Run `git pull` in the main branch to follow along today.

D3.js (Part 2)

DSC 106: Data Visualization

Sam Lau

UC San Diego

Announcements

Lab 5 due Friday.

Project 3 checkpoint due Tuesday next week.

Project 2 peer grading coming out this week.

FAQs:

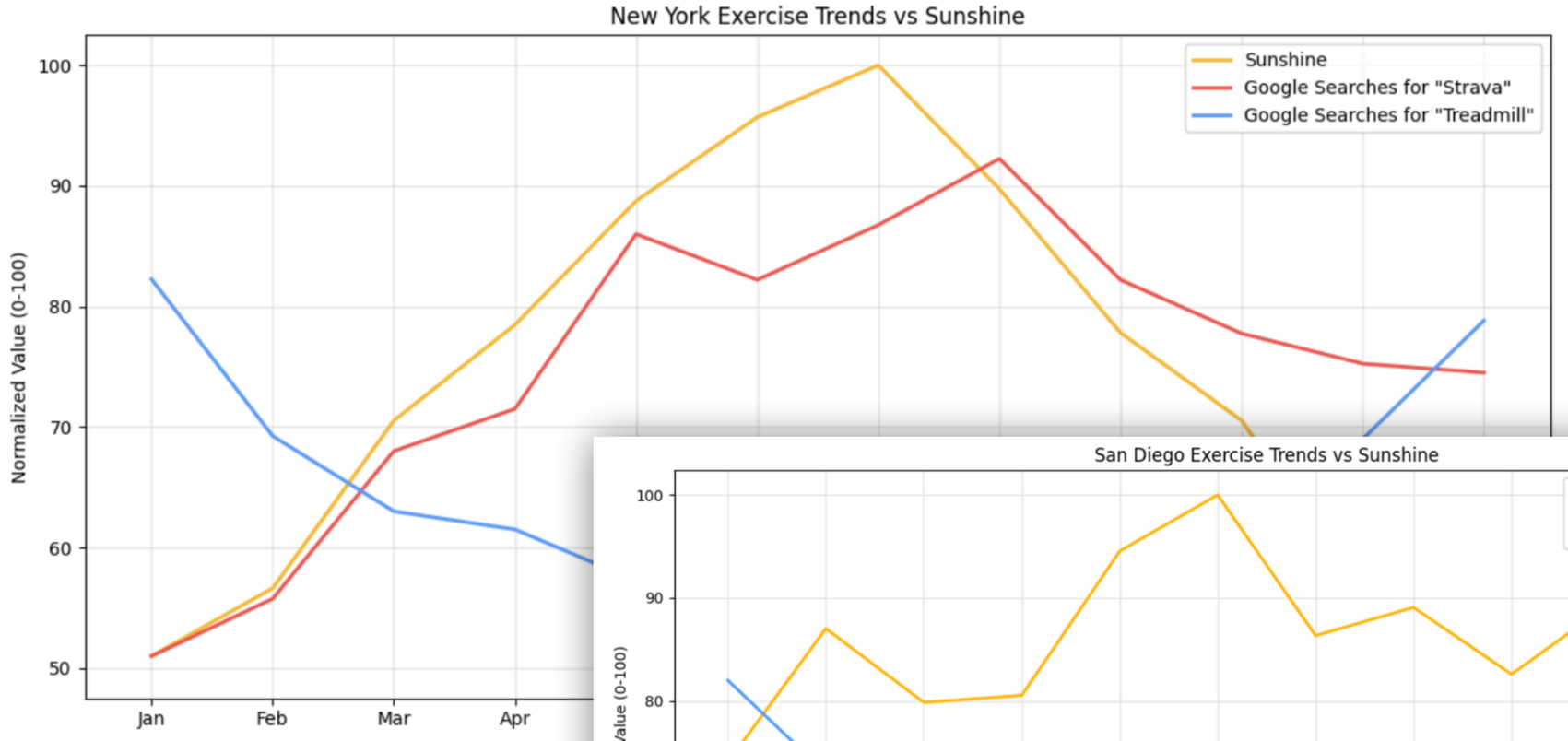
1. **How much time should I allocate for Lab 5?** About 2x your previous labs.
2. **How do I get the Lab 5 extra credit?** Fix the bug described in Step 5.4, then show us the working website in your video.

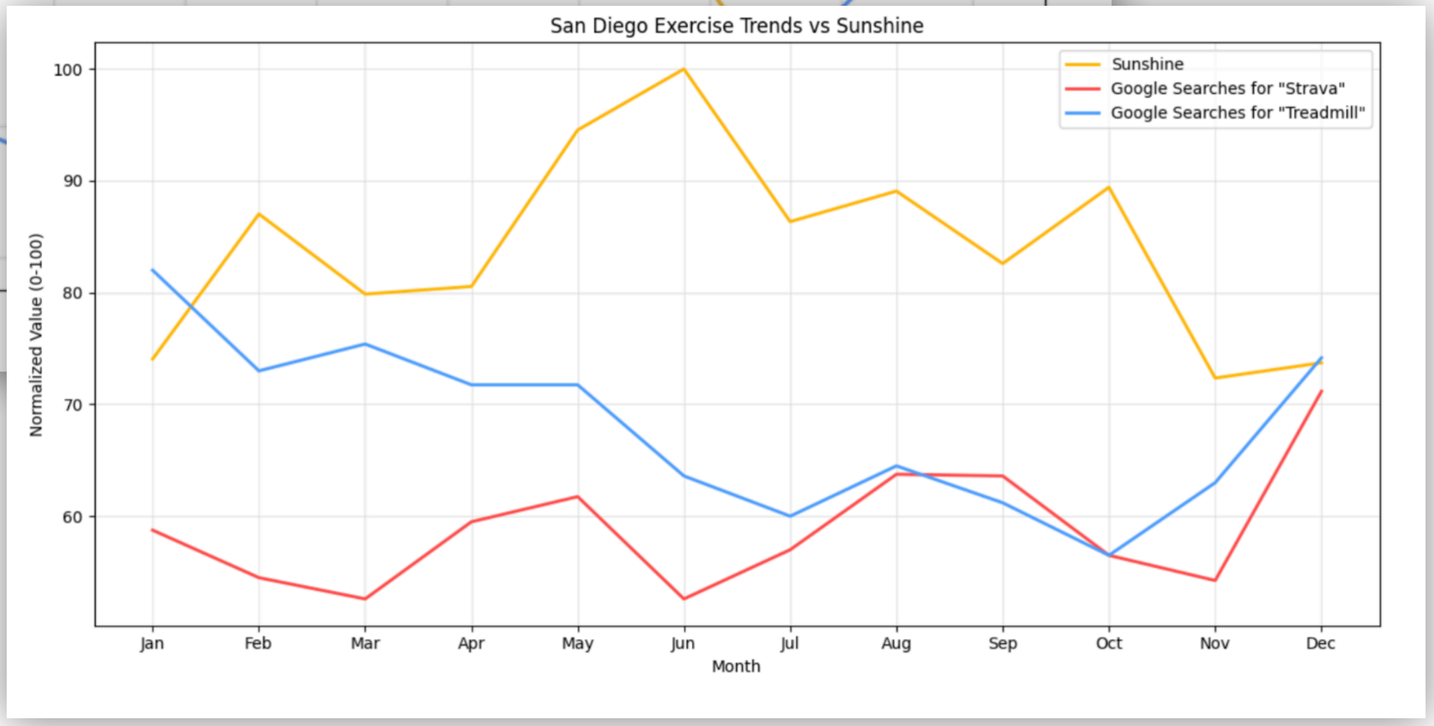
Project 1 Best Project Awards (top 4%)

If you got an award, mention it on your resume / portfolio!

How do Location and Weather Affect Exercise Trends?

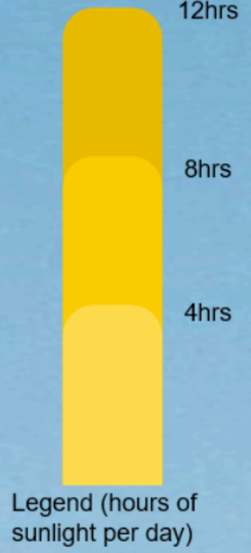
Do extreme weather changes (as well as geographical factors) affect people's preference of forms of physical activity?



