Basic Shape

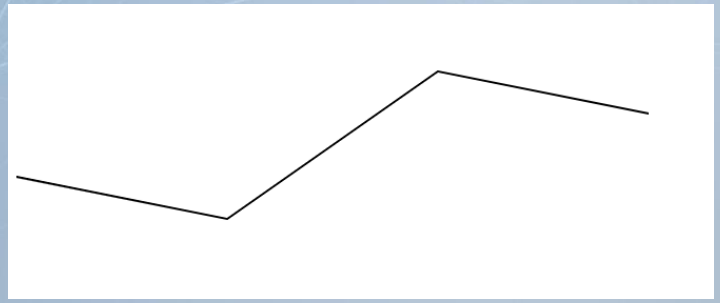
Data Visualization

D3 Shape Document

- https://github.com/d3/d3-shape/tree/v2.1.0

Line – Line Generator (Ex05-01)

- To have lines/curve on the svg, you need “path”
- **d3.line()** can generate path format for us



x y

```
var points = [
  [0, 80],
  [100, 100],
  [200, 30],
  [300, 50],
  [400, 40],
  [500, 80],
];
```

Unit: pixel

```
var lineGenerator = d3.line();
//var lineGenerator = d3.line().curve(d3.curveCardinal);
var pathData = lineGenerator(points);
console.log(pathData);
const svg = d3.select("#chart-area").append("svg")
              .append('path')
              .attr('d', pathData)
              .attr('fill', 'none')
              .attr('stroke', 'black');
```

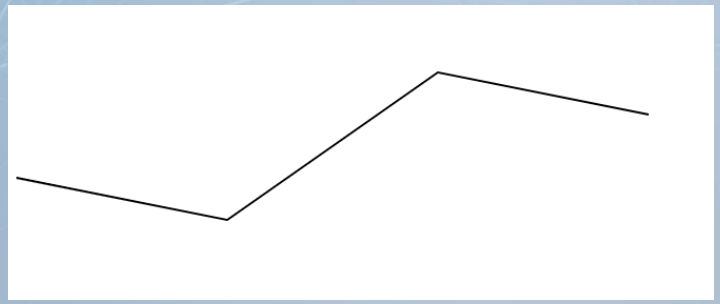
Line – Line Generator (Ex05-01)

- Create a line generator by d3.line()
- Path the x, y points to it. It will return ‘path format’ to you

```
M0,80L100,100L200,30L300,50L400,40L500,80
>
```

These two lines can be replaced by

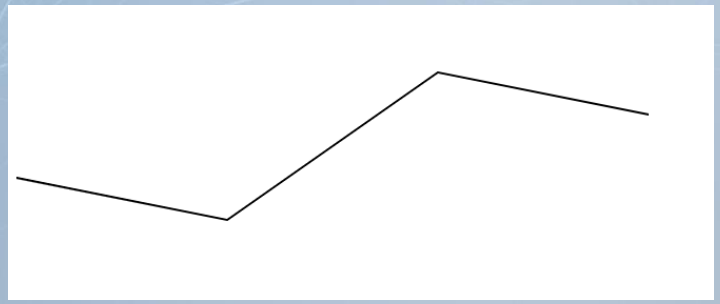
var pathData = d3.line()(points)



```
var points = [
  [0, 80],
  [100, 100],
  [200, 30],
  [300, 50],
  [400, 40],
  [500, 80],
];

var lineGenerator = d3.line();
//var lineGenerator = d3.line().curve(d3.curveCardinal);
var pathData = lineGenerator(points);
console.log(pathData);
const svg = d3.select("#chart-area").append("svg")
              .append('path')
              .attr('d', pathData)
              .attr('fill', 'none')
              .attr('stroke', 'black');
```

Line – Line Generator (Ex05-01)

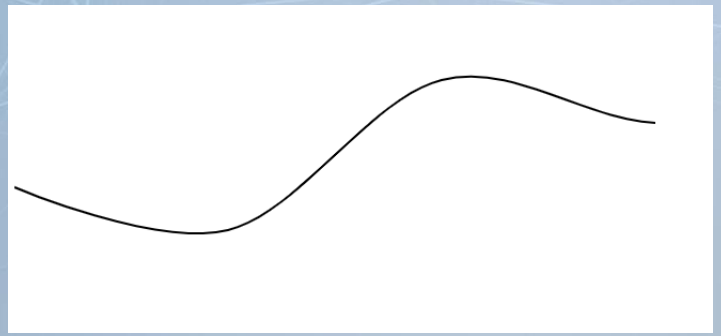
- We draw a ‘path’ on svg by assigning ‘pathData’ to ‘d’ attribute of the path



```
var points = [
  [0, 80],
  [100, 100],
  [200, 30],
  [300, 50],
  [400, 40],
  [500, 80],
];

var lineGenerator = d3.line();
//var lineGenerator = d3.line().curve(d3.curveCardinal);
var pathData = lineGenerator(points);
console.log(pathData);
const svg = d3.select("#chart-area").append("svg")
              .append('path')
              .attr('d', pathData)
              .attr('fill', 'none')
              .attr('stroke', 'black');
```

Line – Line Generator (Ex05-01)

