D3 Topic

- Selecting Element & Data Binding
- Scale & Axis
- Basic Shape & Map
- Transition
- Interaction
- Force
- Layout

Selecting element

Data Visualization

Select

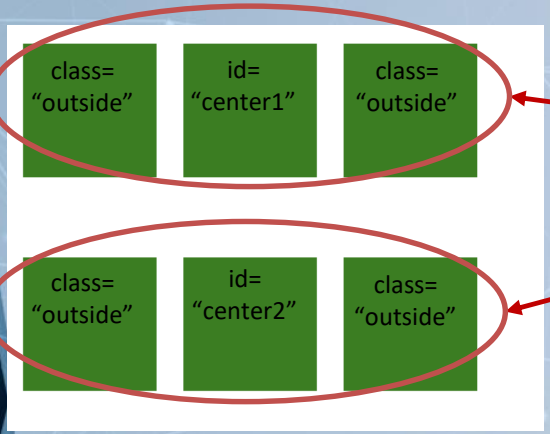
- D3 Select: grab a hold of elements
  - elements: , <g>, <rect>, <circle>…..

- d3.select()
- d3.selectAll()
- We can select elements by “tag”, “ID”, or “class”
  - d3.select(“tag”) (type)
  - d3.select(“#id”) (unique)
  - d3.select(“.class”)(group)

exist

Ex02-1 (Select)

- index.html




```
<!doctype html>
<html>
<head>
    <meta charset="utf-8">
    <meta name="description" content="">
    <title>The First D3 Example</title>
</head>
<body>
    <svg width="400" height="400">
        <g id="group1">
            <rect class="outside" x="0" y="0" width="50" height="50" fill="green"></rect>
            <rect id="center1" x="50" y="0" width="50" height="50" fill="green"></rect>
            <rect class="outside" x="120" y="0" width="50" height="50" fill="green"></rect>
        </g>
        <g id="group2">
            <rect class="outside" x="0" y="80" width="50" height="50" fill="green"></rect>
            <rect id="center2" x="50" y="80" width="50" height="50" fill="green"></rect>
            <rect class="outside" x="120" y="80" width="50" height="50" fill="green"></rect>
        </g>
    </svg>

    <script src="https://d3js.org/d3.v5.min.js"></script>
    <script src="main.js"></script>
</body>
</html>
```

.attr(attrName, value)

- Set the attribute to the specified value on the selected elements
- Attributes

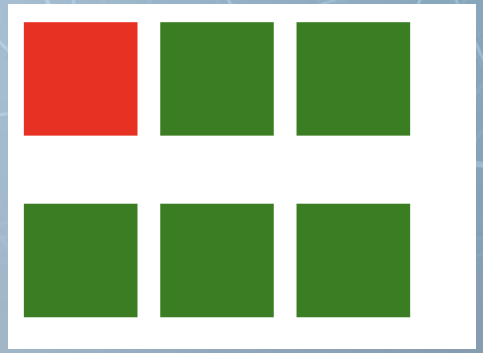
```
<!doctype html>
<html>
<head>
    <meta charset="utf-8">
    <meta name="description" content="">
    <title>The First D3 Example</title>
</head>
<body>
    <svg width="400" height="400">
        <g id="group1">
            <rect class="outsi e" x="0" y="0" width="50" height="50" fill="green"></ ect>
            <rect id="center1" x="60" y="0" width="50" height="50" fill="green"></re t>
            <rect class="outsi e" x="120" y="0" width="50" height="50" fill="green"></rect>
        </g>
        <g id="group2">
            <rect class="outsi e" x="0" y="80" width="50" height="50" fill="green"></rect>
            <rect id="center2" x="60" y="80" width="50" height="50" fill="green"></r ct>
            <rect class="outsi e" x="120" y="80" width="50" height="50" fill="green" ></rect>
        </g>
    </svg>

    <script src="https://d3js.org/d3.v5.min.js"></script>
    <script src="main.js"></script>
</body>
</html>
```

Ex02-1 (Select)

- main.js

- .attr(“fill”, “red”)
  - fill what we select by red
- d3.select(“rect”)
  - select the first element with tag “rect”

```
d3.select("rect").attr("fill", "red");
// d3.select("#center1").attr("fill", "red");
// d3.select("#center2").attr("fill", "blue");
// d3.select(".outside").attr("fill", "red");
// d3.selectAll("rect").attr("fill", "red");
// d3.selectAll(".outside").attr("fill", "red");
// var select1 = d3.selectAll("g");
// select1.select("rect").attr("fill", "red");
// var select2 = d3.select("#group1");
// select2.selectAll("rect").attr("fill", "red");
```

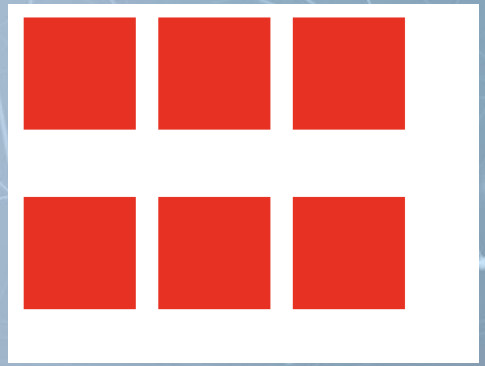


Ex02-1 (Select)

- main.js

- d3.selectAll(“rect”)
  - select all elements with tag rect

```
// d3.select("rect").attr("fill", "red");
// d3.select("#center1").attr("fill", "red");
// d3.select("#center2").attr("fill", "blue");
d3.selectAll("rect").attr("fill", "red");
// d3.selectAll(".outside").attr("fill", "red");
// var select1 = d3.selectAll("g");
// select1.select("rect").attr("fill", "red");
// var select2 = d3.select("#group1");
// select2.selectAll("rect").attr("fill", "red");
```

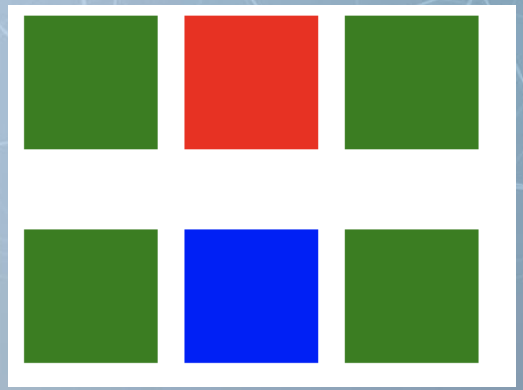


Ex02-1 (Select)

- main.js

- d3.select(“#center1”)
  - select the element with ID “center1”
  - # indicates that the string is an ID
  - Element ID should be unique

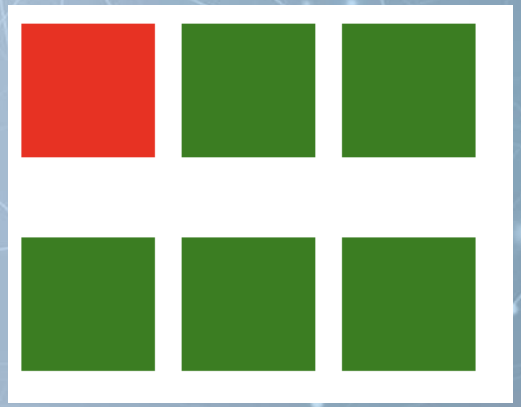
```
// d3.select("rect").attr("fill", "red");
d3.select("#center1").attr("fill", "red");
d3.select("#center2").attr("fill", "blue");
// d3.select(".outside").attr("fill", "red");
// d3.selectAll("rect").attr("fill", "red");
// d3.selectAll(".outside").attr("fill", "red");
// var select1 = d3.selectAll("g");
// select1.select("rect").attr("fill", "red");
// var select2 = d3.select("#group1");
// select2.selectAll("rect").attr("fill", "red");
```



