MATH1401

Fall 2021

Lecture 9

Functions

Class Checklist

- **HW 3 - Due Date** : Friday: 9/24 – 9 PM
  - Graded Questions:1.1-1.7, 2.1-2.5, 2.7, 3.1,3.3, 4.3-4.5
- **Lab 3 – Due Date** : Tuesday 9/21 – 9 PM
  - Graded Questions : 1.1,1.1.1, 3.1-3.2,4.1-4.3, all questions from section 2

- **Quiz 6** – Tuesday: 9/21 – Covers Chapter 7
- **Quiz 7** – Thurday: 9/23 – Covers Chapter 8

Charts Review

Review: Charts

- **Scatter plot**: relation between numerical variables
- **Line graph**: sequential data (over time, etc.)
- **Bar chart**: distribution of categorical data
- **Histogram**: distribution of numerical data

Bar Chart or Histogram?

To display a distribution:

Bar Chart

- Distribution of categorical variable
- Bars have arbitrary (but equal) widths and spacings
- **height (or length)** and **area** of bars proportional to the percent of individuals

Histogram

- Distribution of numerical variable
- Horizontal axis is numerical: to scale, no gaps, bins can be unequal
- **Area** of bars proportional to the percent of individuals; **height** measures density

(Demo)

Density

How to Calculate Height

The [6, 6.5) bin contains 263 out of 1324 sleepers

- “263 out of 1324” is 19.86%
- The bin is 6.5 – 6 = .5 hours wide

$$\text{Height of bar} = \frac{19.86 \text{ percent}}{.5 \text{ hours}}$$

$$= 1.02 \text{ percent per hour}$$

Height Measures Density

$$\text{Height} = \frac{\%\ \text{in bin}}{\text{width of bin}}$$

- The height measures the percent of data in the bin ***relative to the amount of space in the bin*****.**
- Height measures **density**.
- Units: percent per unit on the horizontal axis

Area Measures Percent

Area of bar = % in bin = Height x width of bin

- “How many individuals in the bin?” Use area.
- “How crowded is the bin?” Use height.

Discussion Question

You have data about daily temperatures as shown. Which type of chart would show the answer to each question?

- Are there more cloudy than sunny days?
- What percentage of days have a high above 72º?
- Do hotter days tend to also have hotter nights?

Day	High	Low	Sky condition
1	55.1	43.7	Cloudy
2	57.2	46	Sunny
3	56.8	45.9	Cloudy

... (362 rows omitted)

(Demo)

Lecture 9 - Overview

- **Defining Functions**
  - arguments
  - body
  - return values
- **Apply Method**
  - Apply a function to each entry in a column

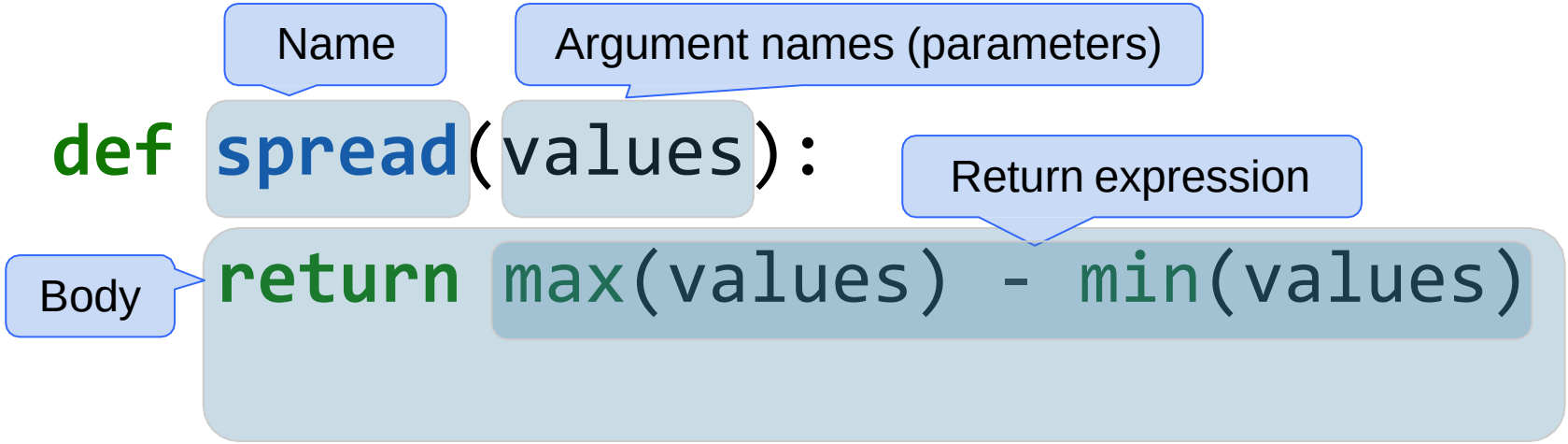
Lecture 9 – Programming Checklist

- **functions keywords**
  - def – defines a new function
  - doc strings – function description
  - body – indentation by 4 spaces
  - return – returns a specified value
- **Apply Method**
  - Table_name.apply(function_to_apply, “column_name”)
  - Applys funtionc_to_apply to column “column_name”

Defining Functions

Def Statements

User-defined functions give names to blocks of code



(Demo)

Discussion Question

What does this function do? What kind of input does it take? What output will it give? What's a reasonable name?

```
def f(s):
    return np.round(s / sum(s) * 100, 2)
```

(Demo)

Apply

Apply

The `apply` method creates an array by calling a function on every element in input column(s)

- First argument: Function to apply
- Other arguments: The input column(s)

```
table_name.apply(function_name, 'column_label')
```

(Demo)