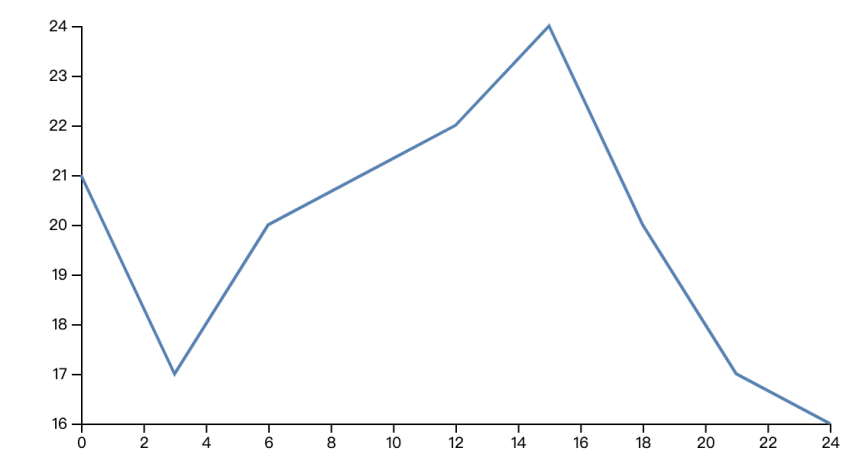
- What if you want a ‘curve’
  - d3.line().curve(curveType)
  - Example: curveType -> d3.curveCardinal
  - More: http://bl.ocks.org/d3indepth/raw/b6d4845973089bc1012dec1674d3aff8/



```
var points = [
  [0, 80],
  [100, 100],
  [200, 30],
  [300, 50],
  [400, 40],
  [500, 80],
];

var lineGenerator = d3.line();
//var lineGenerator = d3.line().curve(d3.curveCardinal);
var pathData = lineGenerator(points);
console.log(pathData);
const svg = d3.select("#chart-area").append("svg")
              .append('path')
              .attr('d', pathData)
              .attr('fill', 'none')
              .attr('stroke', 'black');
```

Ex05-02

- Draw a line chart by data (the unit of the data is not pixels)




```
var data = [
  {'hour': 0, 'temperature': 21},
  {'hour': 3, 'temperature': 17},
  {'hour': 6, 'temperature': 20},
  {'hour': 9, 'temperature': 21},
  {'hour': 12, 'temperature': 22},
  {'hour': 15, 'temperature': 24},
  {'hour': 18, 'temperature': 20},
  {'hour': 21, 'temperature': 17},
  {'hour': 24, 'temperature': 16},
];
```

Ex05-02

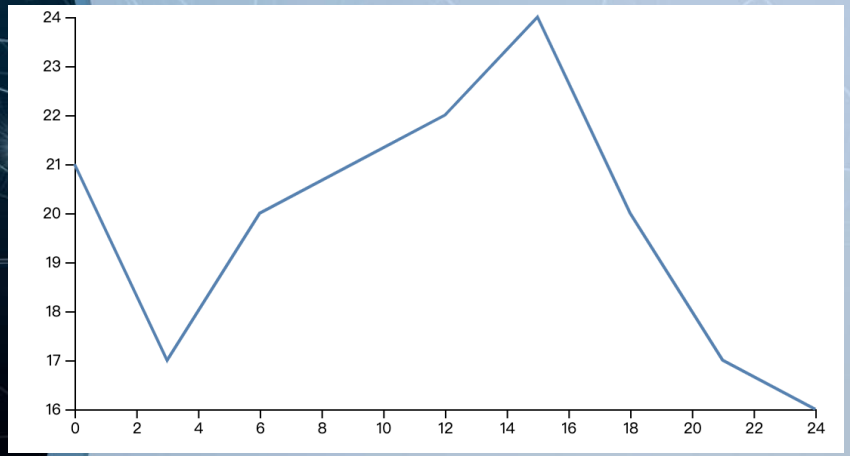
- main.js
  - Set the layout of the plotting area
  - Append a svg
  - Create x, y scale function
  - Use the x and y scale function to append the x and y axis

- The above steps are the same as Ex04-16

```
const MARGIN = { LEFT: 100, RIGHT: 10, TOP: 10, BOTTOM: 130 }
const WIDTH = 600 - MARGIN.LEFT - MARGIN.RIGHT
const HEIGHT = 400 - MARGIN.TOP - MARGIN.BOTTOM

const svg = d3.select("#chart-area").append("svg")
              .attr("width", WIDTH + MARGIN.LEFT + MARGIN.RIGHT)
              .attr("height", HEIGHT + MARGIN.TOP + MARGIN.BOTTOM)

const g = svg.append("g")
             .attr("transform", `translate(${MARGIN.LEFT}, ${MARGIN.TOP})`)

var xScale = d3.scaleLinear()
               .domain(d3.extent(data, d=>d.hour))
               .range([0, WIDTH]);

var yScale = d3.scaleLinear()
               .domain(d3.extent(data, d=>d.temperature))
               .range([HEIGHT, 0]);

g.append("g")
  .attr("transform", "translate(0," + HEIGHT + ")")
  .call(d3.axisBottom(xScale));

g.append("g")
    .call(d3.axisLeft(yScale));
```

Ex05-02

- main.js
- When creating the line generator, we use .x() and .y() to indicate how to get the x locations and y locations in pixel if the data is passed to the line generator **later**

