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Workbook v1.1

Brought to you by the Bootstrap team:

* Emmanuel Schanzer
* Kathi Fisler
* Shriram Krishnamurthi
* Ed Campos
* Emma Youndtsmith
* Sam Dooman

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**Unit 1**

* Many important questions ("what’s the best restaurant in town?”, “is this law good for citizens?”, etc.) are answered with data. Data Scientists try and answer these questions, by writing *programs that ask questions of data.*
* Data of all types can be organized into **Tables**
* Every Table has a **header row**, and some number of **data rows**
* **Quantitative data** is data - usually numeric - that measures *quantity*, such as a person’s height, a score on test, a measure of distance, etc. A list of quantitative data can be ordered from smallest to largest.
* **Categorical data** is data that specifies *categories*, such as eye color, country of origin, etc. A list of categorical data has no notion of “smallest” or “largest”, and cannot be ordered.
* **Programming languages** involves different *datatypes*, such as Numbers, Strings, Booleans and Images.
* **Operators** (like +, -, \*, <, etc.) are written between values. For example: 4 + 2
* **Functions** (like triangle, star, string-repeat, etc.) are written first, followed by a list of **arguments** in parentheses. For example: star(50, “solid”, “red”)
* **Examples** help programmers reason about their code. Every example contains two expressions, and the example “passes” if both expressions evaluate to the same thing. For example: 4 + 2 is 6, or “cat” == “dog” is false

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# Numbers and Strings

Make sure you’ve loaded the Unit 1 Starter File, and clicked “Run”.

1. Try typing 42 into the Interactions Area and hitting “Enter”. What happens?
2. Try typing in other Numbers. What happens if you try a decimal like 0.5? A fraction like 1/3? Try really big Numbers, and really small ones.
3. String values are always in quotes. Try typing your name (in quotes!). What happens when you hit “Enter”?
4. Try typing your name with the opening quote, but *without* the closing quote. What happens? Now try typing it without *any* quotes.
5. Is 42 the same as “42”? Why or why not? Write your answer below:

They are different data types: 42 (without quotes) is a Number, and “42” (with quotes) is a string.

# Operators

1. Just like in math, Pyret has *operators* like + and -. Try typing in 4 + 2, and then 4+2 (without the spaces). What can you conclude from this? Write your answer below:

Operators (like +) need whitespace separating them from their operands.

1. Try typing in 4 + 2 + 6, 4 + 2 \* 6, and 4 + (2 \* 6). What can you conclude from this? Write your answer below:

You can use the same operator multiple times without parentheses, but you need parentheses to group order of operations if using different operators (like + and \*) together.

1. Try typing in 4 + “cat”, and then “dog” + “cat”. What can you conclude from this? Write your answer below:

The + operator can only be used with Numbers, not Strings.

# Booleans

Boolean expressions are yes-or-no questions, and will always evaluate to either true (“yes”) or false (“no”). What will each of the expressions below evaluate to? Write down the result in the blanks provided, and type them into Pyret if you’re not sure.

|  |  |
| --- | --- |
| 3 <= 4 \_\_\_\_\_\_\_\_\_\_\_  False  True  3 == 2 \_\_\_\_\_\_\_\_\_\_\_  2 <> 4 \_\_\_\_\_\_\_\_\_\_\_  True  True  3 <> 3 \_\_\_\_\_\_\_\_\_\_\_ | “a” > “b” \_\_\_\_\_\_\_\_\_\_\_  False  True  “a” <> “b” \_\_\_\_\_\_\_\_\_\_\_  “a” == “b” \_\_\_\_\_\_\_\_\_\_\_  False  False  “a” <> “a” \_\_\_\_\_\_\_\_\_\_\_ |

# Boolean Operators

Pyret also has operators that work on *Booleans*. For each expression below, *write down your guess* about what it will evaluate to. Then type them in and see if you were right!

