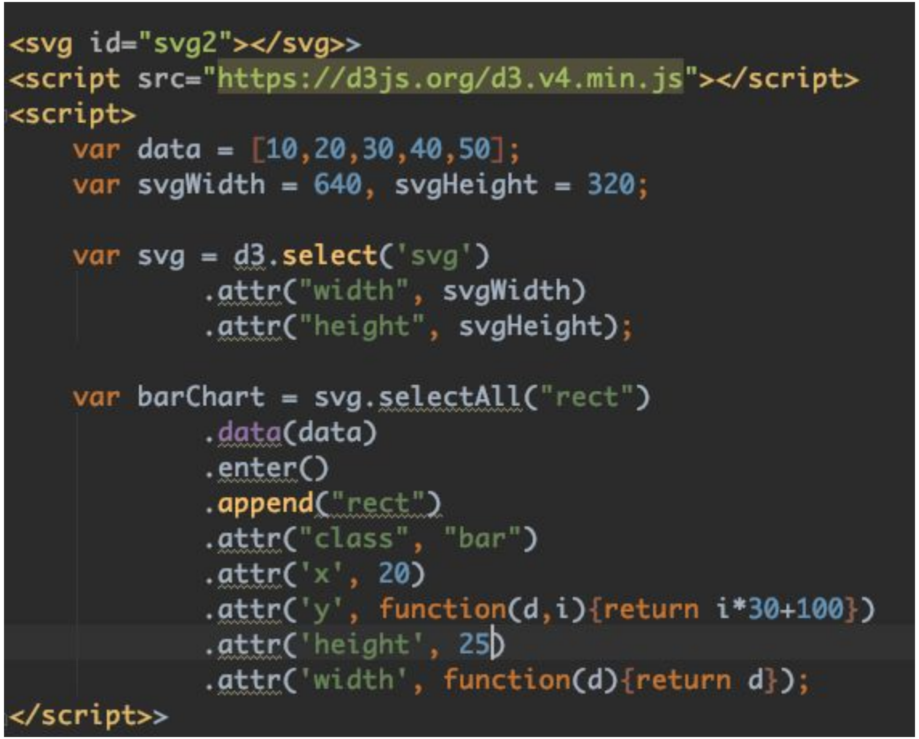
- D3.js, a library to do this in a simple way

D3.js

D3.js is a JavaScript library for manipulating documents based on data. It helps you bring data to life using HTML, SVG, and CSS. It provides a data-driven approach to DOM manipulation.

Visit https://d3js.org for more tutorials!

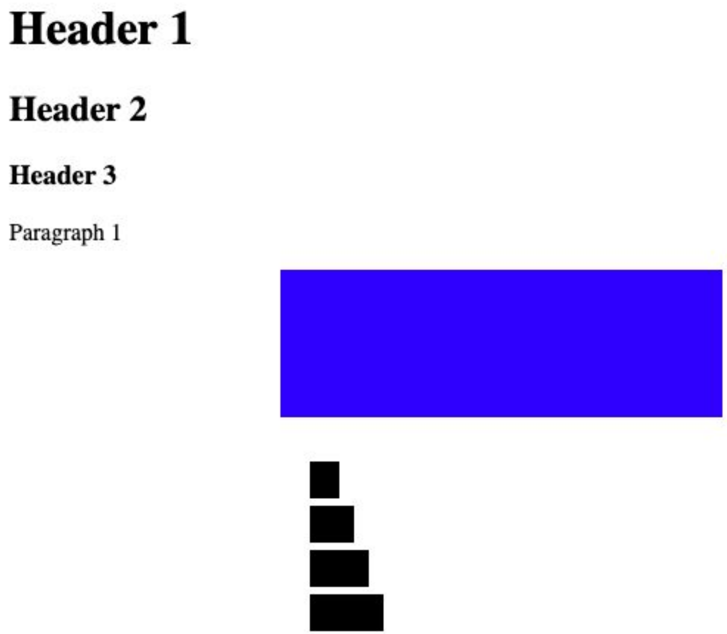
Example: Simple Bar Chart



```
<svg id="svg2"></svg>>
<script src="https://d3js.org/d3.v4.min.js"></script>
<script>
    var data = [10,20,30,40,50];
    var svgWidth = 640, svgHeight = 320;

    var svg = d3.select('svg')
            .attr("width", svgWidth)
            .attr("height", svgHeight);

    var barChart = svg.selectAll("rect")
            .data(data)
            .enter()
            .append("rect")
            .attr("class", "bar")
            .attr('x', 20)
            .attr('y', function(d,i){return i*30+100})
            .attr('height', 25)
            .attr('width', function(d){return d});
</script>>
```

