3.3) Sequences

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Reference

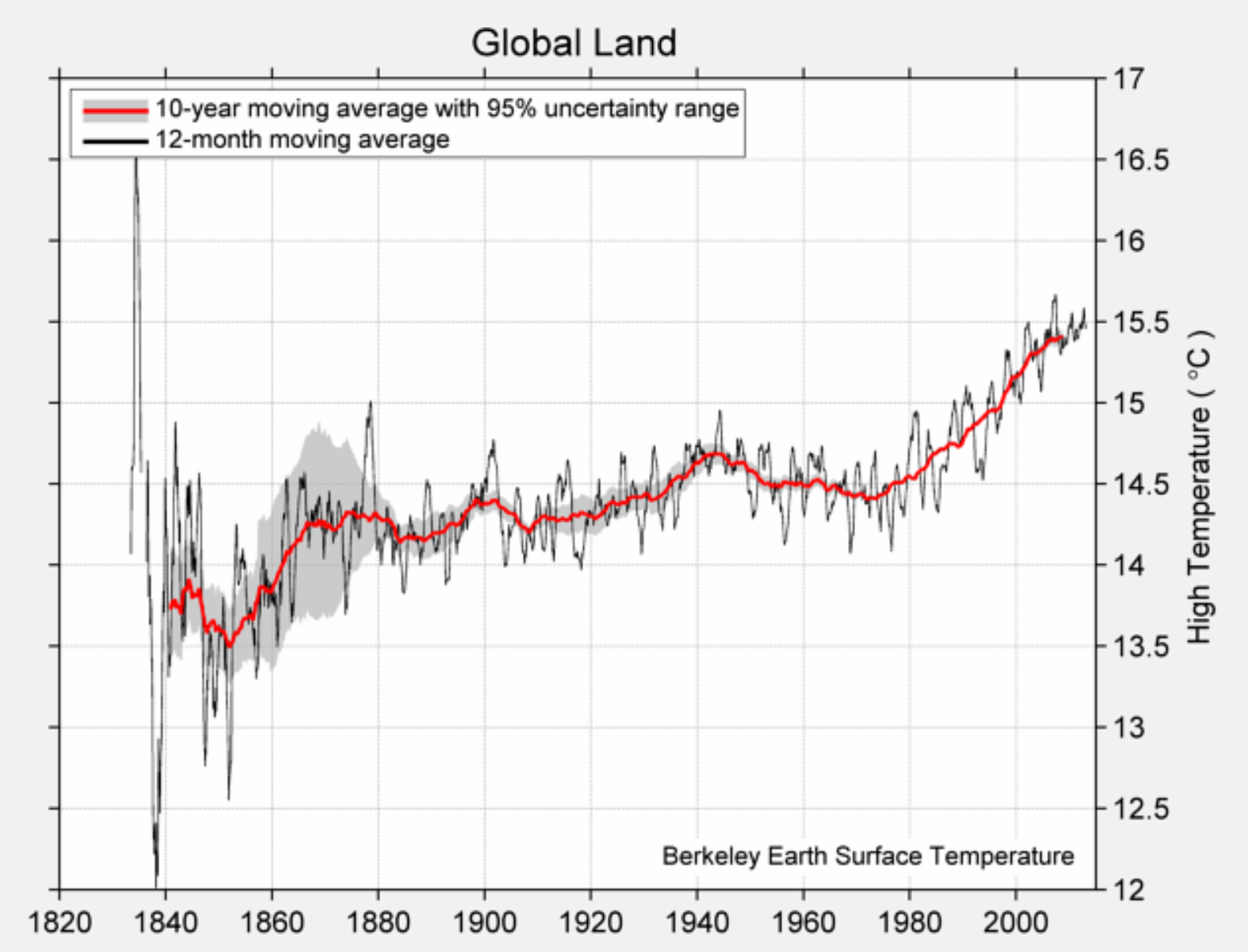
Tables, Graphics, and Figures from

Computational and Inferential Thinking: The Foundations of Data Science

Adhikari & DeNero (2019): Ch 5. Sequences

https://www.inferentialthinking.com/

Mean of Daily High Temperature



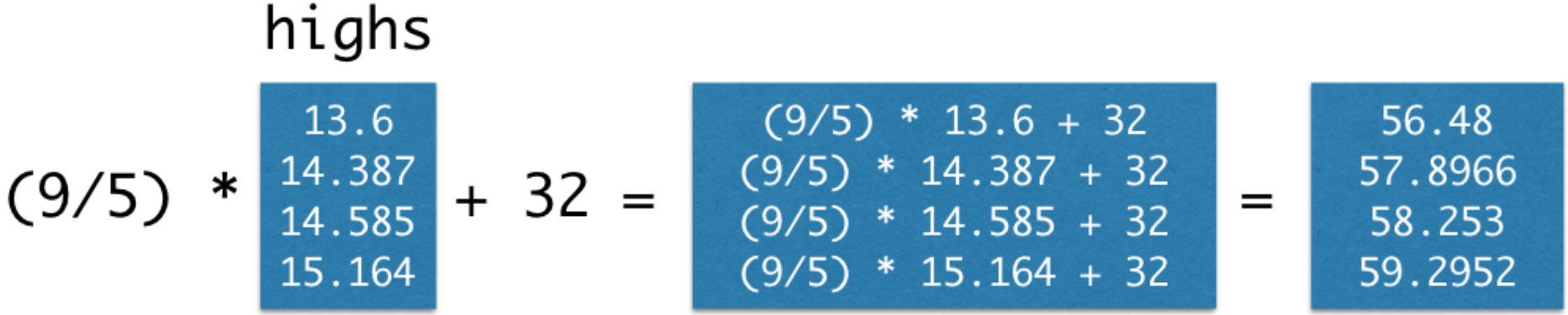
Convert to Fahrenheit

```
from datascience import *
baseline_high = 14.48