False

# (3 <= 4) and (3 == 2) \_\_\_\_\_\_\_\_\_\_\_\_

False

# (“a” == “b”) and (3 <> 4) \_\_\_\_\_\_\_\_\_\_\_\_

True

# (3 <= 4) or (3 == 2) \_\_\_\_\_\_\_\_\_\_\_\_

True

# (“a” == “b”) or (3 <> 4) \_\_\_\_\_\_\_\_\_\_\_\_

Infinite

1. How many different Number values are there in Pyret? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Infinite

1. How many different String values are there in Pyret? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Two

1. How many different Boolean values are there in Pyret? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Lookups

The table below represents four animals at the shelter:

**animals**

|  |  |  |  |
| --- | --- | --- | --- |
| **name** | **gender** | **age** | **weight** |
| “Toggle” | “female” | 3 | 48 |
| “Fritz” | “male” | 4 | 92 |
| “Nori” | “female” | 6 | 35.3 |
| “Maple” | “female” | 3 | 51.6 |

1. Match each Pyret expression (left) to the description of what it does (right).

|  |  |
| --- | --- |
| get-row(animals, 3) | Evaluates to 51.6 |
| get-row(animals, 0) | Evaluates to the last row in the table |
| get-row(animals, 1)[“gender”] | Evaluates to “male” |
| get-row(animals, 2)[“age”] | Evaluates to “Toggle” |
| get-row(animals, 1)[“weight”] | Evaluates to 92 |
| get-row(animals, 0)[“name”] | Evaluates to 6 |
| get-row(animals, 3)[“weight”] | Evaluates to female |
| get-row(animals, 2)[“gender”] | Evaluates to the first row in the table |

1. Fill in the blanks (left) with the Pyret lookup code that will produce the value (right).

|  |  |
| --- | --- |
| a.  *get-row(animals, 3)[“name”]* | “Maple” |
| b.  get-row(animals, 1)[“gender”] | male |
| c.  get-row(animals, 1)[“age”] | 4 |
| d.  get-row(animals, 0)[“weight”] | 48 |
| e.  get-row(animals, 2)[“name”] | “Nori” |

# Writing Examples

1. In the examples block below, **put an “X” next to the examples that will *fail*.** Remember: examples only pass if the left- and right-hand expressions evaluate to the same thing!

**examples:**

1 + 2 + 9 **is** 19

num-sqrt(16) **is** 2 + 2

3 > 99 **is** true

square(10, ”solid”, ”red”) **is** rectangle(10, 10, ”solid”, ”red”)

**end**

1. In the examples block below, **fill in the blank on the right-hand side so the example will *pass*.**

**examples:**

“yeah! yeah! yeah! ”

string-repeat(“yeah! ”, 3) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

true

string-contains(“Maya”, “May”) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

true

“apples” <> “oranges” **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**end**

|  |  |  |
| --- | --- | --- |
| **name** | **corners** | **Is-round** |
| “triangle” | 3 | false |
| “circle” | 0 | true |
| “ellipse” | 0 | true |
| “square” | 4 | false |

1. The examples block below refers to the shapes table on the right, using row-accessors and the get-row function. For each example, **fill in the blank so the example will *pass*.**

**examples:**

shapes

“square”

Number(animal :: Row)

get-row(\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, 3)["name"] **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

0

3

get-row(shapes, \_\_\_\_\_\_\_)["corners"] **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

“is-round”

true

get-row(shapes, 2)[\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_] **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**end**

# **Unit 2**

**Answering Questions from Data** can take many forms. Here are a few types of questions, each requiring a different kind of analysis:

* **Lookup Questions** can be answered just by finding the right row and column a table. (e.g. – “How old is Toggle?”)
* **Compute Questions** can be answered by computing over a single row or column. (e.g. – “What is the heaviest animal at the shelter?”)
* **Analyze Questions** require looking for trends across multiple rows or columns. (e.g. – “Do cats tend to be adopted sooner than dogs?”)