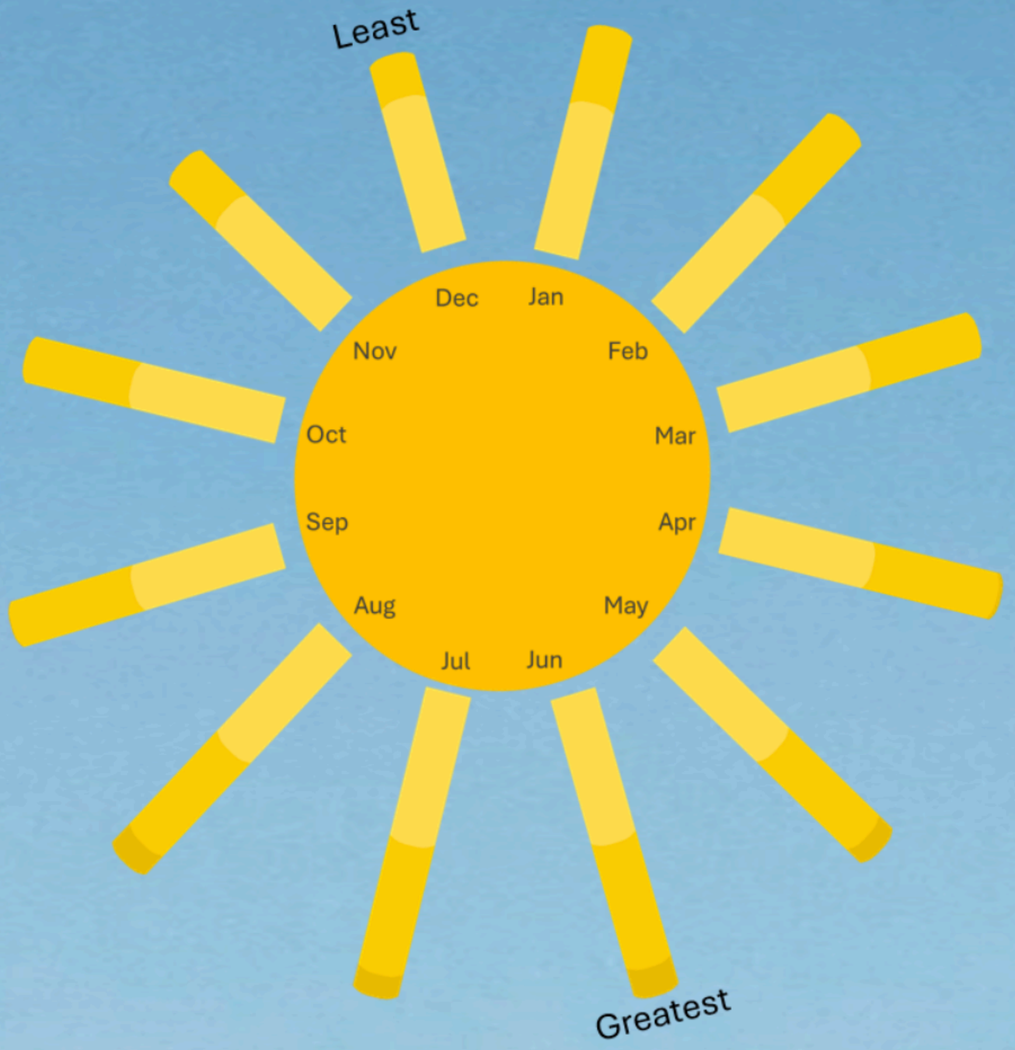


S.W.

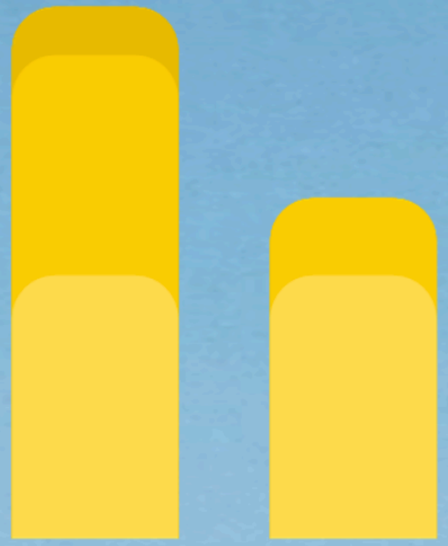
Is there a noticeable difference in sunlight between the months with the least and greatest average hours of sunlight per day?



Legend (hours of sunlight per day)



Comparison between months with greatest and least average hours of sunlight per day



Jun Dec

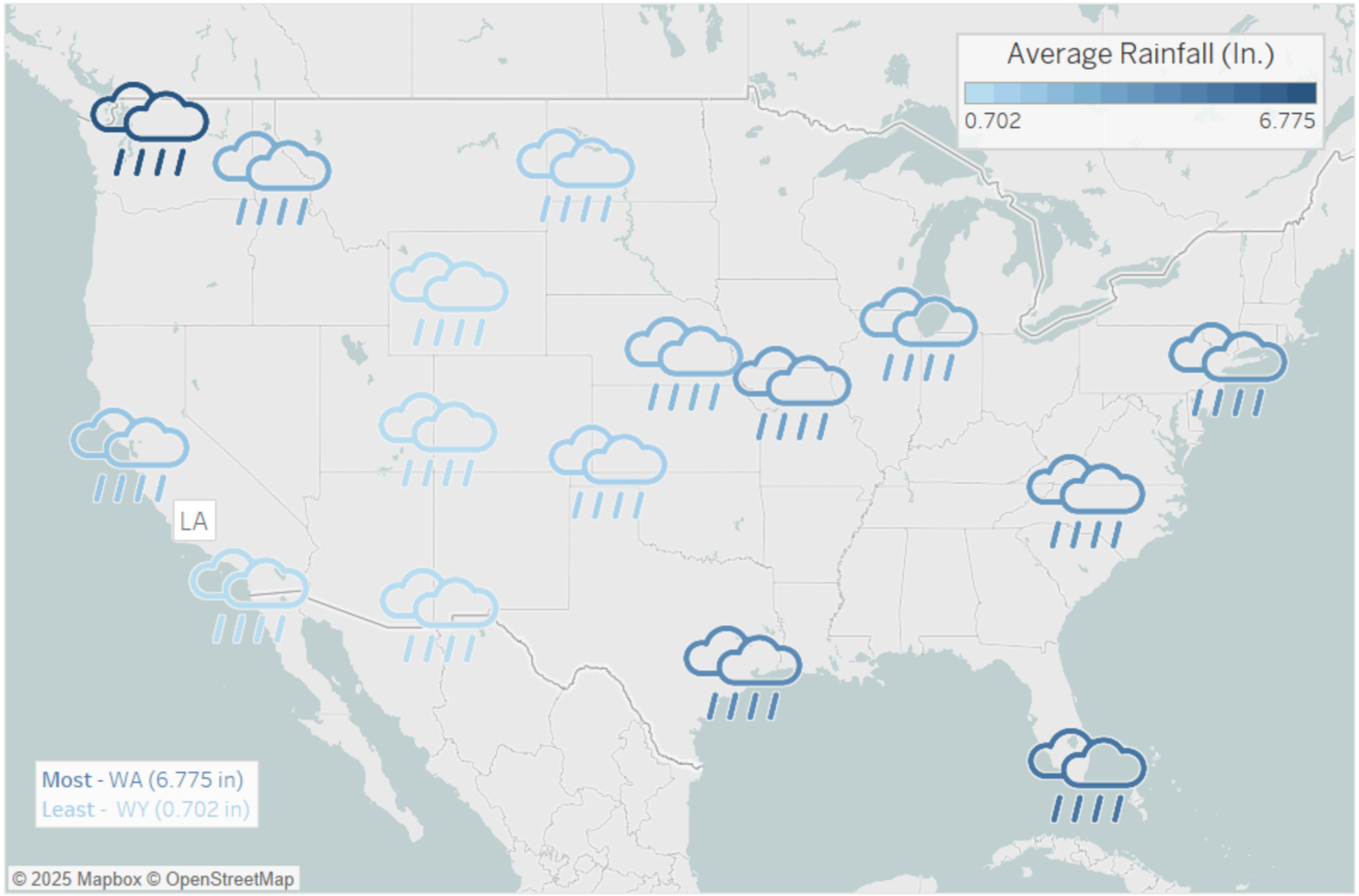
D.H.

Sun Seekers or Rain Romantics: Which Urban Retreat Matches Your Weather Vibe?

N.D.

So, You've Heard About the LA Fires:

How Does Geographic Location Impact Annual Rainfall Patterns Across the U.S.?