highs = make_array(baseline_high - 0.880, baseline_high - 0.093,
                   baseline_high + 0.105, baseline_high + 0.684)
highs
```

```
array([13.6  , 14.387, 14.585, 15.164])
```

```
(9/5) * highs + 32
```

```
array([56.48  , 57.8966, 58.253 , 59.2952])
```



Average Daily High Temperatures

```
highs.size
```

```
4
```

```
highs.sum()
```

```
57.736000000000004
```

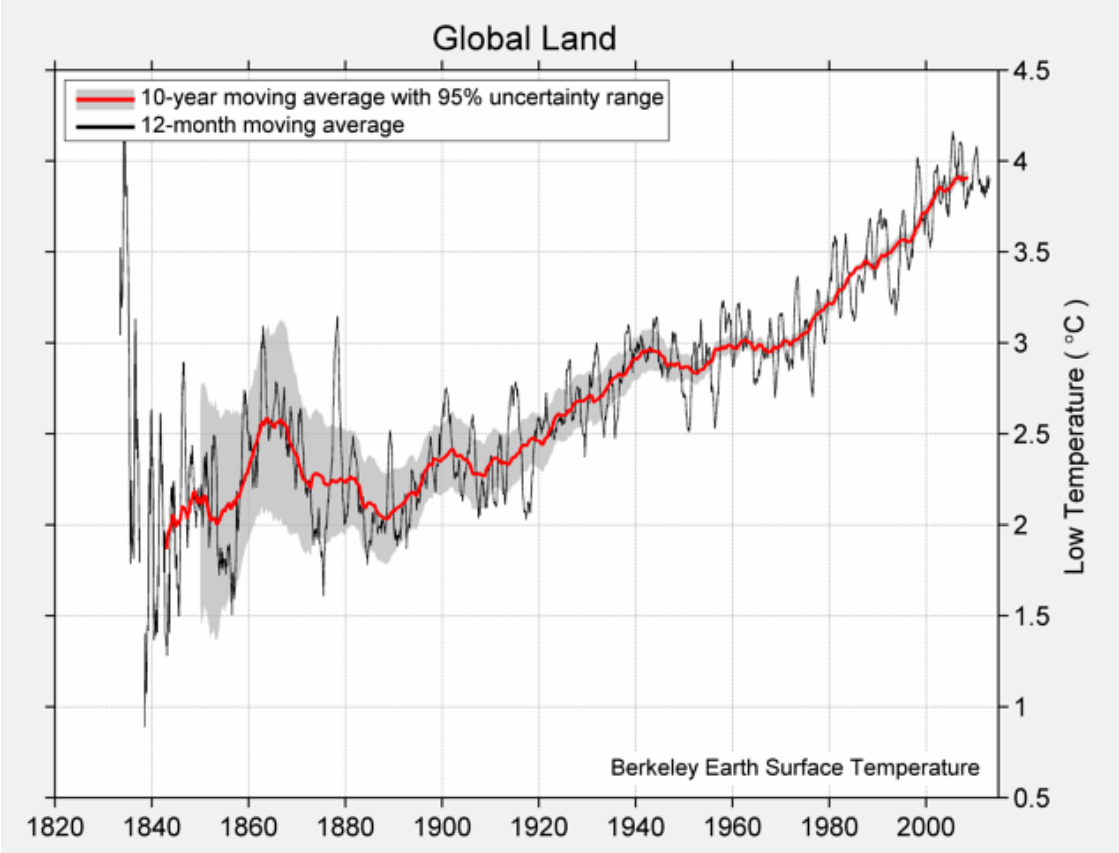
```
sum(highs)/len(highs)
```

```
14.434000000000001
```

```
highs.mean()
```