**Threats to Validity** can undermine a conclusion, even if the analysis was done correctly. Some examples of threats are:

* + - * **Selection bias** –identifying the favorite food of the rabbits won’t tell us anything reliable about what all the animals eat.
      * **Sample size** – averaging the age of only three animals won’t tell us anything reliable about the age of animals at the shelter!
      * **Sample error** – surveying dogs when they are puppies won’t tell us anything reliable about overall dog behavior, since their behavior changes as they age.
      * **Confounding variables** – if they person surveying the animals has a piece of bacon in their pocket, they will incorrectly find that all dogs are friendly!

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# The Animals Dataset

Animals from an animal shelter

1. This dataset is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Some of the columns are….

(For each column in this dataset, fill out the datatype, and whether it contains Qualitative or Categorical data in the table below)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Headers** | **Name** | **species** | **age** | **fixed** | **pounds** |
| **Sample 1** | “Sasha” | “cat” | 1 | false | 6.5 |
| **Sample 2** | “Nori” | “dog” | 6 | true | 35.3 |
| **Sample 3** | “Snowcone” | “cat” | 2 | true | 6.1 |
| **Datatype** | **String** | **String** | **Number** | **Boolean** | **Number** |
| **Quantitative or Categorical?** | **C** | **C** | **Q** | **C** | **Q** |

1. For the questions below, check the box to the left of the questions you CAN answer given this dataset:

|  |  |
| --- | --- |
|  | **Question?** |
| ✓ | *How old is Nori?* |
|  | *What color is Snowcone’s fur?* |
| ✓ | *What is the average age of the animals in the table?* |
| ✓ | *Are there more fixed or unfixed animals in the table?* |
|  | *Are families with children more likely to adopt kittens?* |

1. Some questions I have about this dataset:

Do younger animals get adopted faster?

Are male or female animals more likely to get adopted?

What is the average weight of all the animals in the shelter?

# What Questions Can You Answer?

The following is a dataset of a bicycle rider’s training rides.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **date** | **miles** | **time** | **weather** | **average speed** | **max speed** |
| 04/10/2018 | 10 | 44 | “cloudy” | 13 | 30 |
| 05/30/2018 | 15 | 66 | “sunny” | 13.5 | 22 |
| 06/12/2018 | 12 | 61 | “rainy” | 11.2 | 25 |
| 06/22/2018 | 15 | 61 | “cloudy” | 13 | 28 |
| 07/04/2018 | 24 | 103 | “sunny” | 14 | 26 |
| 07/12/2018 | 24 | 120 | “windy” | 12.5 | 26 |

**What can you answer?** For each of the following questions, check the box to the left of questions you can answer. For each *checked* question, write whether the question is a **lookup**, **compute**, or **analyze** question.

|  |  |  |
| --- | --- | --- |
|  | **Question?** | **Category?** |
| ✓ | *What is the cyclist’s average speed across all rides?* | Compute |
| ✓ | *How many miles did they ride in June?* | Compute |
|  | *What is the tallest hill this cyclist climbed?* |  |
| ✓ | *Does this cyclist ride slower when it is rainy?* | Analyze |
|  | *Does this cyclist ride faster when they are late to an appointment?* |  |

**What *can’t* you answer?** For each of the following questions, check the box to the left of questions you cannotanswer. For each *un-checked* question, write whether the question is a **lookup**, **compute**, or **analyze** question.

|  |  |  |
| --- | --- | --- |
|  | **Question?** | **Category?** |
| ✓ | *What tire pressure produces the highest avg speed?* |  |
|  | *What is the avg time it takes this cyclist to ride 1mi?* | Compute |
|  | *Does this cyclist ride more in April or July?* | Compute |
| ✓ | *What is the average temperature while this cyclist is riding?* |  |
| ✓ | *How many flat tires did this cyclist fix in June?* |  |

# Threats to Validity

Some volunteers from the animal shelter surveyed a group of pet owners at a local park. They found that almost all of the owners were there with their dogs, and from this survey they concluded that dogs are the most popular pet in the region.

What are some possible threats to the validity of this conclusion?

Not many people are likely to walk their cats at the park, so if the volunteers

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only surveyed pet owners at the park, dogs are likely to be more highly

represented in their sampling.