Ex02-1 (Select)

```
// d3.select("rect").attr("fill", "red");
// d3.select("#center1").attr("fill", "red");
// d3.select("#center2").attr("fill", "blue");
d3.select(".outside").attr("fill", "red");
// d3.selectAll("rect").attr("fill", "red");
// d3.selectAll(".outside").attr("fill", "red");
// var select1 = d3.selectAll("g");
// select1.select("rect").attr("fill", "red");
// var select2 = d3.select("#group1");
// select2.selectAll("rect").attr("fill", "red");
```

- main.js
- d3.select(“.outside”)
  - select the first element with class “outside”
  - . indicates that the string is a class
  - Multiple elements could have same class name
- If multiple elements meet the d3.select() condition, it only select the first one

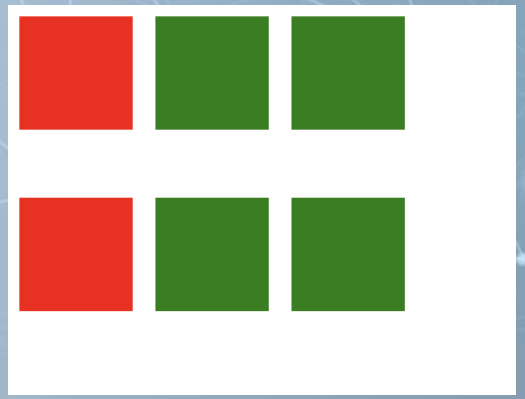


Ex02-1 (Select)

- main.js

```
// d3.select("rect").attr("fill", "red");
// d3.select("#center1").attr("fill", "red");
// d3.select("#center2").attr("fill", "blue");
// d3.select(".outside").attr("fill", "red");
// d3.selectAll("rect").attr("fill", "red");
// d3.selectAll(".outside").attr("fill", "red");
var select1 = d3.selectAll("g");
select1.select("rect").attr("fill", "red");
// var select2 = d3.select("#group1");
// select2.selectAll("rect").attr("fill", "red");
```

- d3.selectAll(“g”)
  - It selects all elements with tag “g”
  - So, “select1” stores the two <g>
- Select1.select(“rect”)
  - Select the first element with tag “rect” from each element in “select1”

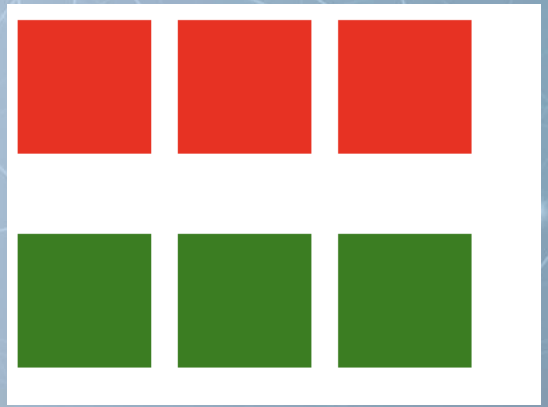


Ex02-1 (Select)

- main.js

- d3.select(“#group1”)
  - Select the element with ID group1
- Select all elements with tag rect from “select2”

```
// d3.select("rect").attr("fill", "red");
// d3.select("#center1").attr("fill", "red");
// d3.select("#center2").attr("fill", "blue");
// d3.select(".outside").attr("fill", "red");
// d3.selectAll("rect").attr("fill", "red");
// d3.selectAll(".outside").attr("fill", "red");
// var select1 = d3.selectAll("g");
// select1.select("rect").attr("fill", "red");
var select2 = d3.select("#group1");
select2.selectAll("rect").attr("fill", "red");
```

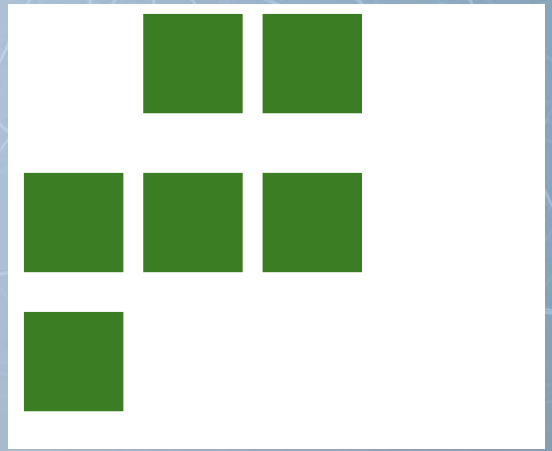


Ex02-2 (.attr())

- main.js

- We can also modify other attributes, such as “y”

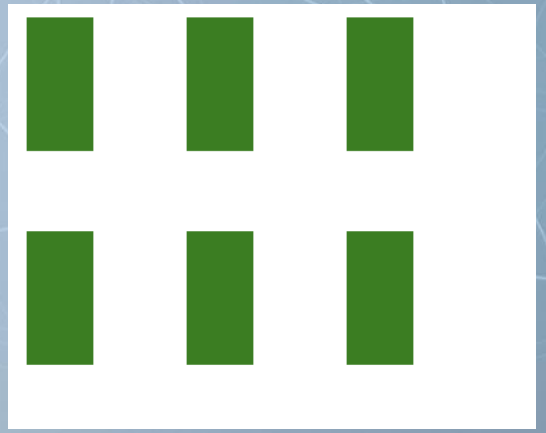
```
// d3.select("rect").attr("fill", "red");
// d3.selectAll(".outside").attr("fill", "red");
d3.select("rect").attr("y", "150");
// d3.selectAll("rect").attr("width", "25");
```



Ex02-2 (.attr())

- main.js
- Or “width”

```
// d3.select("rect").attr("fill", "red");
// d3.selectAll(".outside").attr("fill", "red");
// d3.select("rect").attr("y", "150");
d3.selectAll("rect").attr("width", "25");
```



SVG Elements Reference

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

What kind of attr. that you can use

SVG elements A to Z

A

- <a>
- <animate>
- <animateMotion>
- <animateTransform>

C

- <circle>
- <clipPath>
- <color-profile>

D

- <defs>
- <desc>
- <discard>

E

- <ellipse>

F

- <feBlend>
- <feColorMatrix>
- <feComponentTransfer>
- <feComposite>
- <feConvolveMatrix>
- <feDiffuseLighting>
- <feDisplacementMap>
- <feDistantLight>
- <feDropShadow>
- <feFlood>
- <feFuncA>
- <feFuncB>
- <feFuncG>
- <feFuncR>
- <feGaussianBlur>
- <feImage>
- <feMerge>
- <feMergeNode>
- <feMorphology>
- <feOffset>
- <fePointLight>
- <feSpecularLighting>
- <feSpotLight>
- <feTile>
- <feTurbulence>
- <filter>
- <foreignObject>

G

- <g>

H

- <hatch>
- <hatchpath>

I

- <image>

L

- <line>
- <linearGradient>

M

- <marker>
- <mask>
- <mesh>
- <meshgradient>
- <meshpatch>
- <meshrow>
- <metadata>
- <mpath>

P

- <path>
- <pattern>
- <polygon>
- <polyline>

R

- <radialGradient>
- <rect>

S

- <script>
- <set>
- <solidcolor>
- <stop>
- <style>
- <svg>
- <switch>
- <symbol>

T

- <text>
- <textPath>
- <title>
- <tspan>

U

- <unknown>
- <use>

V

- <view>

.classed(className, value)

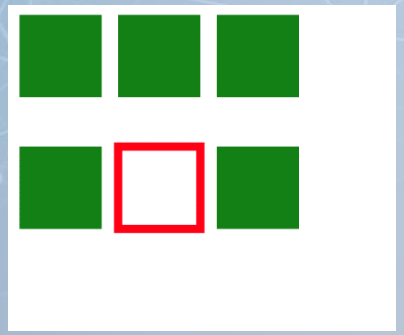
- If we define a CSS style
  - Ex:

```
<head>
    <meta charset="utf-8">
    <meta name="description" content="">
    <title>The First D3 Example</title>
    <style>
        .hollow_rect{
            fill: white;
            stroke: red;
            stroke-width: 5px;
        }
    </style>
</head>
```