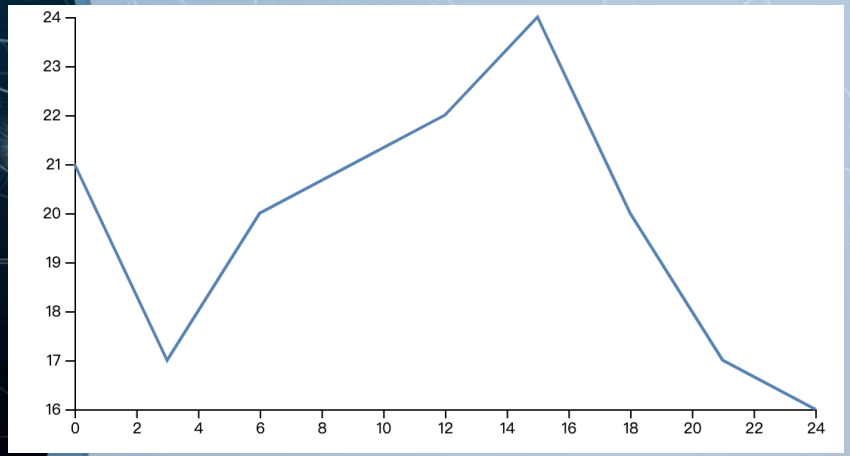



```
var lineGenerator = d3.line()
                      .x(d=>xScale(d.hour))
                      .y(d=>yScale(d.temperature));

g.append("path")
  .attr("fill", "none")
  .attr("stroke", "steelblue")
  .attr("stroke-width", 2)
  .attr("d", lineGenerator(data));
```

later

Ex05-02

- main.js
- Example: when the lineGenerator receives the data, it iterates through the data and calculate all “xScale(d.hour)” as the x locations of the line chart



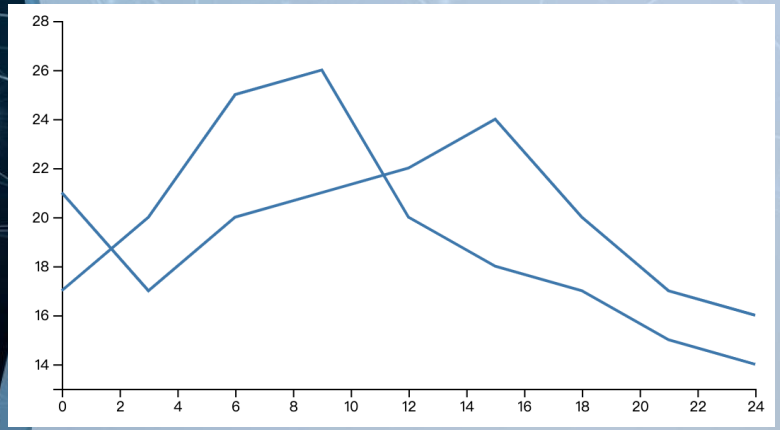

```
var data = [
  {'hour': 0, 'temperature': 21},
  {'hour': 3, 'temperature': 17},
  {'hour': 6, 'temperature': 20},
  {'hour': 9, 'temperature': 21},
  {'hour': 12, 'temperature': 22},
  {'hour': 15, 'temperature': 24},
  {'hour': 18, 'temperature': 20},
  {'hour': 21, 'temperature': 17},
  {'hour': 24, 'temperature': 16},
];
```

```
var lineGenerator = d3.line()
                      .x(d=>xScale(d.hour))
                      .y(d=>yScale(d.temperature));

g.append("path")
  .attr("fill", "none")
  .attr("stroke", "steelblue")
  .attr("stroke-width", 2)
  .attr("d", lineGenerator(data));
```

Ex05-02Ext (Multiple Lines)

- main.js
- data: array with two elements and each one is an array of dictionary
- Visualize each array of dictionary by one line

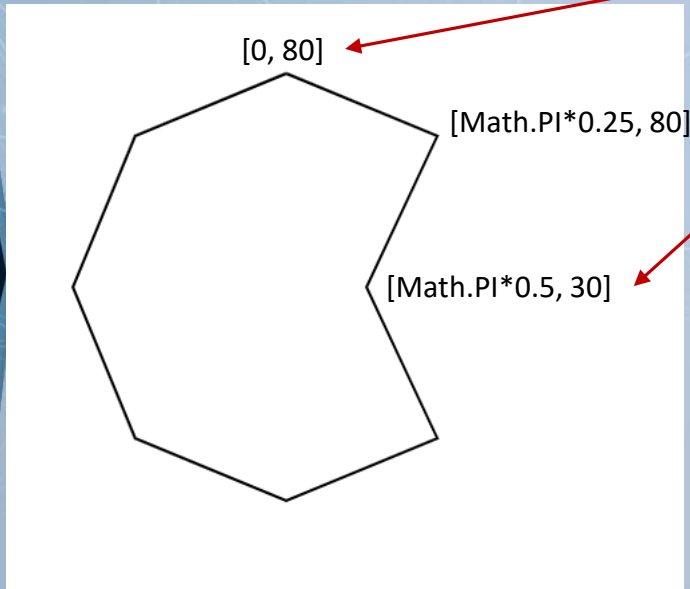
```
var data = [
  [{'hour': 0, 'temperature': 21},  {'hour': 3, 'temperature': 17},
  {'hour': 6, 'temperature': 20},  {'hour': 9, 'temperature': 21},
  {'hour': 12, 'temperature': 22}, {'hour': 15, 'temperature': 24},
  {'hour': 18, 'temperature': 20}, {'hour': 21, 'temperature': 17},
  {'hour': 24, 'temperature': 16}],

  [{'hour': 0, 'temperature': 17},  {'hour': 3, 'temperature': 20},
  {'hour': 6, 'temperature': 25},  {'hour': 9, 'temperature': 26},
  {'hour': 12, 'temperature': 20}, {'hour': 15, 'temperature': 18},
  {'hour': 18, 'temperature': 17}, {'hour': 21, 'temperature': 15},
  {'hour': 24, 'temperature': 14}]
];
```




```
var lineGenerator = d3.line()
                      .x(d=>xScale(d.hour))
                      .y(d=>yScale(d.temperature));

g.selectAll(".line")
  .data(data)
  .enter().append("path")
  .attr("fill", "none")
  .attr("stroke", "steelblue")
  .attr("stroke-width", 2)
  .attr("d", d=>lineGenerator(d))
```