NAVIGATING STORMY WEATHER

THE LINK BETWEEN RAINFALL AND CAR ACCIDENTS

MOTIVATING QUESTION

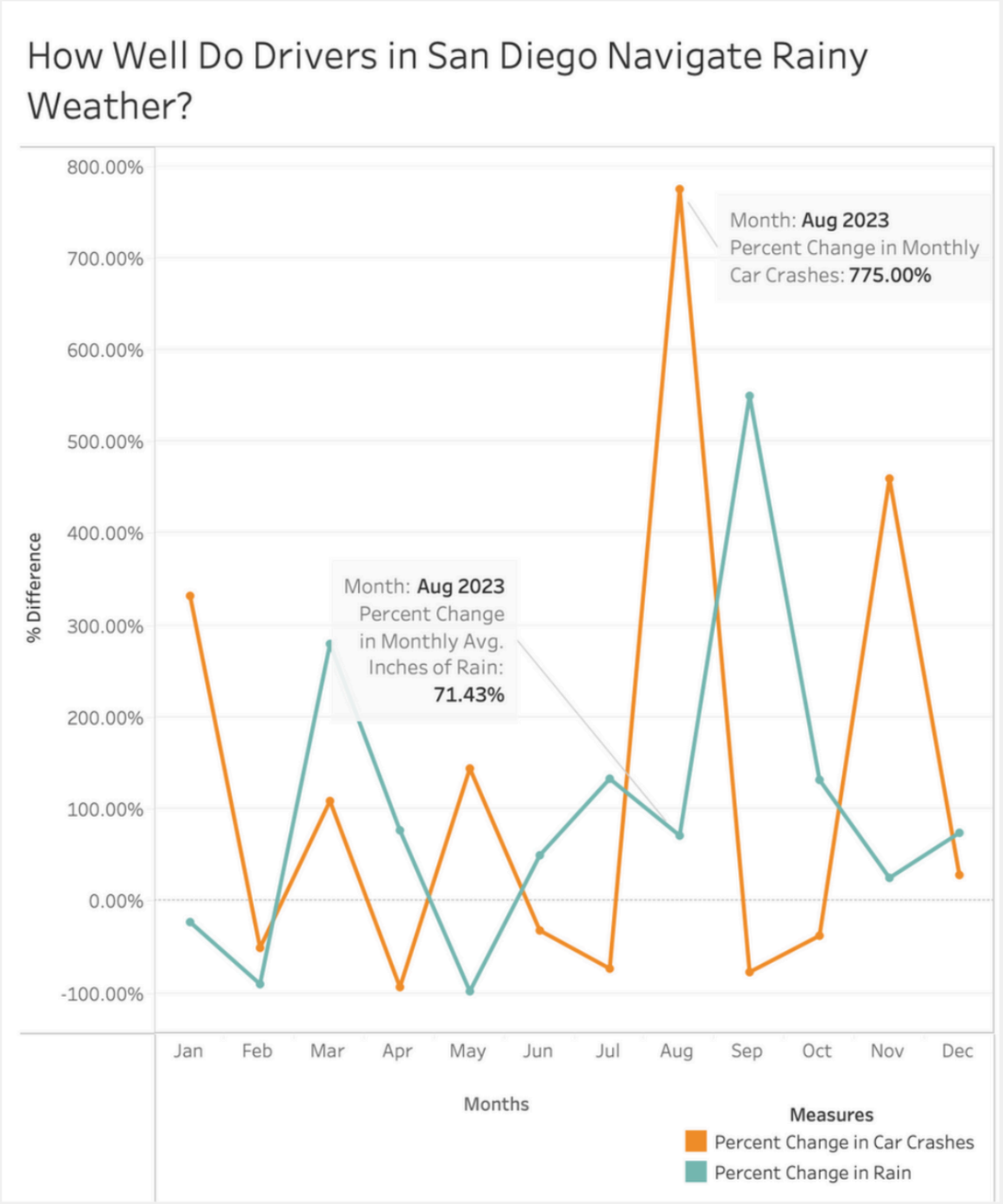
"How Does Rain Impact Car Accident Rates in Areas with Limited Rainfall?"

IMPORTANT BACKGROUND INFO

- Nearly **5,700 people are killed** and more than **544,700 people are injured** in crashes on wet pavement annually.
- Over 3,400 people are killed and over 357,300 people are injured in crashes during rainfall every year.

WHY?

1. Flooding reduces roadway capacity by limiting or preventing access to submerged lanes.
2. Inland flooding, usually following the evolution of a tropical storm or hurricane, has typically been the greatest source of fatalities, and caused the most damage to roadway infrastructure.
3. Rain causes wet pavement, which reduces vehicle traction and maneuverability. Heavy rain also reduces visibility distance. . Rain and wet pavement increase crash risk as well.