- We can apply it to or remove it from an element by **selection.classed(className, value)**
  - ”value” is either true or false
  - true: applied it
  - false: remove it

Ex02-3 (.classed)

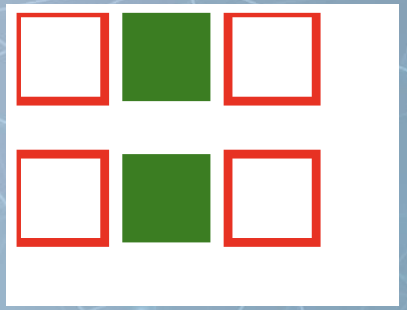
- Files
  - index.html
  - main.js
- Without main.js, you will see this



```
<!doctype html>
<html>
<head>
    <meta charset="utf-8">
    <meta name="description" content="">
    <title>The First D3 Example</title>
    <style>
        .hollow_rect{
            fill: white;
            stroke: red;
            stroke-width: 5px;
        }
    </style>
</head>
<body>
    <svg width="400" height="400">
        <g id="group1">
            <rect class="outside" x="0" y="0" width="50" height="50" fill="green"></rect>
            <rect id="center1" x="60" y="0" width="50" height="50" fill="green"></rect>
            <rect class="outside" x="120" y="0" width="50" height="50" fill="green"></rect>
        </g>
        <g id="group2">
            <rect class="outside" x="0" y="80" width="50" height="50" fill="green"></rect>
            <rect class="hollow_rect" id="center2" x="60" y="80" width="50" height="50" fill="green"></rect>
            <rect class="outside" x="120" y="80" width="50" height="50" fill="green"></rect>
        </g>
    </svg>

    <script src="https://d3js.org/d3.v5.min.js"></script>
    <script src="main.js"></script>
</body>
</html>
```

Ex02-3 (.classed)

```
d3.selectAll(".outside").classed("hollow_rect", true);
d3.select("#center2").classed("hollow_rect", false);
```



```
<body>
    <svg width="400" height="400">
        <g id="group1">
            <rect class="outside" x="0" y="0" width="50" hei
            <rect id="center1" x="60" y="0" width="50" heigh
            <rect class="outside" x="120" y="0" width="50" h
        </g>
        <g id="group2">
            <rect class="outside" x="0" y="80" width="50" he
            <rect class="hollow_rect" id="center2" x="60" y=
            <rect class="outside" x="120" y="80" width="50"
```

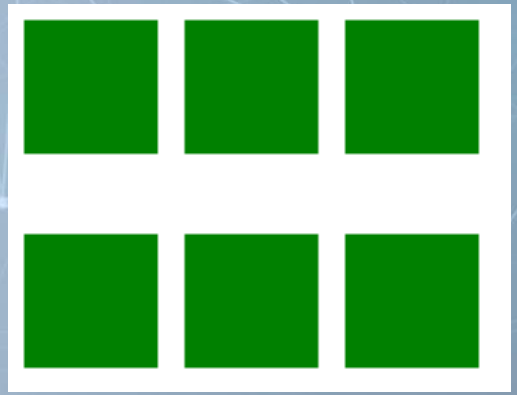
append(tagName)

- Append a new element as the last child of each selected element

Ex02-4 (.append)

- index.html

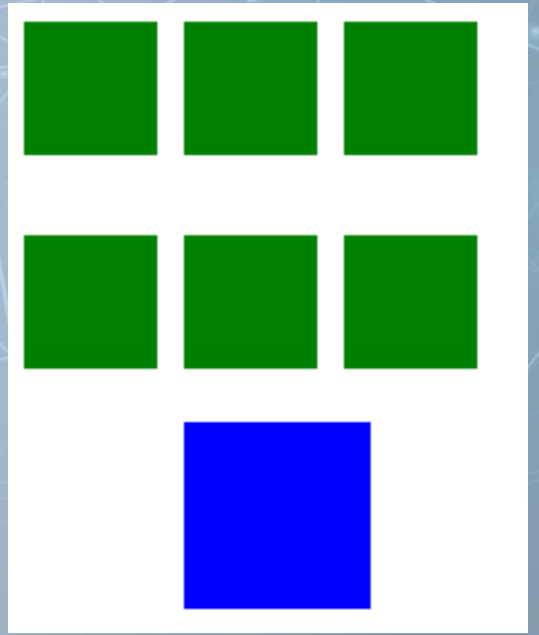
```
<!doctype html>
<html>
<head>
    <meta charset="utf-8">
    <meta name="description" content="">
    <title>The First D3 Example</title>
</head>
<body>
    <svg width="400" height="400">
        <g id="group1">
            <rect class="outside" x="0" y="0" width="50" height="50" fill="green"></rect>
            <rect id="center1" x="60" y="0" width="50" height="50" fill="green"></rect>
            <rect class="outside" x="120" y="0" width="50" height="50" fill="green"></rect>
        </g>
        <g id="group2">
            <rect class="outside" x="0" y="80" width="50" height="50" fill="green"></rect>
            <rect id="center2" x="60" y="80" width="50" height="50" fill="green"></rect>
            <rect class="outside" x="120" y="80" width="50" height="50" fill="green"></rect>
        </g>
    </svg>

    <script src="https://d3js.org/d3.v5.min.js"></script>
    <script src="main.js"></script>
</body>
</html>
```



Ex02-4 (.append)

- main.js

```
d3.selectAll("#group2")
  .append("rect")
  .attr("x", "60")
  .attr("y", "150")
  .attr("width", "70")
  .attr("height", "70")
  .attr("fill", "blue");
```



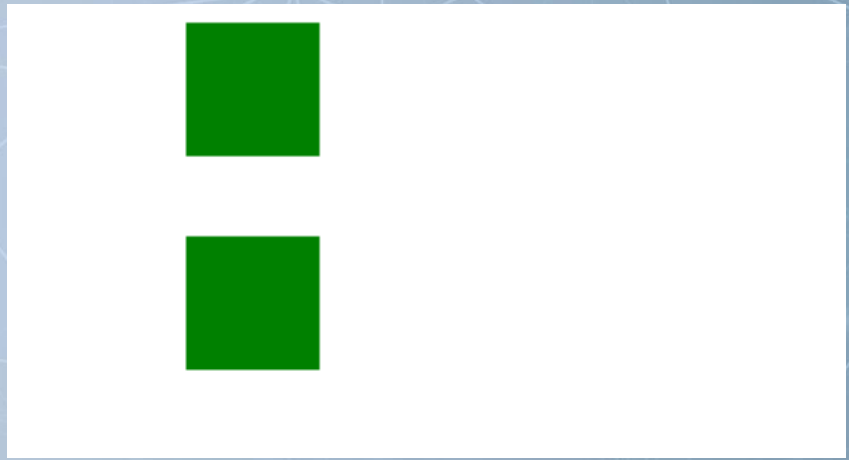
.remove()

- Removes the selected elements from the document

Ex02-5 (.append)

- main.js

```
d3.selectAll(".outside").remove();
```



.text(value)

- Sets the text content to the specified value on all selected elements
  - Replacing any existing child elements
- When to use it?