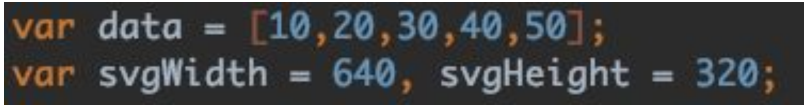


Header 1

Header 2

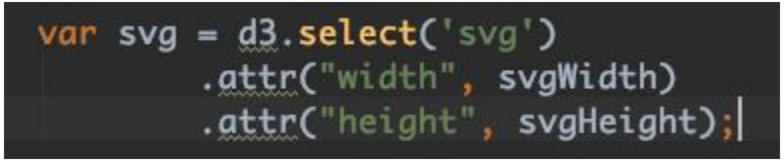
Header 3

Paragraph 1



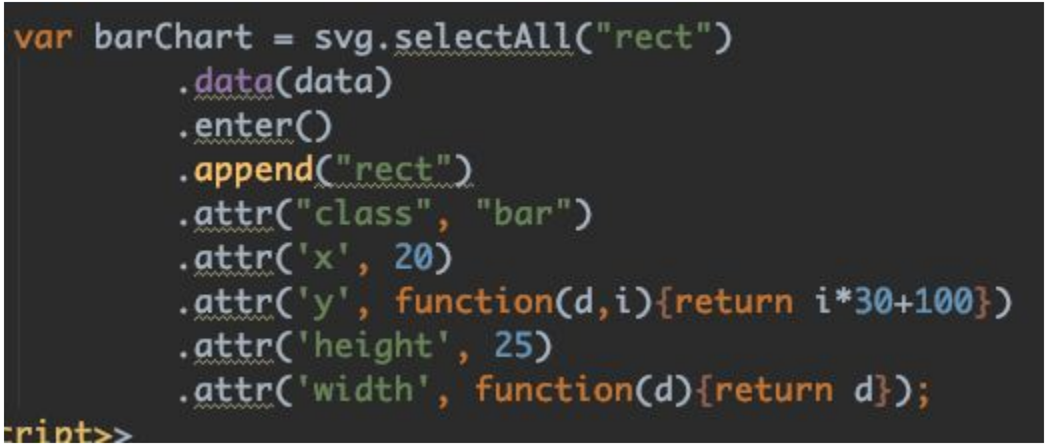
```
var data = [10,20,30,40,50];
var svgWidth = 640, svgHeight = 320;
```

Declaration of data and variables



```
  var svg = d3.select('svg')
          .attr("width", svgWidth)
          .attr("height", svgHeight);
```

D3 provides operating on arbitrary sets of nodes called *selections.* You can manipulate individual nodes and set the attributes



```
var barChart = svg.selectAll("rect")
          .data(data)
          .enter()
          .append("rect")
          .attr("class", "bar")
          .attr('x', 20)
          .attr('y', function(d,i){return i*30+100})
          .attr('height', 25)
          .attr('width', function(d){return d});
cript>>
```

Tricky part of D3: Once you bound data with selection,each element in the data array is paired with the corresponding node in the selection. If there are fewer nodes than data, you can use enter() to appending nodes.

Again, please visit https://d3js.org for more tutorials!

HW4

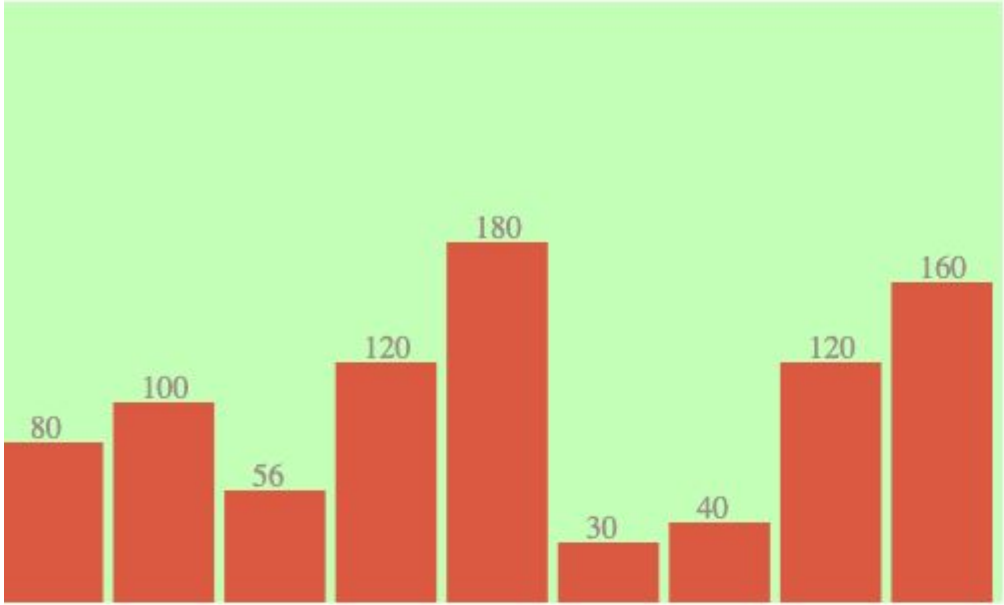
- Part 1 (35%)
    - 4 Short-answer Questions (5% each)
    - Draw a simple barchart with requirement (15%)
- Part 2 (65%, Release 11.1) (temporary)
    - Use one dataset from hw3 to draw a barchart and the other to draw a pie chart
    - Finishing a Dashboard of the data
    - ...

Short answer questions

- What's the difference between SVG Coordinate Space and Mathematical / Graph Coordinate Space? You can use figures to answer. (If you get the figures from website, please make a reference)
- What is `enter()` and `exit()` in d3.js?
- What is `transform` and `translate` in SVG?
- Try to understand the idea of anonymous function and its use in d3.js. If there is a list `a = [a,c,b,d,e]`, what is the return value of this anonymous function: `a.map(function(d,i){return i})`

Modify the sample code to fit the requirement

- You **must** use transform to do this.
- You should write the javascript in a single file (.js), separated with the structure file (.html).
- Hint: add another elements "text" and set its attributes to display the labels.
- (you can use any color you like :D)



References

- https://d3js.org
- https://developer.mozilla.org/en-US/docs/Web/SVG/Attribute