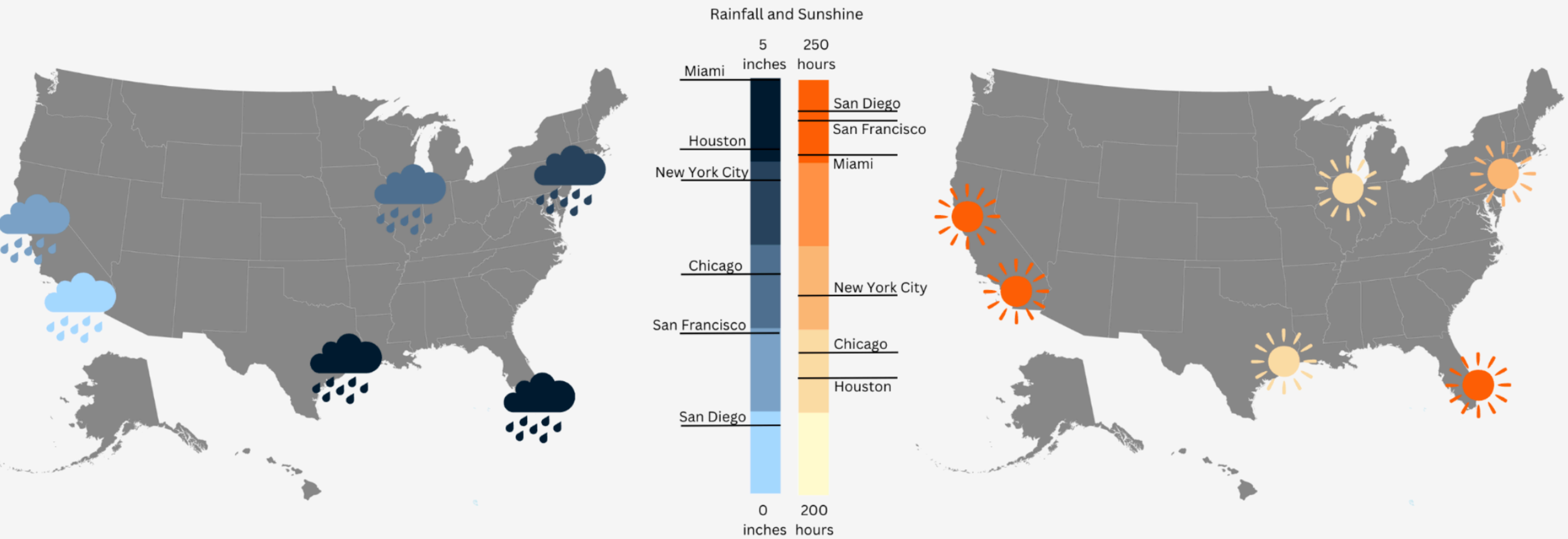


REFERENCES

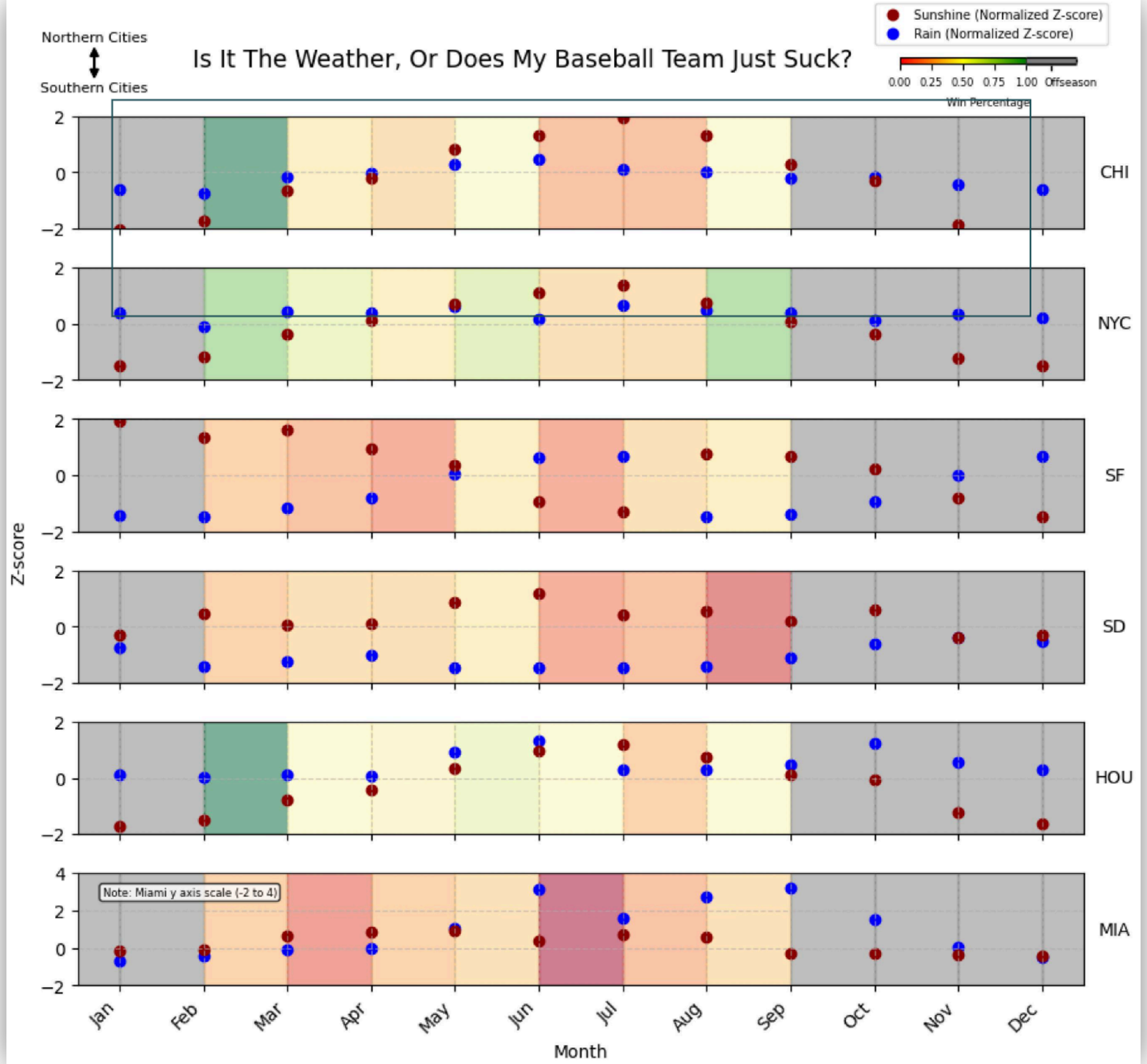
U.S. Department of Transportation: https://www.transportation.gov

K.W.

Rainy Days vs. Sunny Skies: A Year in Major U.S. Cities

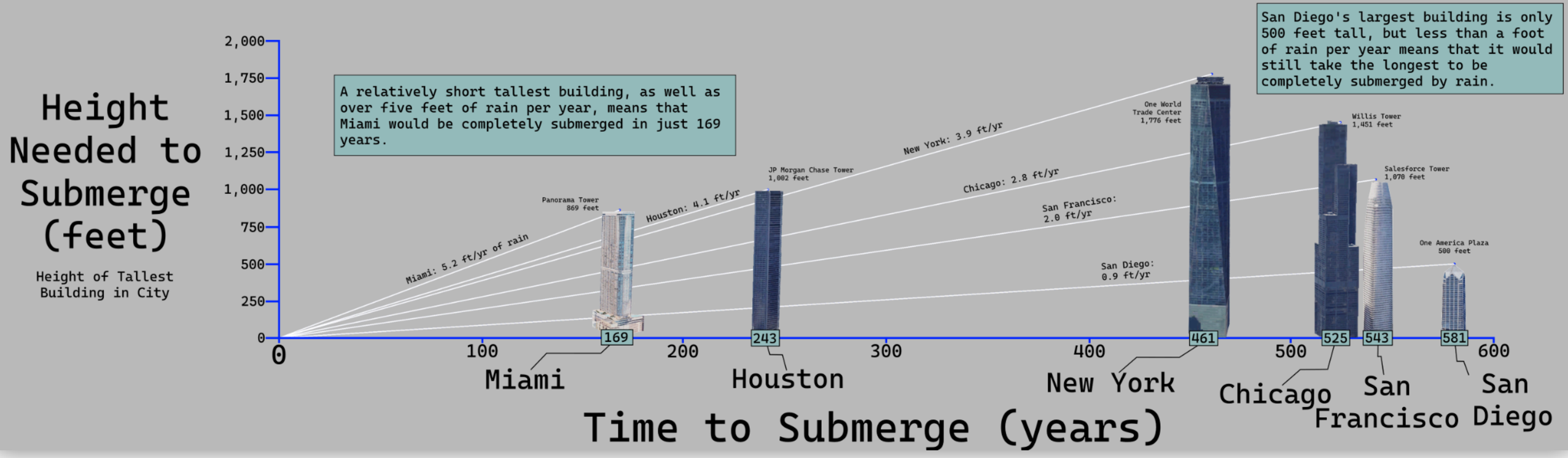


K.Z.


Is It The Weather, Or Does My Baseball Team Just Suck?
Northern Cities
Southern Cities
Sunshine (Normalized Z-score)
Rain (Normalized Z-score)
0.00 0.25 0.50 0.75 1.00 Offseason
Win Percentage
CHI
NYC
SF
SD
HOU
MIA
Note: Miami y axis scale (-2 to 4)
Z-score
Month
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

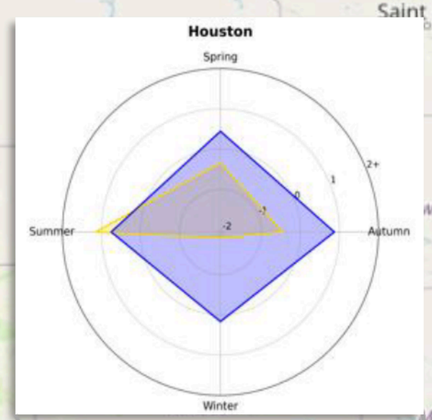
How Many Years Would it Take to Submerge a City?

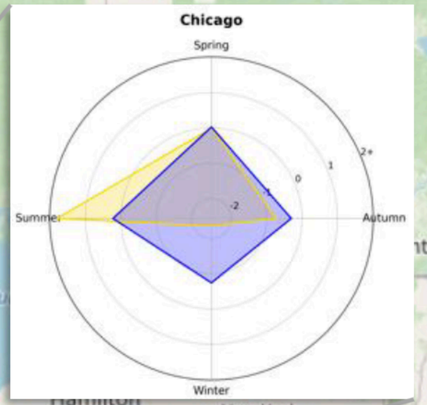
If the rain never evaporated or drained

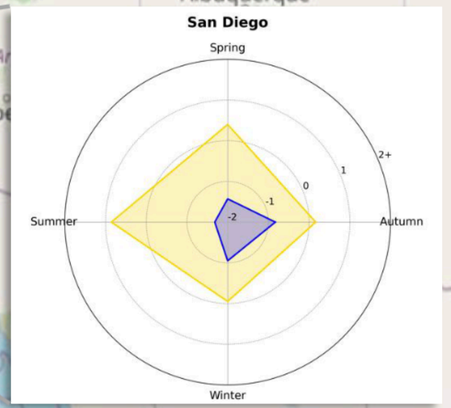


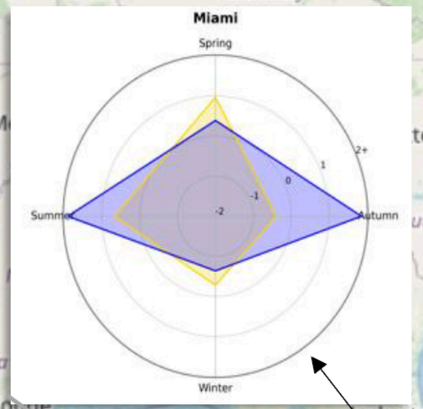
Which Popular City Offers the Perfect Weather for My Seasonal Getaway?

(Data standardized by Z-scores across cities and seasons)









Deviation from mean in standard deviation units.