Method Chaining

- Ex02-5: main.js
  - The same
  - .append(“rect”) returns the rect obj
  - rect.attr() also return the rect obj

```
var rect = d3.selectAll("#group2").append("rect");
rect.attr("x", "60");
rect.attr("y", "150")
rect.attr("width", "70")
rect.attr("height", "70")
rect.attr("fill", "blue");
```

```
d3.selectAll("#group2")
  .append("rect")
  .attr("x", "60")
  .attr("y", "150")
  .attr("width", "70")
  .attr("height", "70")
  .attr("fill", "blue");
```

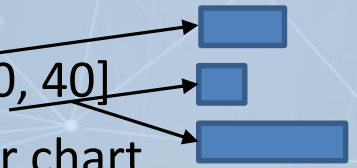
Data Binding (Data Joining)

Data Visualization

Data-Driven Documents (D3)

- D3 can map data to HTML/SVG elements
  - Construct the DOM from data
- Each data value has a corresponding HTML/SVG elements
  - D3 helps us maintain this mapping

- Data: [20, 10, 40]
- Map to a bar chart



In this example, we want to bind our data to width of the rectangles

```
<svg>
    <rect x="0" y="0" width="20" height="10"></rect>
    <rect x="0" y="15" width="10" height="10"></rect>
    <rect x="0" y="30" width="40" height="10"></rect>
</svg>
```

Ex03-1

- D3 to update bar chart appearance

- File
  - index.html
  - main.js

index.html

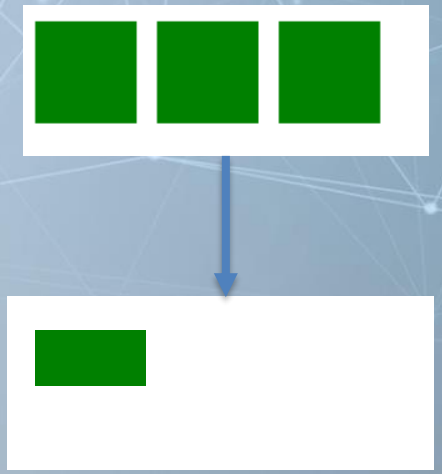
```
<svg width="1000" height="1000">
    <rect x="0" y="0" width="50" height="50" fill="green"></rect>
    <rect x="60" y="0" width="50" height="50" fill="green"></rect>
    <rect x="120" y="0" width="50" height="50" fill="green"></rect>
</svg>
```

Without main.js

Ex03-1

- main.js
- It selects all rectangles (we have three)
  - Set all x=0, y=0, width=20, height=10 to all rectangles
  - So, you only see one rectangle

```
d3.selectAll("rect")
  .attr("x", 0)
  .attr("y", 0)
  .attr("width", 20)
  .attr("height", 10);
```



Ex03-2

- Add data (a javascript array) [20, 10, 40] in to main.js
- Bind the data array to rectangles and update the appearances of them

- File
  - index.html
  - main.js

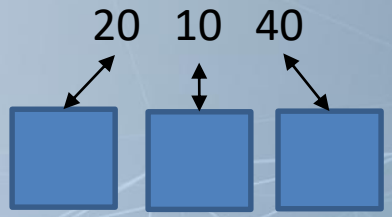
Ex03-2

- main.js

```
var data = [20, 10, 40];

d3.selectAll("rect")
  .data(data)
  .attr("x", 0)
  .attr("y", function(d, i){
      return i*15;
  })
  .attr("width", function(d, i){
      return d;
  })
  .attr("height", 10);
```

Ex03-2

- main.js
  - .data: bind data to elements

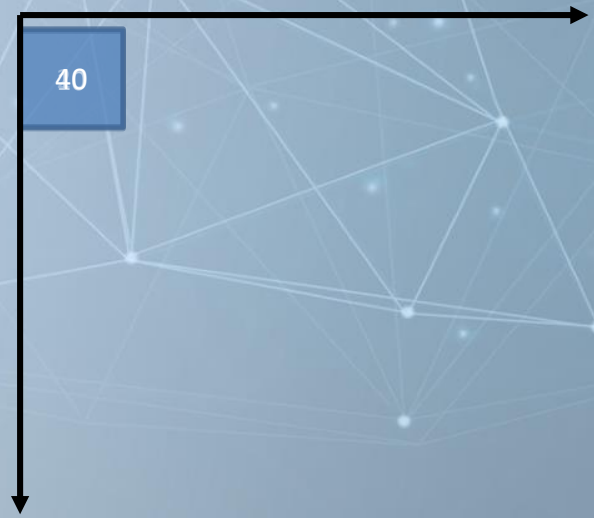



```
var data = [20, 10, 40];

d3.selectAll("rect")
  .data(data)
  .attr("x", 0)
  .attr("y", function(d, i){
      return i*15;
  })
  .attr("width", function(d, i){
      return d;
  })
  .attr("height", 10);
```

Ex03-2

- main.js

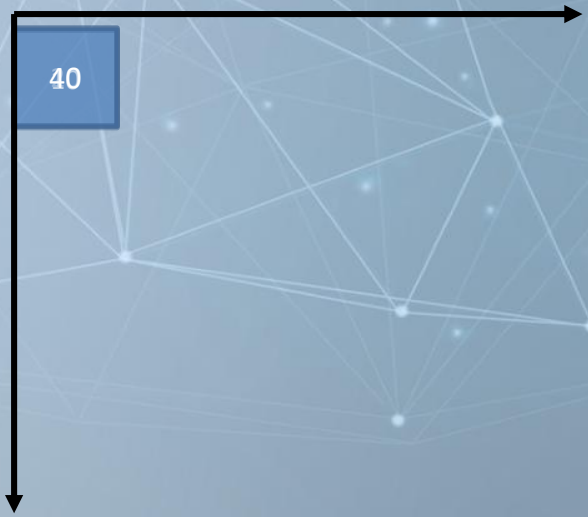
```
var data = [20, 10, 40];

d3.selectAll("rect")
  .data(data)
  .attr("x", 0)
  .attr("y", function(d, i){
      return i*15;
  })
  .attr("width", function(d, i){
      return d;
  })
  .attr("height", 10);
```



Ex03-2

- main.js
- The function(d, i) iterates through all elements one by one. The first argument(d) is the attached data, the second argument(i) is the index

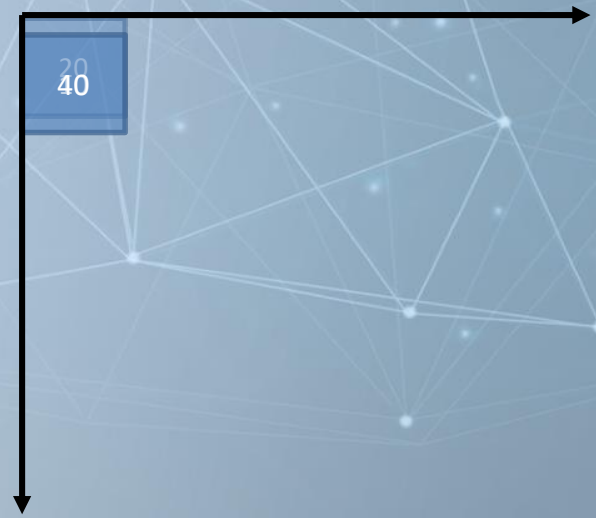
```
var data = [20, 10, 40];

d3.selectAll("rect")
  .data(data)
  .attr("x", 0)
  .attr("y", function(d, i){
      return i*15;
  })
  .attr("width", function(d, i){
      return d;
  })
  .attr("height", 10);
```



Ex03-2

- main.js
- Ex: the first rectangle attaches data value 20. So, in the iteration for the first rectangle d=20, i=0.
- This line set y of the first rectangle to 0 (0*15)