Radial Line – d3.radialLine()

- Ex05-03
- The radial line generator is similar to the line generator but the points are formed by angle in radians(clockwise) and radius
  - Application: radar graphs
- https://github.com/d3/d3-shape/blob/v2.1.0/README.md#lineRadial



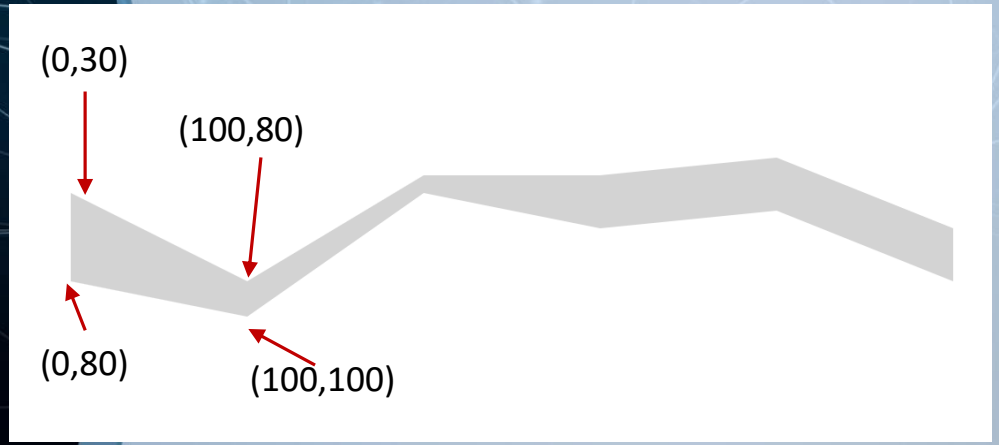

```
var points = [
  [0, 80],
  [Math.PI * 0.25, 80],
  [Math.PI * 0.5, 30],
  [Math.PI * 0.75, 80],
  [Math.PI, 80],
  [Math.PI * 1.25, 80],
  [Math.PI * 1.5, 80],
  [Math.PI * 1.75, 80],
  [Math.PI * 2, 80]
];
var radialLineGenerator = d3.radialLine();
var pathData = radialLineGenerator(points);
const svg = d3.select("#chart-area")
              .append("svg")
              .attr('width', 600).attr('height', 600)
              .append('g')
              .attr("transform", "translate(100,100)")
              .append('path')
              .attr('d', pathData)
              .attr('fill', 'none')
              .attr('stroke', 'black');
```

Angle in radians

radius

Area – d3.area()

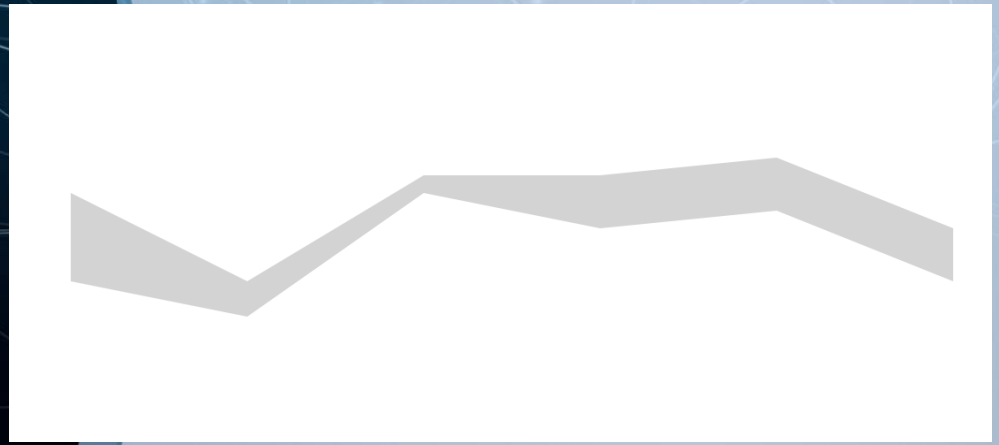
- Ex05-04
- The area generator ouptus path that defines an area between two lines
  - Data can be encoded into coordinates on the two lines
  - Application: stream graph, filled line chart
  - https://github.com/d3/d3-shape/blob/v2.1.0/README.md#area




```
var points = [
  {x: 0, y0: 30, y1: 80},
  {x: 100, y0: 80, y1: 100},
  {x: 200, y0: 20, y1: 30},
  {x: 300, y0: 20, y1: 50},
  {x: 400, y0: 10, y1: 40},
  {x: 500, y0: 50, y1: 80}
];

var areaGenerator = d3.area()
                      .x(d=>d.x)
                      .y0(d=>d.y0)
                      .y1(d=>d.y1);
var pathData = areaGenerator(points);
const svg = d3.select("#chart-area")
              .append("svg")
              .attr('width', 600).attr('height', 600)
              .append('g')
              .attr("transform", "translate(100,100)")
              .append('path')
              .attr('d', pathData)
              .attr('fill', 'lightgrey');
```

Area – d3.area()