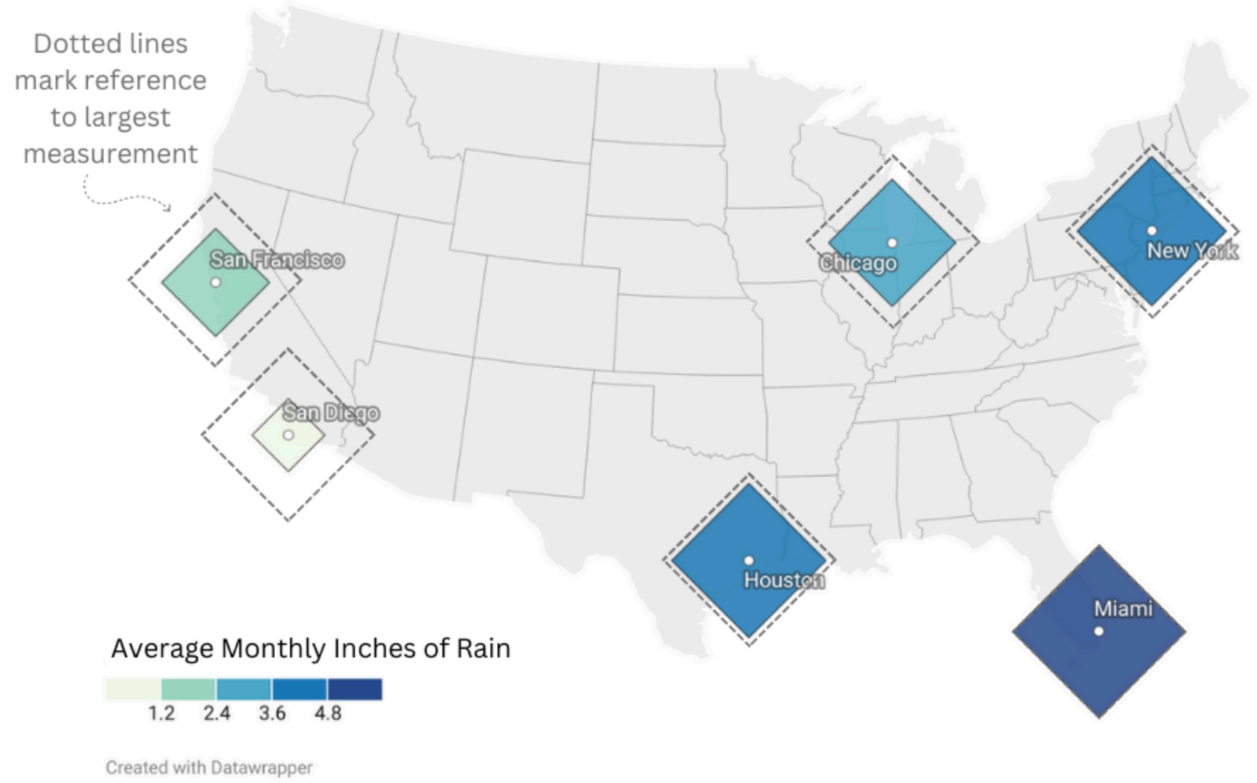
Spring
Summer
Autumn
Winter

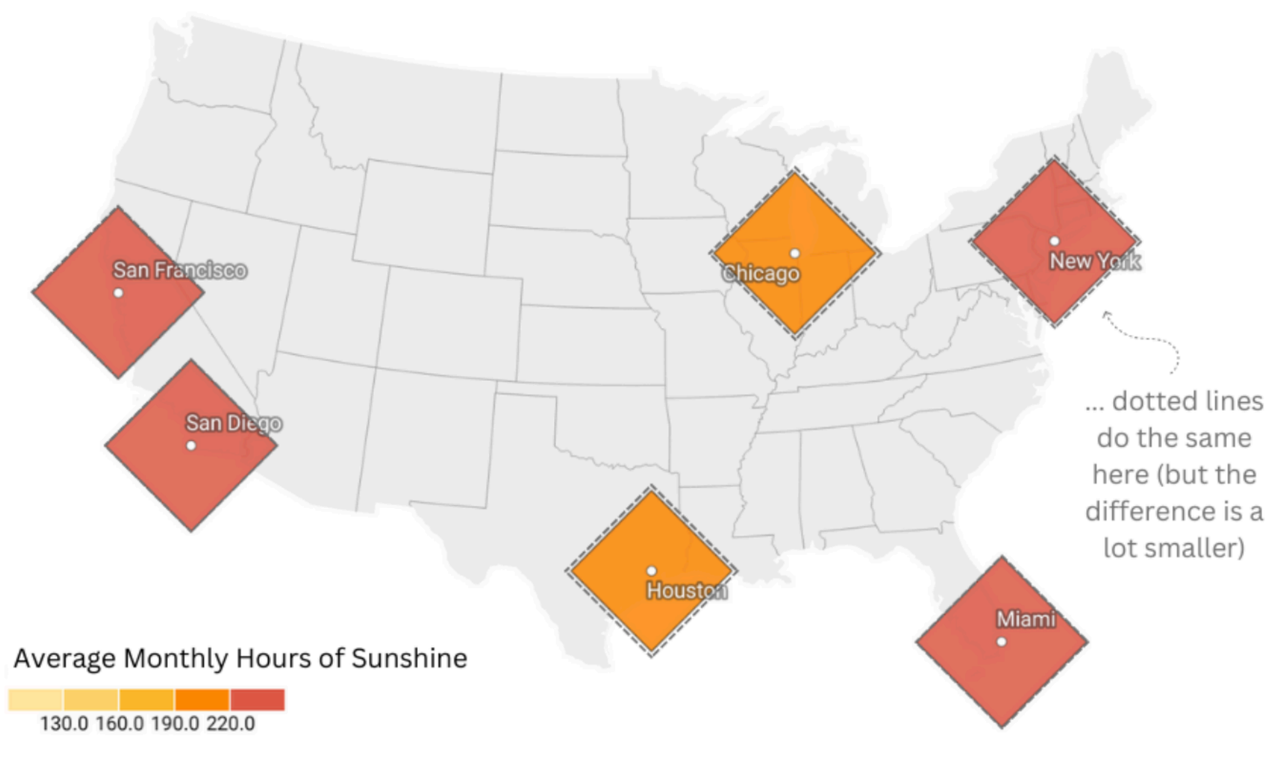
Sunshine: The average hours of sunshine
Rainfall: The average inches of rain

K.Z.

Rain or Shine? Why Not Both?

Miami witnesses more than twice the average rain of SD, but has nearly the same amount of sun





What was the most challenging part of Project 2 for you?

tryclassbuzz.com
Code: **proj2**

Project 2 Peer Feedback

Opportunity to get feedback from your peers.

"I like / I wish / What if?" format.

Worth 5% of your final grade, graded by completion.

Project 3: Interactive Visualization

Choose a health dataset (can reuse Project 2 data).

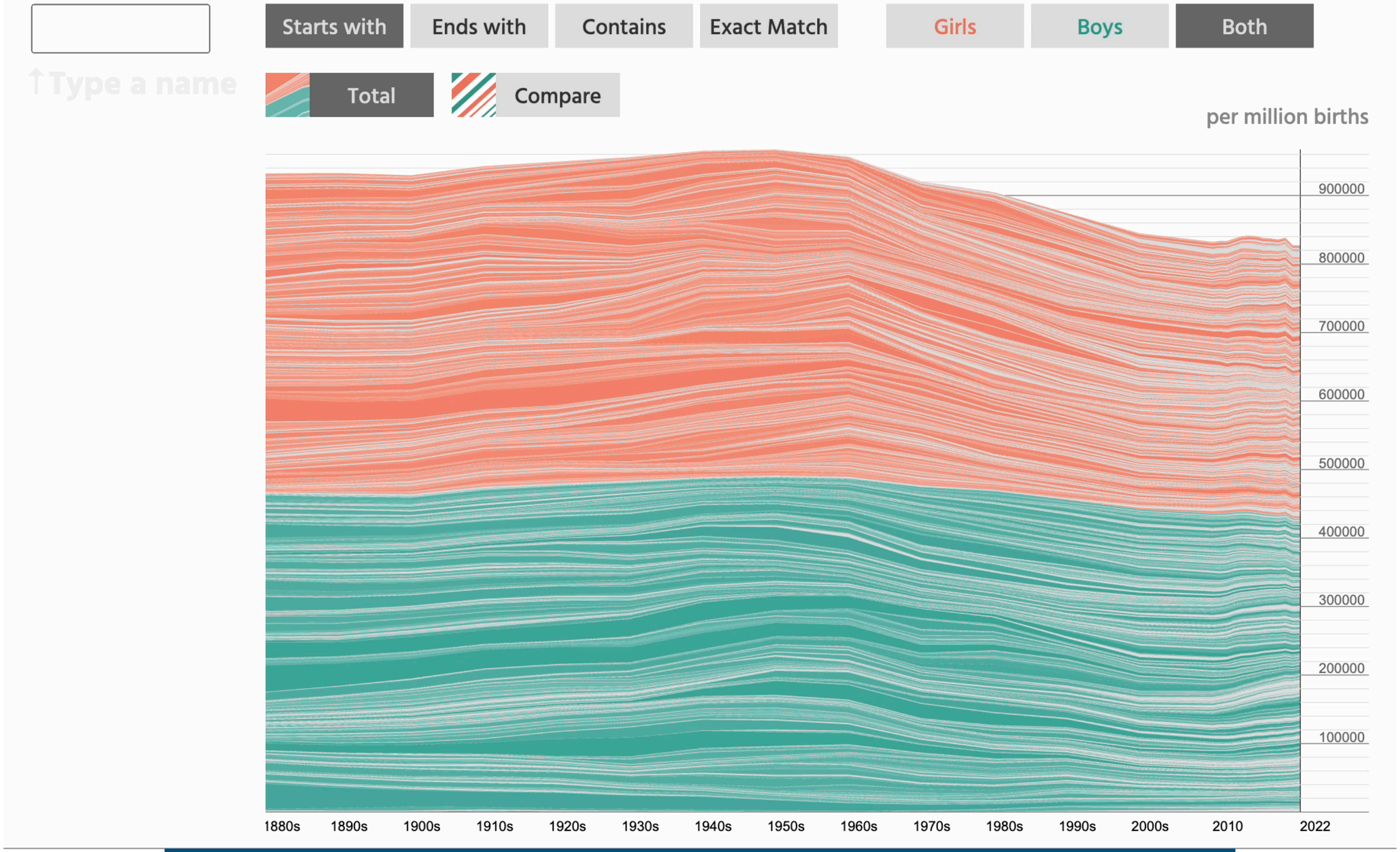
Create **one** interactive graphic to let readers explore the data.