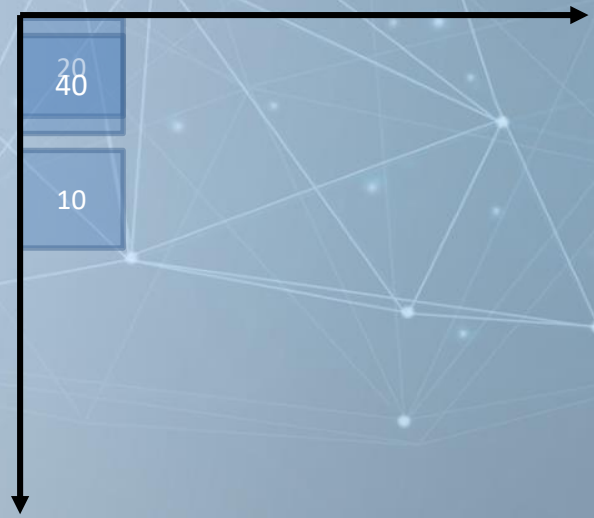
```
var data = [20, 10, 40];

d3.selectAll("rect")
  .data(data)
  .attr("x", 0)
  .attr("y", function(d, i){
      return i*15;
  })
  .attr("width", function(d, i){
      return d;
  })
  .attr("height", 10);
```



Ex03-2

- main.js
- Ex: the second rectangle attaches data value 20. So, in the iteration for the second rectangle d=10, i=1.
- This line set y of the second rectangle to 15 (1*15)

```
var data = [20, 10, 40];

d3.selectAll("rect")
  .data(data)
  .attr("x", 0)
  .attr("y", function(d, i){
      return i*15;
  })
  .attr("width", function(d, i){
      return d;
  })
  .attr("height", 10);
```



Ex03-2

- main.js
- Ex: the third rectangle attaches data value 40. So, in the iteration for the third rectangle d=40, i=2.
- This line set y of the third rectangle to 30 (2*15)

```
var data = [20, 10, 40];

d3.selectAll("rect")
  .data(data)
  .attr("x", 0)
  .attr("y", function(d, i){
      return i*15;
  })
  .attr("width", function(d, i){
      return d;
  })
  .attr("height", 10);
```

Ex03-2

- main.js
- Ex: the first rectangle attaches data value 20. So, in the iteration for the first rectangle d=20, i=0.
- This line set width of the first rectangle to 20

```
var data = [20, 10, 40];

d3.selectAll("rect")
  .data(data)
  .attr("x", 0)
  .attr("y", function(d, i){
      return i*15;
  })
  .attr("width", function(d, i){
      return d;
  })
  .attr("height", 10);
```

Ex03-2

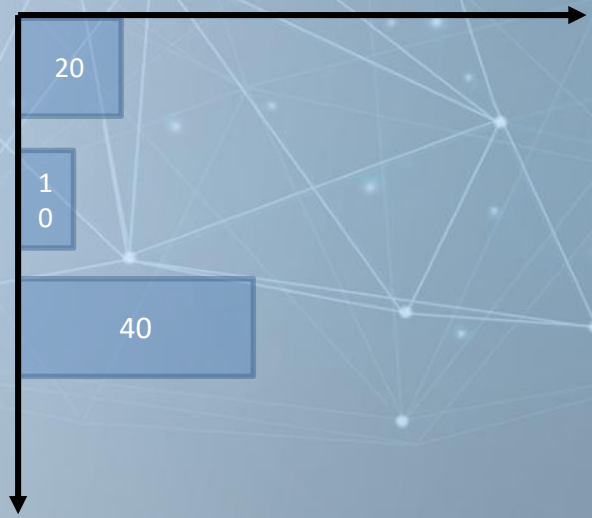
- main.js
- Ex: the second rectangle attaches data value 10. So, in the iteration for the second rectangle d=10, i=1.
- This line set width of the second rectangle to 10

```
var data = [20, 10, 40];

d3.selectAll("rect")
  .data(data)
  .attr("x", 0)
  .attr("y", function(d, i){
      return i*15;
  })
  .attr("width", function(d, i){
      return d;
  })
  .attr("height", 10);
```

Ex03-2

- main.js
- Ex: the third rectangle attaches data value 40. So, in the iteration for the third rectangle d=40, i=2.
- This line set width of the third rectangle to 40

```
var data = [20, 10, 40];

d3.selectAll("rect")
  .data(data)
  .attr("x", 0)
  .attr("y", function(d, i){
      return i*15;
  })
  .attr("width", function(d, i){
      return d;
  })
  .attr("height", 10);
```



Ex03-2

- main.js
- Arrow function expression
  - A compact alternative to a function expression
- The following three expressions are the same

```
var data = [20, 10, 40];

d3.selectAll("rect")
  .data(data)
  .attr("x", 0)
  .attr("y", function(d, i){
      return i*15;
  })
  .attr("width", function(d, i){
      return d;
  })
  .attr("height", 10);
```

You can remove “function” but use “=>”

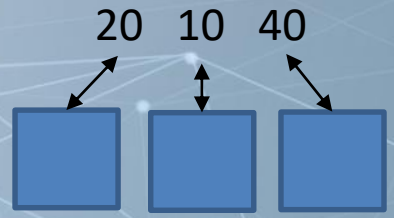
```
.attr("width", (d, i)=>{
    return d;
})
```

if the return statement is the only line in the function, you can remove “return” and the “curly brackets”

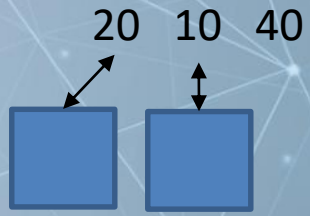
```
.attr("width", (d, i)=>d)
```

D3 Update Pattern

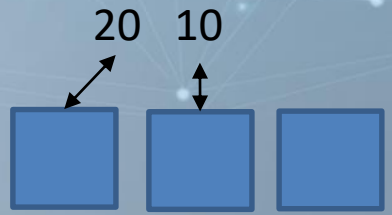
- In Ex02-3, the number of <rect> in index.html is the same of the number of values in data array



- What if the number of <rect> in index.html < the number of values in data array
  - Add elements



- What if the number of <rect> in index.html > the number of values in data array
  - Remove elements



“enter” and “exit”

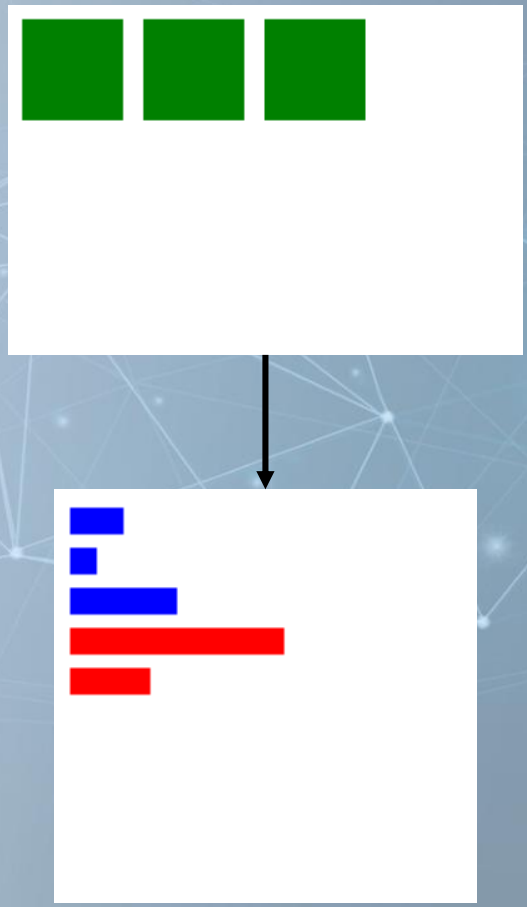
- After you select elements and bind data to them

- D3 automatically determines
  - how many elements should be added
    - **enter**
  - how many elements should be removed
    - **exit**

Ex03-3

- If we have data [20, 10, 40, 80, 30]
- But we only have three rectangles in index.html
- How to use the above data to show five bars (rectangles)
  - Color the old three rects by blue
  - Color the new two rect by red

- We have to get the hold of the old three rectangles and set their x, y, width, height and color by the corresponding data
- Then, append two more rectangles to “svg” and set their x, y, width, height and color by the corresponding data