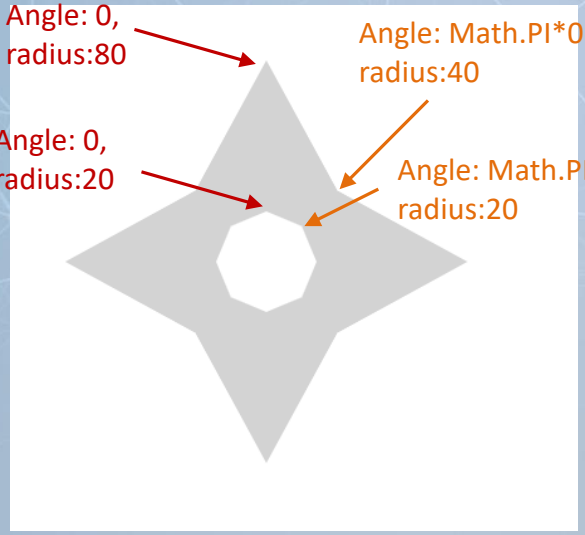
- Ex05-04
- .x(), .y0(), .y1() to indicate the format of the data



```
var points = [
  {x: 0, y0: 30, y1: 80},
  {x: 100, y0: 80, y1: 100},
  {x: 200, y0: 20, y1: 30},
  {x: 300, y0: 20, y1: 50},
  {x: 400, y0: 10, y1: 40},
  {x: 500, y0: 50, y1: 80}
];

var areaGenerator = d3.area()
                      .x(d=>d.x)
                      .y0(d=>d.y0)
                      .y1(d=>d.y1);
var pathData = areaGenerator(points);
const svg = d3.select("#chart-area")
              .append("svg")
              .attr('width', 600).attr('height', 600)
              .append('g')
              .attr("transform", "translate(100,100)")
              .append('path')
              .attr('d', pathData)
              .attr('fill', 'lightgrey');
```

Radial Area – d3.radialArea()

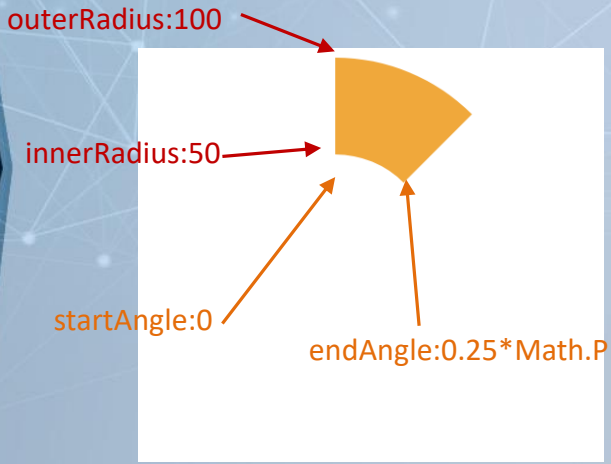
- Ex05-05
- The radial area generator is similar to the area generator but the points are formed by angle in radians(clockwise) and radius
  - Application: filled radar graphs
  - https://github.com/d3/d3-shape/blob/v2.1.0/README.md#areaRadial




```
var points = [
  {angle: 0, r0: 20, r1: 80},
  {angle: Math.PI * 0.25, r0: 20, r1: 40},
  {angle: Math.PI * 0.5, r0: 20, r1: 80},
  {angle: Math.PI * 0.75, r0: 20, r1: 40},
  {angle: Math.PI, r0: 20, r1: 80},
  {angle: Math.PI * 1.25, r0: 20, r1: 40},
  {angle: Math.PI * 1.5, r0: 20, r1: 80},
  {angle: Math.PI * 1.75, r0: 20, r1: 40},
  {angle: Math.PI * 2, r0: 20, r1: 80}
];

var radialAreaGenerator = d3.radialArea()
                            .angle(d=>d.angle)
                            .innerRadius(d=>d.r0)
                            .outerRadius(d=>d.r1);
var pathData = radialAreaGenerator(points);
const svg = d3.select("#chart-area")
              .append("svg")
              .attr('width', 600).attr('height', 600)
              .append('g')
              .attr("transform", "translate(100,100)")
              .append('path')
              .attr('d', pathData)
              .attr('fill', 'lightgrey');
```

Arc – d3.arc()

- Ex05-06
- Arc generator produce path data from **angle** and **radius** values
  - Application: pie chart
- https://github.com/d3/d3-shape/blob/v2.1.0/README.md#arc

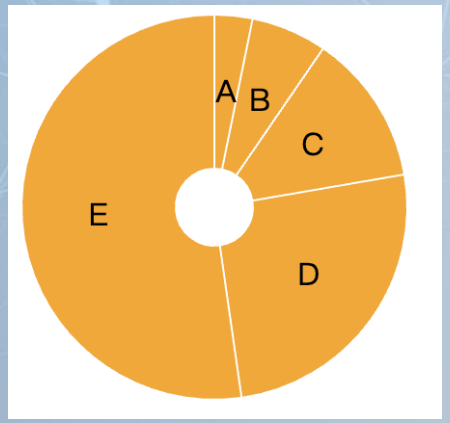


A dictionary for an arc

```
var data = {
  startAngle: 0,
  endAngle: 0.25 * Math.PI,
  innerRadius: 50,
  outerRadius: 100
};

var arcGenerator = d3.arc();
var pathData = arcGenerator(data);
const svg = d3.select("#chart-area")
              .append("svg")
              .attr('width', 600).attr('height', 600)
              .append('g')
              .attr("transform", "translate(100,100)")
              .append('path')
              .attr('d', pathData)
              .attr('fill', 'orange');
```