E.g. panning, zooming, brushing, annotations, etc.

Must use D3, no other plotting libraries allowed.

Must complete in teams of 3-4.

Pro-tip: Explore lots of options using pen-and-paper. Then, keep scope of project very tight! Do one thing well.



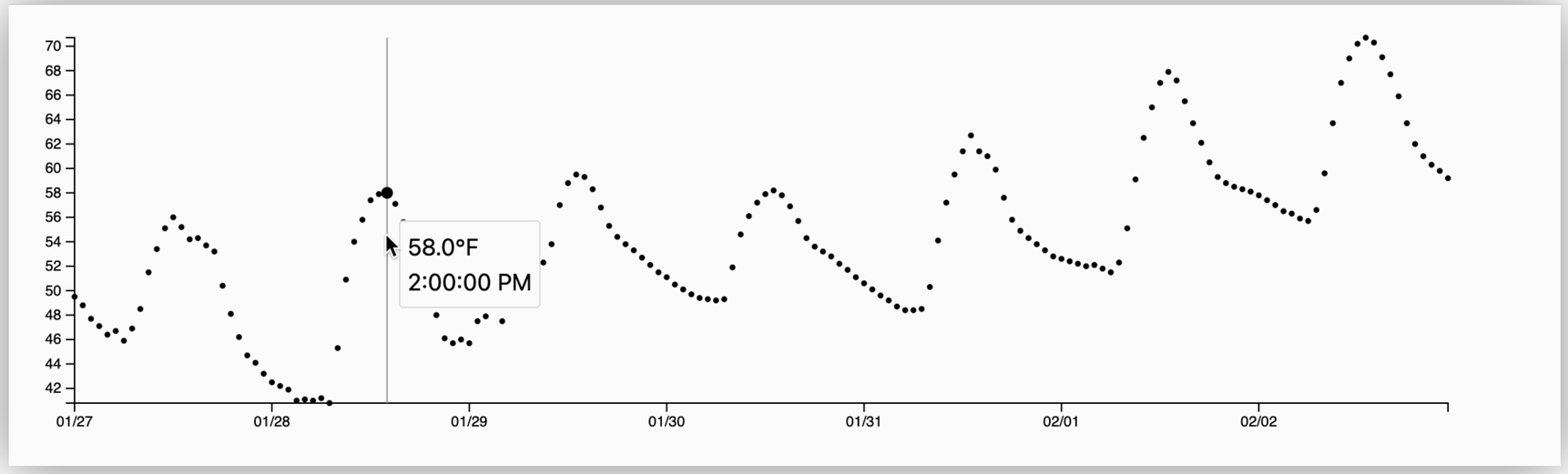
https://namerology.com/baby-name-grapher/

D3

Today: Making an interactive scatterplot

Before:

After:



Step 1: Using D3 instead of plain JS

Before:

After:

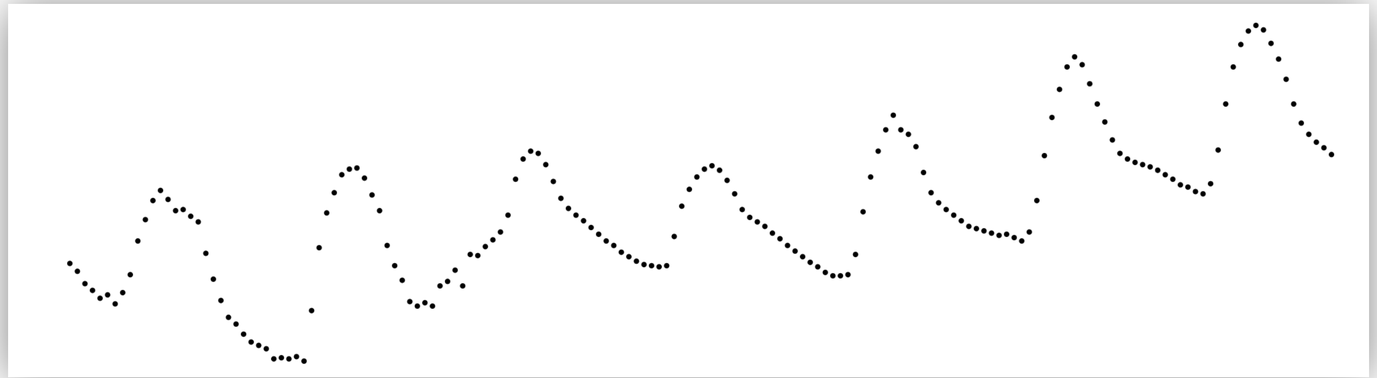
But in D3!

Demo: `d3-lecture/weather01`

Step 2: Making circles and using d3 scales

Before:

After:



Demo: `d3-lecture/weather02`

Making circles

Before:

```
svg
  .selectAll('text')
  .data(weatherData.hourly.temperature_2m)
  .join('text')
  .attr('x', (d, i) => i * 5)
  .attr('y', (d) => 500 - d * 6)
  .text((d) => d);
```

After:

```
svg
  .selectAll('circle')
  .data(weatherData.hourly.temperature_2m)
  .join('circle')
  .attr('cx', (d, i) => xScale(i))
  .attr('cy', (d) => yScale(d))
  .attr('r', 2);
```

Just needed to swap out text with circle + set the right attributes.

Scales

Before:

```
.attr('cx', (d, i) => i * 5)
.attr('cy', (d) => 500 - d * 6)
```

Magic numbers!

After:

```
.attr('cx', (d, i) => xScale(i))
.attr('cy', (d) => yScale(d))
```

D3 scales

```
const xScale = d3
  .scaleLinear()
  .domain([0, weatherData.hourly.temperature_2m.length - 1])
  .range([margin.left, width - margin.right]);
```