Ex03-3

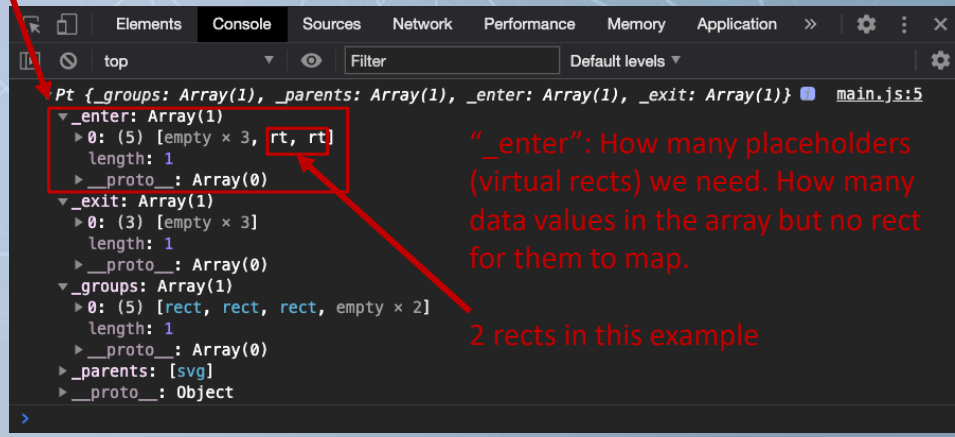
- main.js

Our data

Select all rectangles from svg and bind the data

```
var data = [20, 10, 40, 80, 30];

var rects = d3.select("svg").selectAll("rect").data(data);

console.log(rects);

rects.exit().remove();

rects.attr("x", 0)
     .attr("y", function(d, i){
         return i*15;
     })
     .attr("width", function(d, i){
         return d;
     })
     .attr("height", 10)
     .attr("fill", "blue");


rects.enter()
     .append("rect")
     .attr("x", 0)
     .attr("y", function(d, i){
         return i*15;
     })
     .attr("width", function(d, i){
         return d;
     })
     .attr("height", 10)
     .attr("fill", "red");
```

What we have in "rects"



Ex03-3

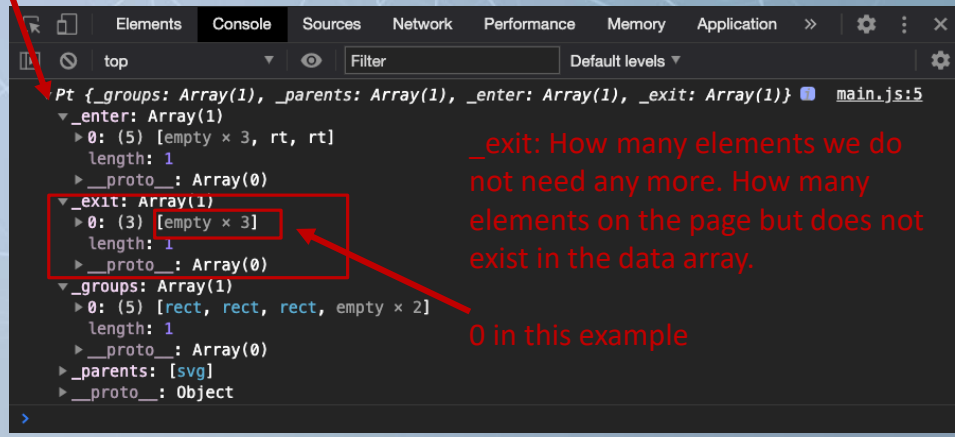
- main.js

Our data

Select all rectangles from svg and bind the data

```
var data = [20, 10, 40, 80, 30];

var rects = d3.select("svg").selectAll("rect").data(data);

console.log(rects);

rects.exit().remove();

rects.attr("x", 0)
    .attr("y", function(d, i){
        return i*15;
    })
    .attr("width", function(d, i){
        return d;
    })
    .attr("height", 10)
    .attr("fill", "blue");


rects.enter()
    .append("rect")
    .attr("x", 0)
    .attr("y", function(d, i){
        return i*15;
    })
    .attr("width", function(d, i){
        return d;
    })
    .attr("height", 10)
    .attr("fill", "red");
```

What we have in "rects"



_exit: How many elements we do not need any more. How many elements on the page but does not exist in the data array.

0 in this example

Ex03-3

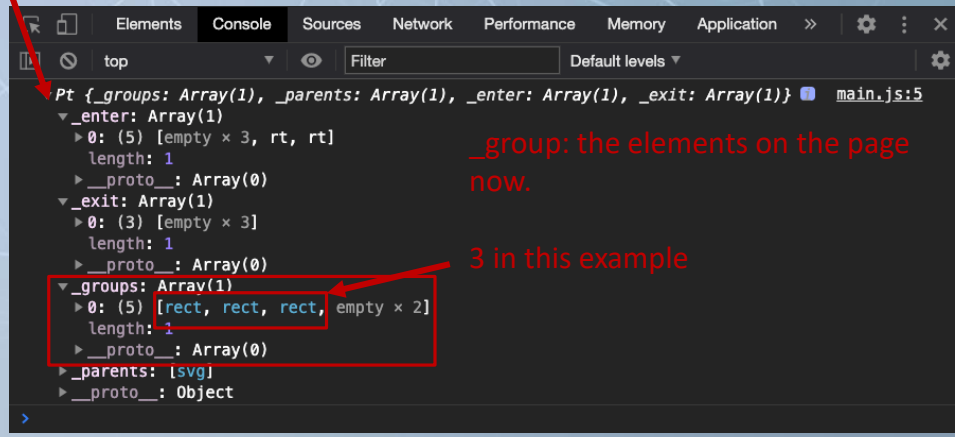
- main.js

Our data

Select all rectangles from svg and bind the data

```
var data = [20, 10, 40, 80, 30];

var rects = d3.select("svg").selectAll("rect").data(data);

console.log(rects);

rects.exit().remove();

rects.attr("x", 0)
    .attr("y", function(d, i){
        return i*15;
    })
    .attr("width", function(d, i){
        return d;
    })
    .attr("height", 10)
    .attr("fill", "blue");


rects.enter()
    .append("rect")
    .attr("x", 0)
    .attr("y", function(d, i){
        return i*15;
    })
    .attr("width", function(d, i){
        return d;
    })
    .attr("height", 10)
    .attr("fill", "red");
```

What we have in "rects"

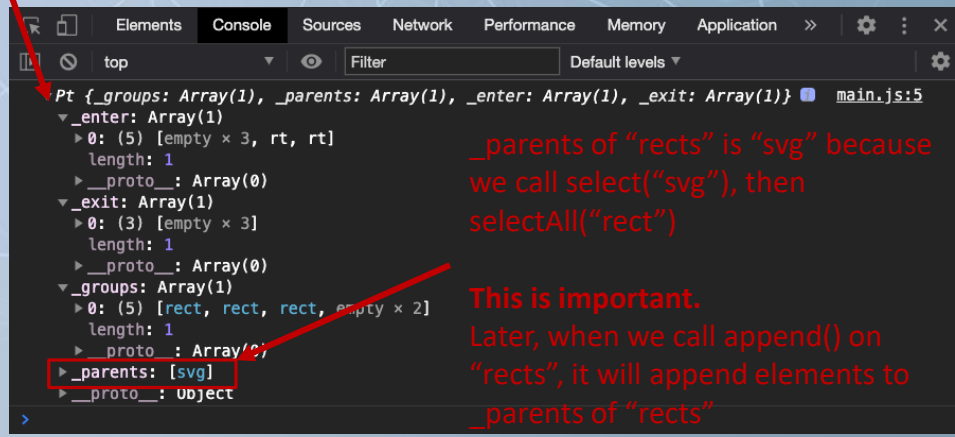


Ex03-3

- main.js

```
var data = [20, 10, 40, 80, 30];

var rects = d3.select("svg").selectAll("rect").data(data);

console.log(rects);

rects.exit().remove();

rects.attr("x", 0)
     .attr("y", function(d, i){
         return i*15;
     })
     .attr("width", function(d, i){
         return d;
     })
     .attr("height", 10)
     .attr("fill", "blue");


rects.enter()
     .append("rect")
     .attr("x", 0)
     .attr("y", function(d, i){
         return i*15;
     })
     .attr("width", function(d, i){
         return d;
     })
     .attr("height", 10)
     .attr("fill", "red");
```