Pie Chart – Multiple Arcs

- Ex05-07




```
var data = [
  {label: 'A', startAngle: 0, endAngle: 0.2},
  {label: 'B', startAngle: 0.2, endAngle: 0.6},
  {label: 'C', startAngle: 0.6, endAngle: 1.4},
  {label: 'D', startAngle: 1.4, endAngle: 3},
  {label: 'E', startAngle: 3, endAngle: 2* Math.PI}
];
```

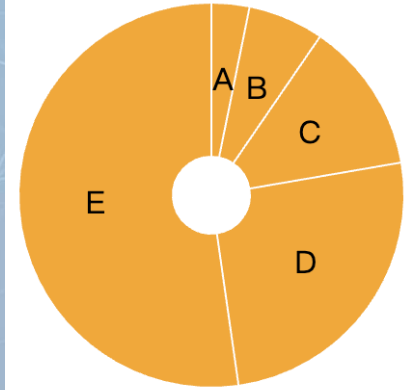
Dictionary array: an arc is a dictionary

```
var arcGenerator = d3.arc()
                     .innerRadius(20)
                     .outerRadius(100);

const svg = d3.select("#chart-area")
              .append("svg")
              .attr('width', 600).attr('height', 600);
const g = svg.append('g')
              .attr("transform", "translate(100,100)");

g.selectAll('path')
    .data(data)
    .enter()
    .append('path')
    .attr('d', arcGenerator)
    .attr('fill', 'orange')
    .attr('stroke', 'white');

g.selectAll('text')
  .data(data)
  .enter()
  .append('text')
  .each(function(d) {
    var centroid = arcGenerator.centroid(d);
    d3.select(this)
      .attr('x', centroid[0])
      .attr('y', centroid[1])
      .attr('dx', '-0.33em')
      .attr('dy', '0.33em')
      .text(d.label);
  });
```

Pie Chart – Multiple Arcs

- Ex05-07

This is an alternative way to assign the inner and outer radius of arcs if they are all the same

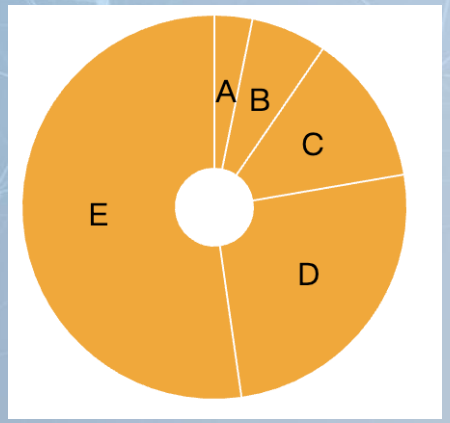



```
var data = [
  {label: 'A', startAngle: 0, endAngle: 0.2},
  {label: 'B', startAngle: 0.2, endAngle: 0.6},
  {label: 'C', startAngle: 0.6, endAngle: 1.4},
  {label: 'D', startAngle: 1.4, endAngle: 3},
  {label: 'E', startAngle: 3, endAngle: 2* Math.PI}
];

var arcGenerator = d3.arc()
                     .innerRadius(20)
                     .outerRadius(100);

const svg = d3.select("#chart-area")
              .append("svg")
              .attr('width', 600).attr('height', 600);
const g = svg.append('g')
              .attr("transform", "translate(100,100)");

g.selectAll('path')
    .data(data)
    .enter()
    .append('path')
    .attr('d', arcGenerator)
    .attr('fill', 'orange')
    .attr('stroke', 'white');

g.selectAll('text')
  .data(data)
  .enter()
  .append('text')
  .each(function(d) {
    var centroid = arcGenerator.centroid(d);
    d3.select(this)
      .attr('x', centroid[0])
      .attr('y', centroid[1])
      .attr('dx', '-0.33em')
      .attr('dy', '0.33em')
      .text(d.label);
  });
```

Pie Chart – Multiple Arcs

- Ex05-07

Append <svg> and <g>. We will draw the pie chart in ‘g’




```
var data = [
  {label: 'A', startAngle: 0, endAngle: 0.2},
  {label: 'B', startAngle: 0.2, endAngle: 0.6},
  {label: 'C', startAngle: 0.6, endAngle: 1.4},
  {label: 'D', startAngle: 1.4, endAngle: 3},
  {label: 'E', startAngle: 3, endAngle: 2* Math.PI}
];

var arcGenerator = d3.arc()
                     .innerRadius(20)
                     .outerRadius(100);

const svg = d3.select("#chart-area")
              .append("svg")
              .attr('width', 600).attr('height', 600);
const g = svg.append('g')
              .attr("transform", "translate(100,100)");

g.selectAll('path')
    .data(data)
    .enter()
    .append('path')
    .attr('d', arcGenerator)
    .attr('fill', 'orange')
    .attr('stroke', 'white');

g.selectAll('text')
  .data(data)
  .enter()
  .append('text')
  .each(function(d) {
    var centroid = arcGenerator.centroid(d);
    d3.select(this)
      .attr('x', centroid[0])
      .attr('y', centroid[1])
      .attr('dx', '-0.33em')
      .attr('dy', '0.33em')
      .text(d.label);
  });
```