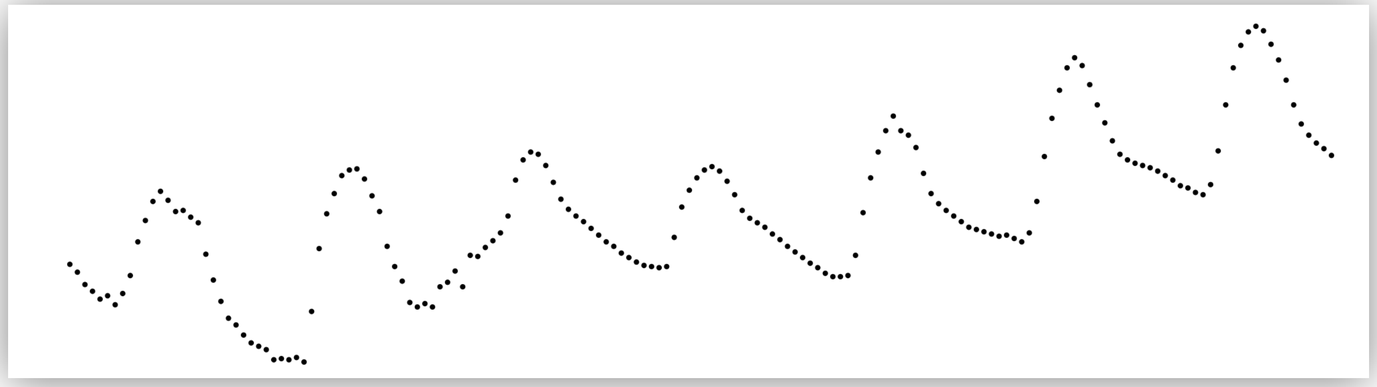
Domain = possible inputs

Range = possible outputs

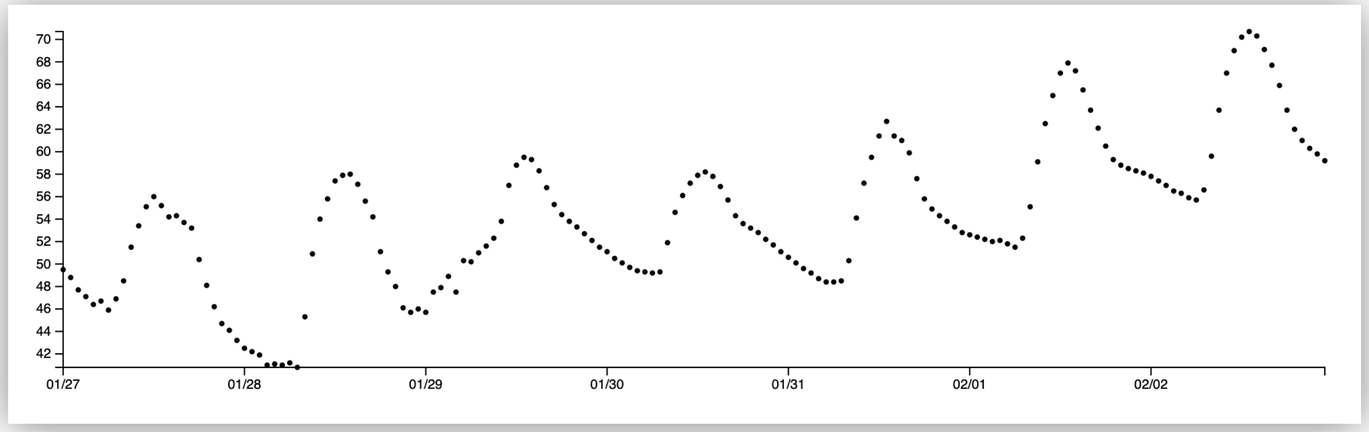
D3 scales will automatically make plot fit the space.

Step 3: Adding axes

Before:



After:



Demo: `d3-lecture/weather03`

Axes

```
const yAxis = d3.axisLeft(yScale);
```

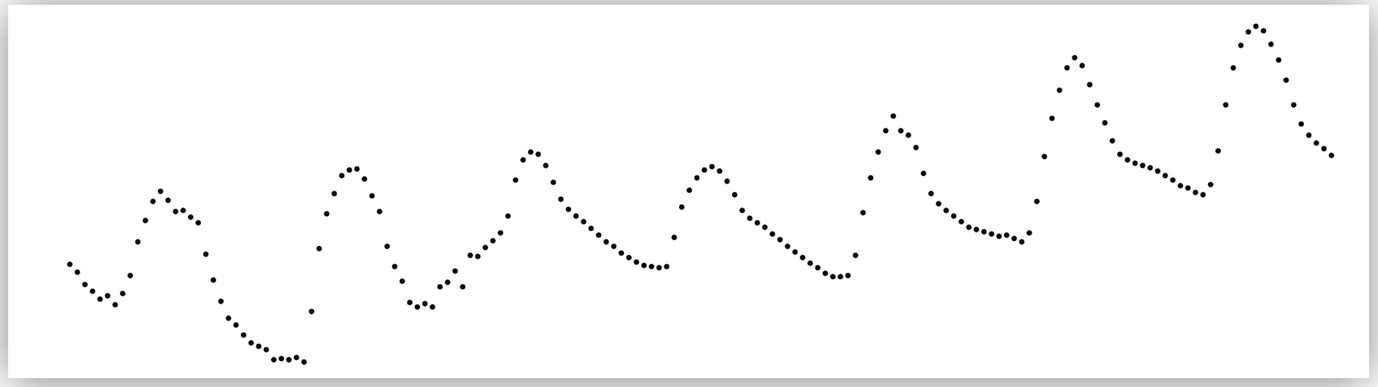
Creates a D3 axis object

```
svg
  .append('g')
  .attr('class', 'y axis')
  .attr('transform', `translate(${margin.left}, 0)`)
  .call(yAxis);
```

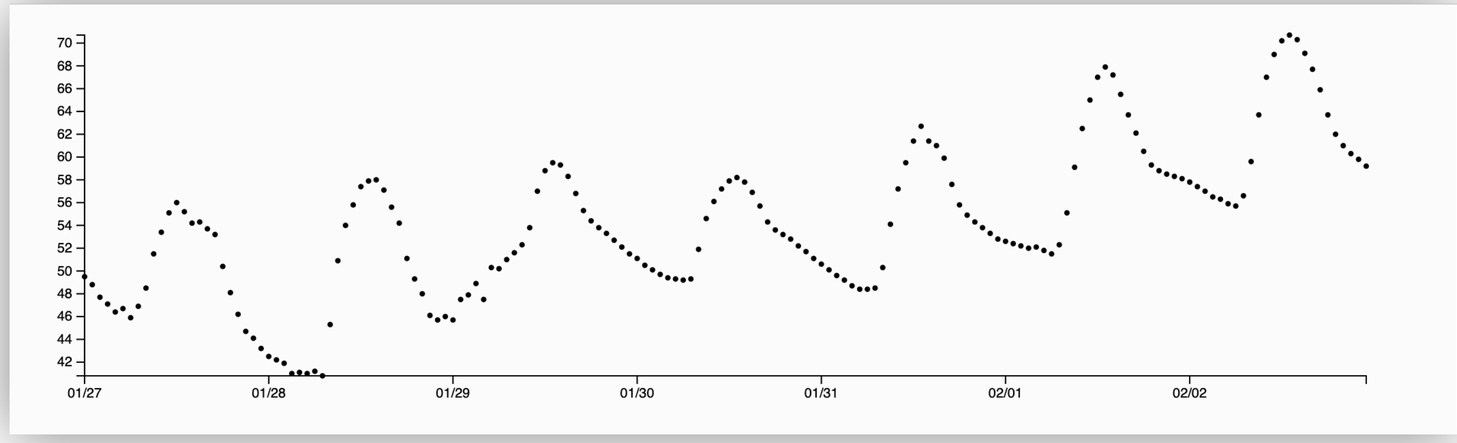
Creates an SVG <g> object, then draws axis into it

Step 4: Adding a basic tooltip

Before:



After:



Demo: `d3-lecture/weather04`

Making a tooltip

```
const tooltip = d3
  .select('body')
  .append('div')
  .attr('class', 'tooltip')
  .style('position', 'absolute')
  .style('visibility', 'hidden')
  .style('background-color', 'white')
  .style('border', '1px solid #ddd')
  .style('padding', '5px')
  .style('border-radius', '3px');
```

Creates a , styles it, and hides it so that it'll only show up with interaction

Adding interaction

```
.on('mouseover', function (event, d) {
  d3.select(this).attr('r', 4); // Increase circle size on hover


  tooltip.style('visibility', 'visible').text(`${d.toFixed(1)}°F`);
})
```

D3 version of event listener + handler

Adding interaction

```
.on('mouseover', function (event, d) {
  // Increase circle size on hover

  tooltip.style('visibility', 'visible').text(`${d.toFixed(1)}°F`);
})
```

When a circle is moused over...