What we have in "rects"



_parents of "rects" is "svg" because we call select("svg"), then selectAll("rect")

This is important.
Later, when we call append() on "rects", it will append elements to _parents of "rects"

Ex03-3

- main.js

```
var data = [20, 10, 40, 80, 30];

var rects = d3.select("svg").selectAll("rect").data(data);

console.log(rects);

rects.exit().remove();

rects.attr("x", 0)
     .attr("y", function(d, i){
         return i*15;
     })
     .attr("width", function(d, i){
         return d;
     })
     .attr("height", 10)
     .attr("fill", "blue");


rects.enter()
     .append("rect")
     .attr("x", 0)
     .attr("y", function(d, i){
         return i*15;
     })
     .attr("width", function(d, i){
         return d;
     })
     .attr("height", 10)
     .attr("fill", "red");
```

D3 Update Pattern

After binding the data

1. **Exit – use exit() to remove the elements we do not need**
2. Update – update the attributes of the existing elements
3. Enter – use enter() to append(add) new elements and set their attributes

Remove nothing in this example

Ex03-3

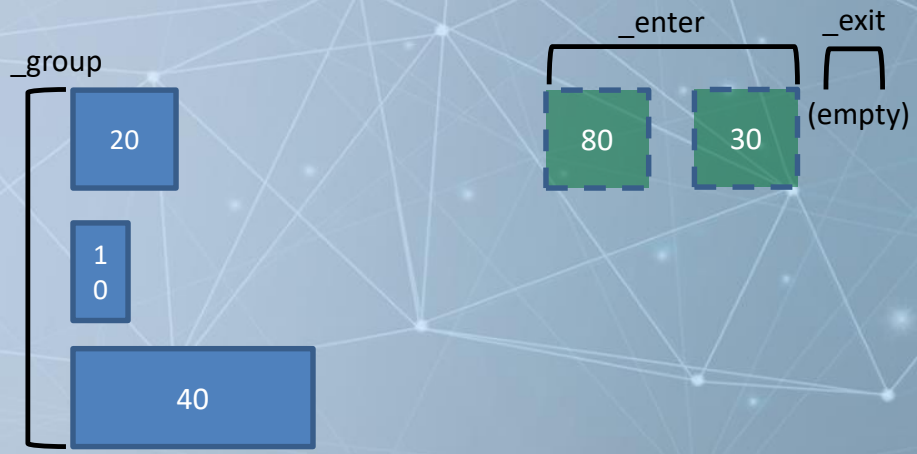
- main.js

```
var data = [20, 10, 40, 80, 30];

var rects = d3.select("svg").selectAll("rect").data(data);

console.log(rects);

rects.exit().remove();

rects.attr("x", 0)
     .attr("y", function(d, i){
         return i*15;
     })
     .attr("width", function(d, i){
         return d;
     })
     .attr("height", 10)
     .attr("fill", "blue");


rects.enter()
     .append("rect")
     .attr("x", 0)
     .attr("y", function(d, i){
         return i*15;
     })
     .attr("width", function(d, i){
         return d;
     })
     .attr("height", 10)
     .attr("fill", "red");
```

D3 Update Pattern

After binding the data

1. Exit – use exit() to remove the elements we do not need
2. **Update – update the attributes of the existing elements**
3. Enter – use enter() to append(add) new elements and set their attributes



"rects" indicates "_group"

Ex03-3

- main.js

```
var data = [20, 10, 40, 80, 30];

var rects = d3.select("svg").selectAll("rect").data(data);

console.log(rects);

rects.exit().remove();

rects.attr("x", 0)
     .attr("y", function(d, i){
         return i*15;
     })
     .attr("width", function(d, i){
         return d;
     })
     .attr("height", 10)
     .attr("fill", "blue");


rects.enter()
     .append("rect")
     .attr("x", 0)
     .attr("y", function(d, i){
         return i*15;
     })
     .attr("width", function(d, i){
         return d;
     })
     .attr("height", 10)
     .attr("fill", "red");
```

D3 Update Pattern

After binding the data

1. Exit – use exit() to remove the elements we do not need
2. Update – update the attributes of the existing elements
3. **Enter – use enter() to append(add) new elements and set their attributes**

Remember to append() first. Without append(), they does not exist in DOM (webpage)

Ex03-3

- main.js

```
var data = [20, 10, 40, 80, 30];

var rects = d3.select("svg").selectAll("rect").data(data);

console.log(rects);

rects.exit().remove();

rects.attr("x", 0)
     .attr("y", function(d, i){
         return i*15;
     })
     .attr("width", function(d, i){
         return d;
     })
     .attr("height", 10)
     .attr("fill", "blue");
```

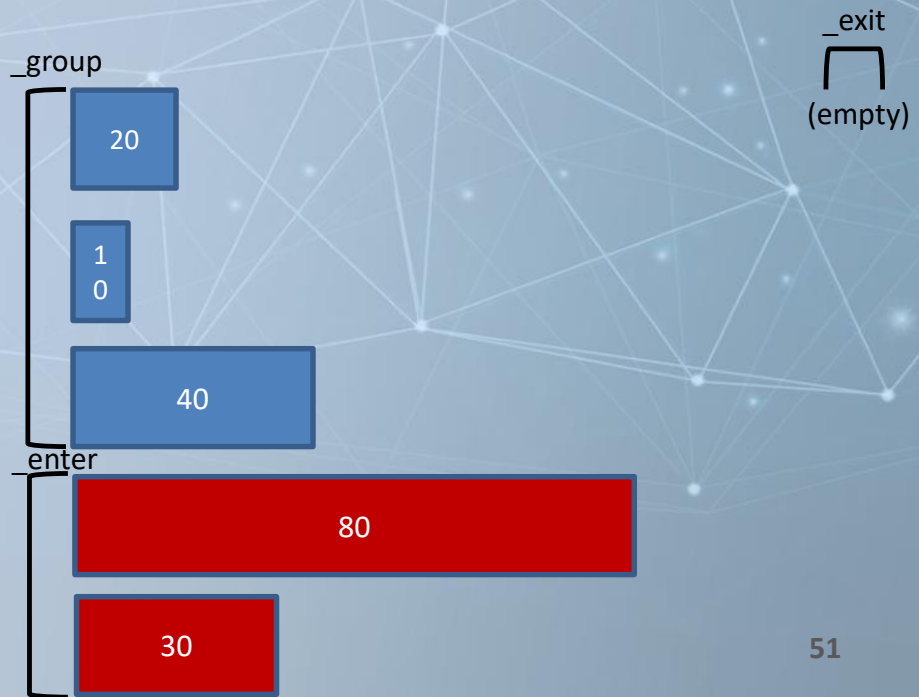
Set their attributes by the data

```
rects.enter()
     .append("rect")
     .attr("x", 0)
     .attr("y", function(d, i){
         return i*15;
     })
     .attr("width", function(d, i){
         return d;
     })
     .attr("height", 10)
     .attr("fill", "red");
```

D3 Update Pattern

After binding the data

1. Exit – use exit() to remove the elements we do not need
2. Update – update the attributes of the existing elements
3. **Enter – use enter() to append(add) new elements and set their attributes**