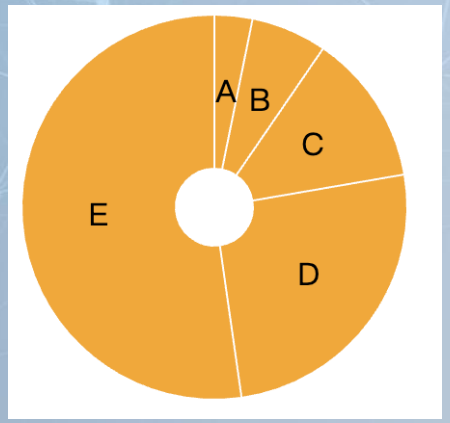
Pie Chart – Multiple Arcs

- Ex05-07

Draw the pie chart (without texts)

Assign out data to let d3 know we have 5 elements

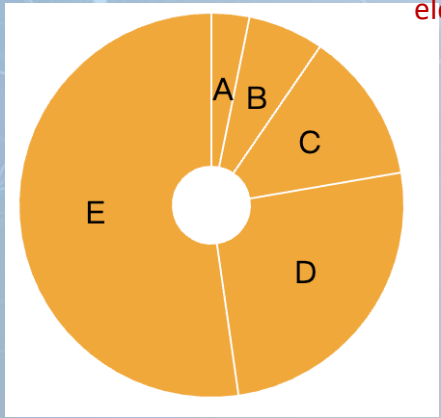
The data element is fed to 'arcGenerator' to generate path of an arc




```
var data = [
  {label: 'A', startAngle: 0, endAngle: 0.2},
  {label: 'B', startAngle: 0.2, endAngle: 0.6},
  {label: 'C', startAngle: 0.6, endAngle: 1.4},
  {label: 'D', startAngle: 1.4, endAngle: 3},
  {label: 'E', startAngle: 3, endAngle: 2* Math.PI}
];

var arcGenerator = d3.arc()
                     .innerRadius(20)
                     .outerRadius(100);

const svg = d3.select("#chart-area")
              .append("svg")
              .attr('width', 600).attr('height', 600);
const g = svg.append('g')
             .attr("transform", "translate(100,100)");

g.selectAll('path')
   .data(data)
   .enter()
   .append('path')
   .attr('d', arcGenerator)
   .attr('fill', 'orange')
   .attr('stroke', 'white');

g.selectAll('text')
  .data(data)
  .enter()
  .append('text')
  .each(function(d) {
    var centroid = arcGenerator.centroid(d);
    d3.select(this)
      .attr('x', centroid[0])
      .attr('y', centroid[1])
      .attr('dx', '-0.33em')
      .attr('dy', '0.33em')
      .text(d.label);
  });
```

Pie Chart – Multiple Arcs

- Ex05-07



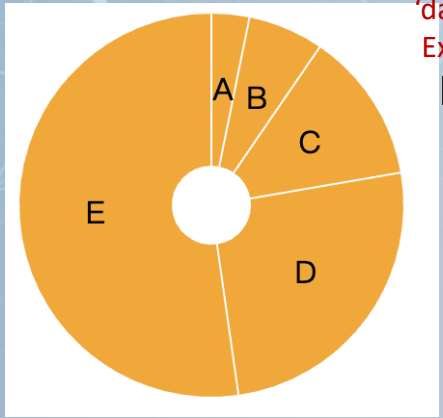
Draw texts

We will append 5 texts
(why d3 knows? We have 5 elements in the data array)

```
var data = [
  {label: 'A', startAngle: 0, endAngle: 0.2},
  {label: 'B', startAngle: 0.2, endAngle: 0.6},
  {label: 'C', startAngle: 0.6, endAngle: 1.4},
  {label: 'D', startAngle: 1.4, endAngle: 3},
  {label: 'E', startAngle: 3, endAngle: 2* Math.PI}
];

var arcGenerator = d3.arc()
                     .innerRadius(20)
                     .outerRadius(100);

const svg = d3.select("#chart-area")
              .append("svg")
              .attr('width', 600).attr('height', 600);
const g = svg.append('g')
             .attr("transform", "translate(100,100)");

g.selectAll('path')
    .data(data)
    .enter()
    .append('path')
    .attr('d', arcGenerator)
    .attr('fill', 'orange')
    .attr('stroke', 'white');

g.selectAll('text')
  .data(data)
  .enter()
  .append('text')
  .each(function(d) {
    var centroid = arcGenerator.centroid(d);
    d3.select(this)
      .attr('x', centroid[0])
      .attr('y', centroid[1])
      .attr('dx', '-0.33em')
      .attr('dy', '0.33em')
      .text(d.label);
  });
```

Pie Chart – Multiple Arcs

- Ex05-07



Iterate through all ‘d’.
What is d? an element in ‘data’.
Example:

```
▸ {label: "A", startAngle: 0, endAngle: 0.2}
```