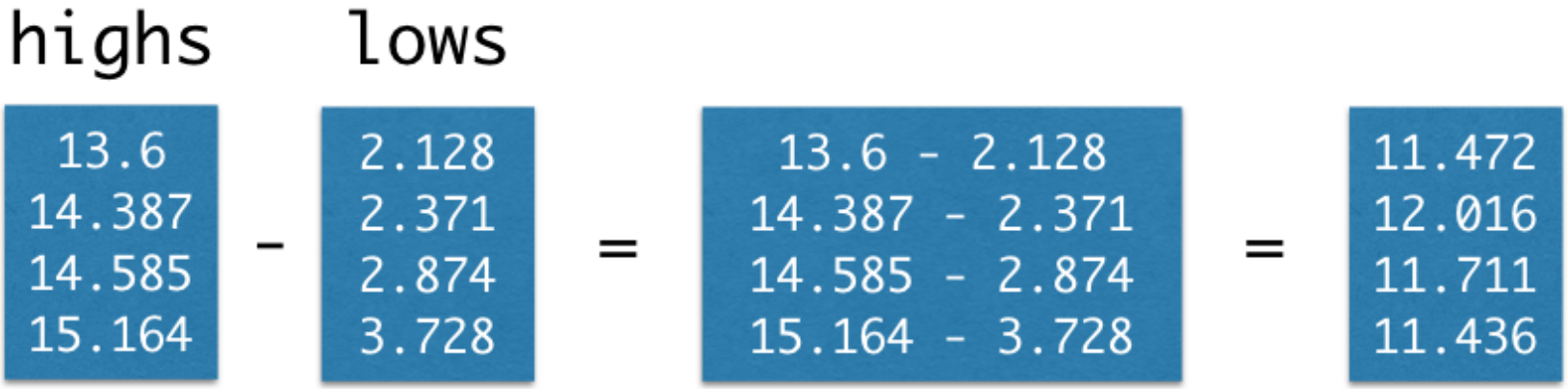
```
14.434000000000001
```

Mean of Daily Low Temperature




```
baseline_low = 3.00
lows = make_array(baseline_low - 0.872, baseline_low - 0.629,
                  baseline_low - 0.126, baseline_low + 0.728)
lows
```

.item vs array




```
make_array(
    highs.item(0) - lows.item(0),
    highs.item(1) - lows.item(1),
    highs.item(2) - lows.item(2),
    highs.item(3) - lows.item(3)
)
```

```
array([11.472, 12.016, 11.711, 11.436])
```

```
highs - lows
```

Leibniz's Formula for π

$$\pi = 4 \cdot \left(1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} + \dots\right)$$

$$4 \cdot \left(\left(1 + \frac{1}{5} + \frac{1}{9} + \dots + \frac{1}{9997}\right) - \left(\frac{1}{3} + \frac{1}{7} + \frac{1}{11} + \dots + \frac{1}{9999}\right)\right)$$

```
import numpy as np
positive_term_denominators = np.arange(1, 10000, 4)
positive_term_denominators
```

```
array([   1,    5,    9, ..., 9989, 9993, 9997])
```

```
positive_terms = 1 / positive_term_denominators
negative_terms = 1 / (positive_term_denominators + 2)
4 * ( sum(positive_terms) - sum(negative_terms) )
```

```
3.1413926535917955
```

Wallis' Formula for π

$$\pi = 2 \cdot \left(\frac{2}{1} \cdot \frac{2}{3} \cdot \frac{4}{3} \cdot \frac{4}{5} \cdot \frac{6}{5} \cdot \frac{6}{7} \cdots \right)$$

$$\pi \approx 2 \cdot \left(\frac{2}{1} \cdot \frac{4}{3} \cdot \frac{6}{5} \cdots \frac{1,000,000}{999999} \right) \cdot \left(\frac{2}{3} \cdot \frac{4}{5} \cdot \frac{6}{7} \cdots \frac{1,000,000}{1,000,001} \right)$$

```
even = np.arange(2, 1000001, 2)
one_below_even = even - 1
one_above_even = even + 1
2 * np.prod(even/one_below_even) * np.prod(even/one_above_even)
```

```
3.1415910827951143
```