Ex03-3

- main.js

```
var data = [20, 10, 40, 80, 30];

var rects = d3.select("svg").selectAll("rect").data(data);

console.log(rects);

rects.exit().remove();

rects.attr("x", 0)
    .attr("y", function(d, i){
        return i*15;
    })
    .attr("width", function(d, i){
        return d;
    })
    .attr("height", 10)
    .attr("fill", "blue");


rects.enter()
    .append("rect")
    .attr("x", 0)
    .attr("y", function(d, i){
        return i*15;
    })
    .attr("width", function(d, i){
        return d;
    })
    .attr("height", 10)
    .attr("fill", "red");
```

if we do not care about the “color” in this example.
After exit() and enter().append(), we can simply selectAll(“rect”) again from the svg and update the rects’ attributes by the data

(this an alternative way to set the attributes, but the code is shorter)

```
rects.exit().remove();
rects.enter().append("rect");
d3.select("svg").selectAll("rect")
  .attr("x", 0)
  .attr("y", function(d, i){
      return i*15;
  })
  .attr("width", function(d, i){
      return d;
  })
  .attr("height", 10);
```

Load External File

.csv
(comma separated values)

```
name,age
Tony,10
Jessica,12
Andrew,9
Emily,10
Richard,11
```

.tsv
(tab separated values)

```
name  age
Tony  10
Jessica 12
Andrew  9
Emily 10
Richard 11
```

.json
(Javascript object Notation)


```
d3.csv("ages.csv").then(data =>{
    //code to use the data
});
```

```
d3.tsv("ages.tsv").then(data =>{
    //code to use the data
});
```

```
d3.json("ages.json").then(data =>{
    //code to use the data
});
```

```
d3.csv("ages.csv", function(data){
        //code to process data
})
```

Before v5.x (callback)

Ex03-4

- Load age.csv file and draw bars

- File
  - index.html
  - main.js

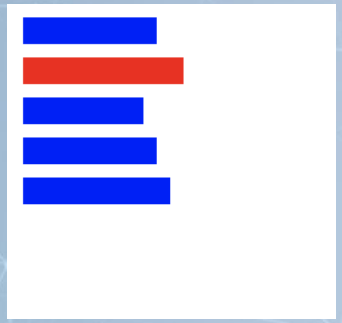
index.html

```
<!doctype html>
<html>
<head>
    <meta charset="utf-8">
    <meta name="description" content="">
    <title>D3 Example</title>
</head>
<body>
    <svg width="1000" height="1000">
    </svg>

    <script src="https://d3js.org/d3.v5.min.js"></script>
    <script src="main.js"></script>
</body>
</html>
```

Keep svg only in index.html

Ex03-4

- main.js



If d3 loads the file successfully, it put the data in the variable “data”

Code to use/visualize the data

```
d3.csv("ages.csv").then(data =>{
    console.log(data);

    data.forEach(function(d){
        d.age = Number(d.age);
    });

    console.log(data);

    let rects = d3.select("svg")
                  .selectAll("rect")
                  .data(data);

    rects.enter()
         .append("rect")
         .attr("x", 0)
         .attr("y", function(d, i){
             return i*15;
         })
         .attr("width", function(d, i){
             return d.age * 5;
         })
         .attr("height", 10)
         .attr("fill", function(d, i){
             if( d.name === "Jessica"){
                 return "red";
             }else{
                 return "blue";
             }
         });
    }
).catch(function(error){
    console.log(error);
});
```

Ex03-4

- main.js

```
name,age
Tony,10
Jessica,12
Andrew,9
Emily,10
Richard,11
```

```
▼(5) [{…}, {…}, {…}, {…}, {…}, columns: Array(2)]
  ▶0: {name: "Tony", age: "10"}
  ▶1: {name: "Jessica", age: "12"}
  ▶2: {name: "Andrew", age: "9"}
  ▶3: {name: "Emily", age: "10"}
  ▶4: {name: "Richard", age: "11"}
  ▶columns: (2) ["name", "age"]
   length: 5
  ▶__proto__: Array(0)
```

What the “data” looks like
(array of dictionary and all strings)

```
d3.csv("ages.csv").then(data =>{
    console.log(data);

    data.forEach(function(d){
        d.age = Number(d.age);
    });

    console.log(data);

    let rects = d3.select("svg")
                  .selectAll("rect")
                  .data(data);

    rects.enter()
         .append("rect")
         .attr("x", 0)
         .attr("y", function(d, i){
             return i*15;
         })
         .attr("width", function(d, i){
             return d.age * 5;
         })
         .attr("height", 10)
         .attr("fill", function(d, i){
             if( d.name === "Jessica"){
                 return "red";
             }else{
                 return "blue";
             }
         });
    }
).catch(function(error){
    console.log(error);
});
```

Ex03-4

- main.js

A way to iterate through all data and convert some attributes to “number”

```
▼ (5) [{…}, {…}, {…}, {…}, {…}, columns: Array(2)]
  ▶ 0: {name: "Tony", age: 10}
  ▶ 1: {name: "Jessica", age: 12}
  ▶ 2: {name: "Andrew", age: 9}
  ▶ 3: {name: "Emily", age: 10}
  ▶ 4: {name: "Richard", age: 11}
  ▶ columns: (2) ["name", "age"]
    length: 5
  ▶ __proto__: Array(0)
```

```
d3.csv("ages.csv").then(data =>{
    console.log(data);

    data.forEach(function(d){
        d.age = Number(d.age);
    });

    console.log(data);

    let rects = d3.select("svg")
                  .selectAll("rect")
                  .data(data);

    rects.enter()
         .append("rect")
         .attr("x", 0)
         .attr("y", function(d, i){
             return i*15;
         })
         .attr("width", function(d, i){
             return d.age * 5;
         })
         .attr("height", 10)
         .attr("fill", function(d, i){
             if( d.name === "Jessica"){
                 return "red";
             }else{
                 return "blue";
             }
         });
    }
).catch(function(error){
    console.log(error);
});
```

Ex03-4

- main.js

```
▼(5) [{…}, {…}, {…}, {…}, {…}, columns: Array(2)]
  ▶0: {name: "Tony", age: 10}
  ▶1: {name: "Jessica", age: 12}
  ▶2: {name: "Andrew", age: 9}
  ▶3: {name: "Emily", age: 10}
  ▶4: {name: "Richard", age: 11}
  ▶columns: (2) ["name", "age"]
   length: 5
  ▶__proto__: Array(0)
```

Add rects to the svg
“age” in the data determines lengths of bars
“name” to determine bar colors

```
d3.csv("ages.csv").then(data =>{
    console.log(data);

    data.forEach(function(d){
        d.age = Number(d.age);
    });

    console.log(data);

    let rects = d3.select("svg")
                  .selectAll("rect")
                  .data(data);

    rects.enter()
         .append("rect")
         .attr("x", 0)
         .attr("y", function(d, i){
             return i*15;
         })
         .attr("width", function(d, i){
             return d.age * 5;
         })
         .attr("height", 10)
         .attr("fill", function(d, i){
             if( d.name === "Jessica"){
                 return "red";
             }else{
                 return "blue";
             }
         });
    }
).catch(function(error){
    console.log(error);
});
```

Ex03-4

- main.js

Handle the error: e.g. if d3 cannot find the file (the error message is stored in “error” variable)

```
d3.csv("ages.csv").then(data =>{
    console.log(data);

    data.forEach(function(d){
        d.age = Number(d.age);
    });

    console.log(data);

    let rects = d3.select("svg")
                  .selectAll("rect")
                  .data(data);

    rects.enter()
         .append("rect")
         .attr("x", 0)
         .attr("y", function(d, i){
             return i*15;
         })
         .attr("width", function(d, i){
             return d.age * 5;
         })
         .attr("height", 10)
         .attr("fill", function(d, i){
             if( d.name === "Jessica"){
                 return "red";
             }else{
                 return "blue";
             }
         });
    }
).catch(function(error){
    console.log(error);
});
```

Load External File (old version)

- Before v5.x (callback)
  - You might see the following code to load external file

```
d3.csv("ages.csv", function(data){
                //code to process data
})
```