D3 version of event listener + handler

Adding interaction

```
.on('mouseover', function (event, d) {
  d3.select(this).attr('r', 4); // Increase circle size on hover
                                                    ${d.toFixed(1)}°F`);
})
```

Make the circle’s radius larger

D3 version of event listener + handler

Adding interaction

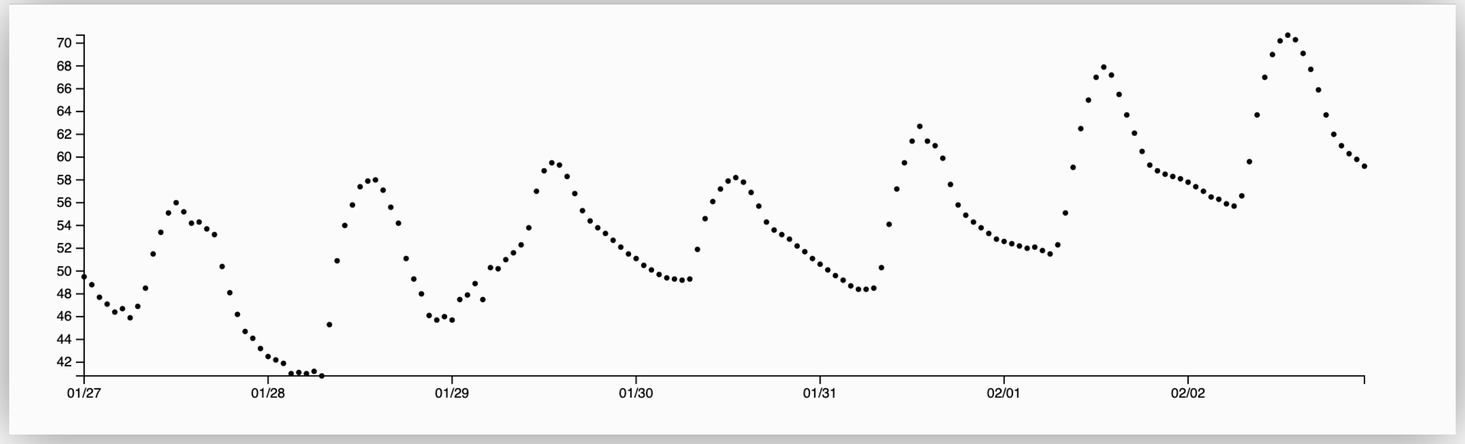
```
.on('mouseover', function (event, d) {
  d3.select(this).attr('r', 4); // Increase circle size on hover

  tooltip.style('visibility', 'visible').text(`${d.toFixed(1)}°F`);
})
```

Make tooltip visible and set its text

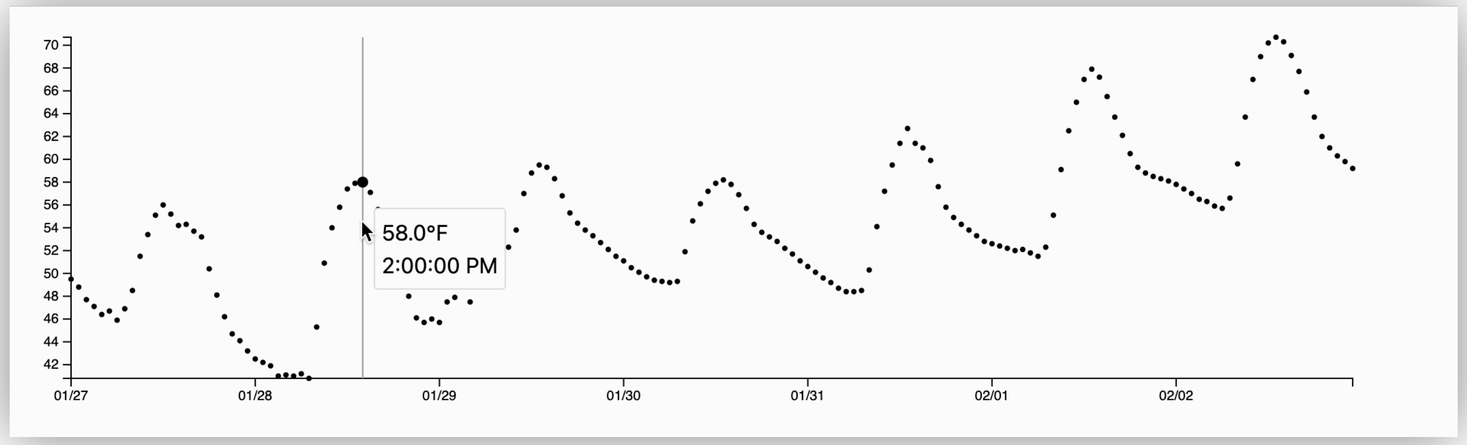
D3 version of event listener + handler

Step 5: Improving our tooltip

Before:



After:



Demo: `d3-lecture/weather05`

Interacting with the plot, not just points

```
// Create a rect overlay for mouse tracking
const overlay = svg
  .append('rect')
  .attr('class', 'overlay')
  .attr('x', margin.left)
  .attr('y', margin.top)
  .attr('width', width - margin.left - margin.right)
  .attr('height', height - margin.top - margin.bottom)
  .style('fill', 'none')
  .style('pointer-events', 'all');
```

Interaction trick:
Add an invisible rectangle just to capture mouse events

Listening for mouse events on the parent <svg> tag also ok

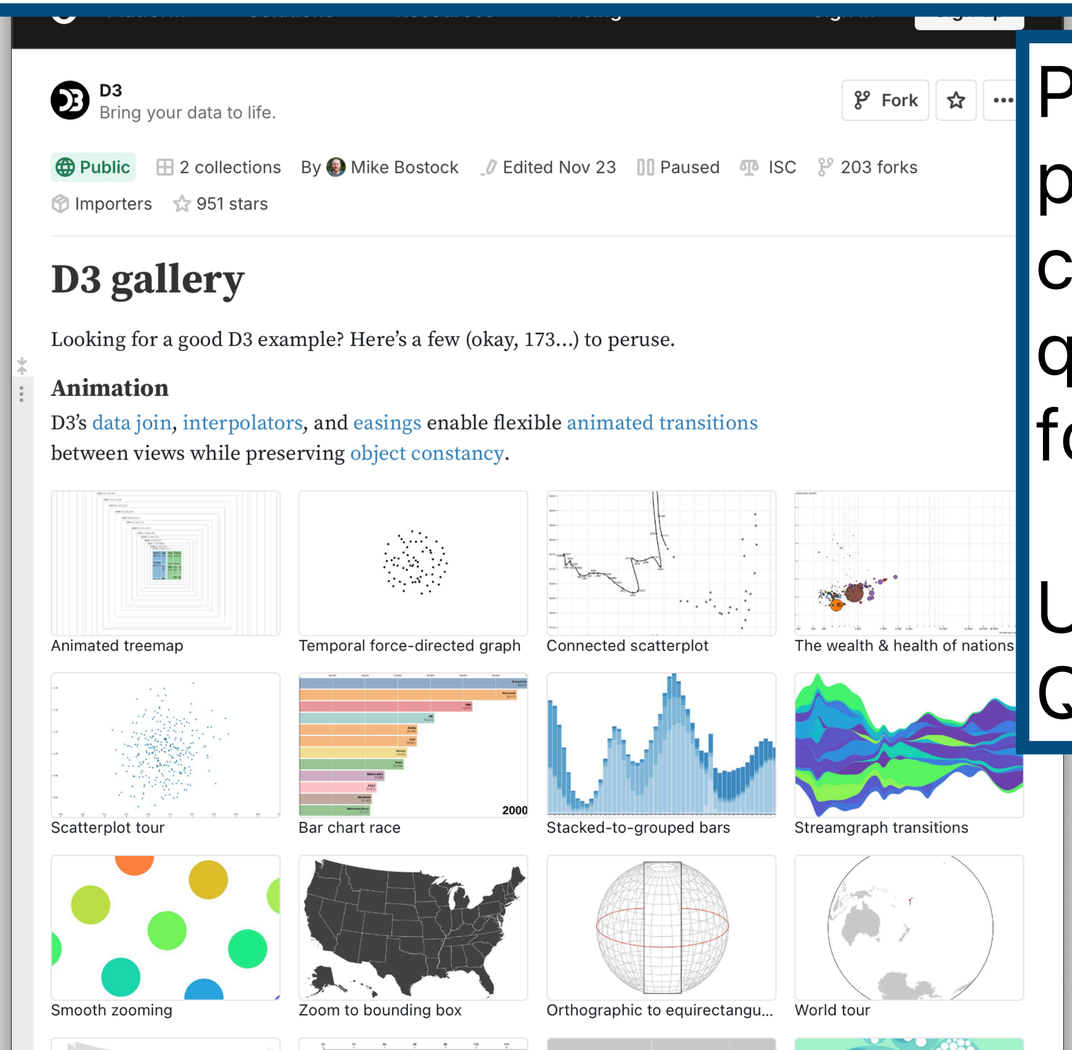
Improving interaction

```
.on('mousemove', function (event) {
  const mouseX = d3.pointer(event)[0];
  const xDate = xScale.invert(mouseX);

  // Find the closest data point
  const bisect = d3.bisector((d) => new Date(d)).left;
  const index = bisect(weatherData.hourly.time, xDate);
  const temp = weatherData.hourly.temperature_2m[index];
  const time = new Date(weatherData.hourly.time[index]);
```

Challenge: since we're not hovering directly over points, we have to use the mouse position to find nearest point

You Try: Explain D3 code

https://observablehq.com/@d3/gallery



Pick a simple visualization (scatter plot, line plot, bar chart). Explain the code to your neighbor, then write a question about the code using this format:

URL: …
Question: …

tryclassbuzz.com
Code: **explain-d3**