Draw texts

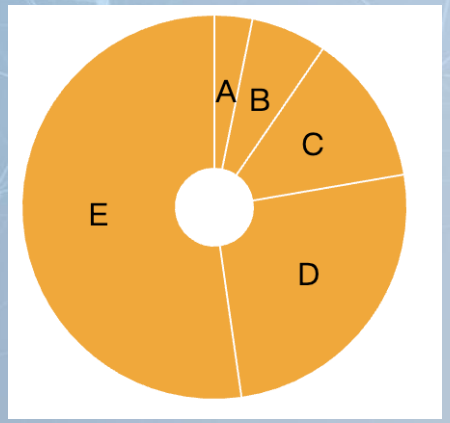
```
var data = [
  {label: 'A', startAngle: 0, endAngle: 0.2},
  {label: 'B', startAngle: 0.2, endAngle: 0.6},
  {label: 'C', startAngle: 0.6, endAngle: 1.4},
  {label: 'D', startAngle: 1.4, endAngle: 3},
  {label: 'E', startAngle: 3, endAngle: 2* Math.PI}
];

var arcGenerator = d3.arc()
                     .innerRadius(20)
                     .outerRadius(100);

const svg = d3.select("#chart-area")
              .append("svg")
              .attr('width', 600).attr('height', 600);
const g = svg.append('g')
             .attr("transform", "translate(100,100)");

g.selectAll('path')
    .data(data)
    .enter()
    .append('path')
    .attr('d', arcGenerator)
    .attr('fill', 'orange')
    .attr('stroke', 'white');

g.selectAll('text')
  .data(data)
  .enter()
  .append('text')
  .each(function(d) {
    var centroid = arcGenerator.centroid(d);
    d3.select(this)
      .attr('x', centroid[0])
      .attr('y', centroid[1])
      .attr('dx', '-0.33em')
      .attr('dy', '0.33em')
      .text(d.label);
  });
```

Pie Chart – Multiple Arcs

- Ex05-07

Pass the element in 'data' to arcGenerator and get the centroid of it

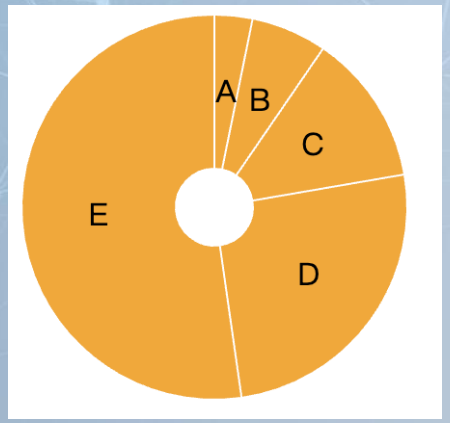
Draw texts




```
var data = [
  {label: 'A', startAngle: 0, endAngle: 0.2},
  {label: 'B', startAngle: 0.2, endAngle: 0.6},
  {label: 'C', startAngle: 0.6, endAngle: 1.4},
  {label: 'D', startAngle: 1.4, endAngle: 3},
  {label: 'E', startAngle: 3, endAngle: 2* Math.PI}
];

var arcGenerator = d3.arc()
                     .innerRadius(20)
                     .outerRadius(100);

const svg = d3.select("#chart-area")
              .append("svg")
              .attr('width', 600).attr('height', 600);
const g = svg.append('g')
             .attr("transform", "translate(100,100)");

g.selectAll('path')
    .data(data)
    .enter()
    .append('path')
    .attr('d', arcGenerator)
    .attr('fill', 'orange')
    .attr('stroke', 'white');

g.selectAll('text')
  .data(data)
  .enter()
  .append('text')
  .each(function(d) {
    var centroid = arcGenerator.centroid(d);
    d3.select(this)
      .attr('x', centroid[0])
      .attr('y', centroid[1])
      .attr('dx', '-0.33em')
      .attr('dy', '0.33em')
      .text(d.label);
  });
```

Pie Chart – Multiple Arcs

- Ex05-07



Draw texts

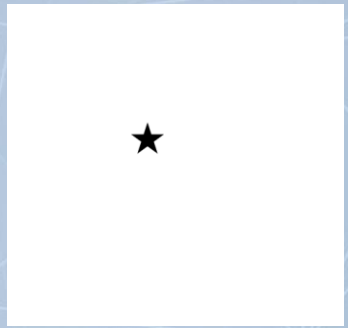
'this'? Current 'text'

Set where the text should be and where it should be

```
var data = [
  {label: 'A', startAngle: 0, endAngle: 0.2},
  {label: 'B', startAngle: 0.2, endAngle: 0.6},
  {label: 'C', startAngle: 0.6, endAngle: 1.4},
  {label: 'D', startAngle: 1.4, endAngle: 3},
  {label: 'E', startAngle: 3, endAngle: 2* Math.PI}
];

var arcGenerator = d3.arc()
                     .innerRadius(20)
                     .outerRadius(100);

const svg = d3.select("#chart-area")
              .append("svg")
              .attr('width', 600).attr('height', 600);
const g = svg.append('g')
              .attr("transform", "translate(100,100)");

g.selectAll('path')
    .data(data)
    .enter()
    .append('path')
    .attr('d', arcGenerator)
    .attr('fill', 'orange')
    .attr('stroke', 'white');

g.selectAll('text')
  .data(data)
  .enter()
  .append('text')
  .each(function(d) {
    var centroid = arcGenerator.centroid(d);
    d3.select(this)
      .attr('x', centroid[0])
      .attr('y', centroid[1])
      .attr('dx', '-0.33em')
      .attr('dy', '0.33em')
      .text(d.label);
  });
```

Symbols – d3.symbol()

- Ex05-08
- The symbol generator generates path for symbols
- https://github.com/d3/d3-shape/tree/v2.1.0#symbols



```
var symbolGenerator = d3.symbol()
                        .size(180)
                        .type(d3.symbolStar);
                        // .type(d3.symbolCross);
                        // .type(d3.symbolDiamond);
                        // .type(d3.symbolSquare);
                        // .type(d3.symbolCircle);
                        // .type(d3.symbolTriangle);
                        // .type(d3.symbolWye);

const svg = d3.select("#chart-area")
              .append("svg")
              .attr('width', 600).attr('height', 600)
              .append('path')
              .attr("transform", "translate(100,100)")
              .attr('d', symbolGenerator())
```