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The animal shelter noticed a large increase in pet adoptions between Thanksgiving and New Year’s Eve. They conclude that at this current rate, there will be a huge demand for pets between January and April.

What are some possible threats to the validity of this conclusion?

Lots of people may be adopting animals during the holiday season, so these

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past patterns are unlikely to predict future patterns in adoption rates.

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# Threats to Validity

The animal shelter wanted to find out what kind of food to buy for their animals. They took a random sample of two animals and the food they eat, and found that spider and rabbit food was by far the most popular cuisine!

What are some possible threats to the validity of this conclusion?

A random sample may not be representative of the whole group of pets. In

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this case, there are many more dogs and cats than spiders and rabbits at the

shelter, so using this random sample to draw conclusions about the whole group

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is wrong!

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A volunteer opens the shelter in the morning and walks all the dogs. At mid-day, another volunteer feeds all the dogs and walks them again. In the evening, a third volunteer walks the dogs a final time, and closes the shelter. The volunteers report that the dogs are much friendlier and more active at mid-day, so the shelter staff assume the second volunteer must be better with animals then the others.

What are some possible threats to the validity of this conclusion?

There may be other reasons the dogs are happier at mid-day than morning and

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evening- for instance, mid-day is when they eat lunch, which is likely to make

the dogs very excited!

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# My Dataset

[specific to each student]

1. My dataset is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Some of my columns are….

(Copy six columns from your dataset, and for each column write its datatype, and whether it contains Qualitative or Categorical data in the table below)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Headers** |  |  |  |  |
| **Sample 1** |  |  |  |  |
| **Sample 2** |  |  |  |  |
| **Sample 3** |  |  |  |  |
| **Datatype** |  |  |  |  |
| **Quantitative or Categorical?** |  |  |  |  |

1. Some questions I have about this dataset:

1. What are some possible threats to validity you may encounter in your analysis?

# **Unit 3**

* Programming languages let us **define our own function***.*
* We use the **Design Recipe** to help us define functions without making mistakes.
* The first step is to write a **Contract** and **Purpose Statement** for the function, which specify the Name, Domain and Range of the function and give a summary of what it does.
* The second step is to **write at least two examples**, which show how the function should work for specific inputs. These examples help us see patterns, and we express those patterns by **circling and labeling** what changes.
* The final step is to **define the function**, which generalizes our examples.

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# The Design Recipe

**Define a function called is-fixed, which tells us whether or not an animal is fixed**

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| --- | --- |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  *(animal :: Row)*  *Boolean*  *Number(animal :: Row)*  *is-fixed*  name domain range  *Consumes an animal, and produces the value in the fixed column*  # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |
| **examples:**  sasha[“fixed”]  sasha  is-fixed  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  is-fixed  felix  felix[“fixed”]  is-fixed  animal  animal[“fixed”]  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |
| **fun** \_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |

**Define a function called gender, which consumes a Row of the animals table tells us the gender of that animal**

|  |  |
| --- | --- |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  gender  (animal :: Row)  String  Consumes an animal, and produces the value in the gender column  gender  gender  gender  snowcone  toggle  animal  snowcone[“gender”]  toggle[“gender”]  animal[“gender”]  name domain range  # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |
| **examples:**  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |
| **fun** \_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |

**Define a function called is-cat, which consumes a Row of the animals table and produces true if it's a cat.**

|  |  |
| --- | --- |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Boolean*  *Number(animal :: Row)*  *(animal :: Row)*  *is-cat*  name domain range  *Consumes an animal, and return true if the species is “cat”*  # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |
| **examples:**  is-cat  sasha  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  sasha[“species”] == “cat”  snuggles[“species”] == “cat”  animal[“species”] == “cat”  is-cat  is-cat  snuggles  animal  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |
| **fun** \_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |

**Define a function called is-young, which consumes a Row of the animals table and produces true if it's an animal that is less than two years old.**

|  |  |
| --- | --- |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  is-young  is-young  is-young  is-young  (animal :: Row)  Boolean  Consumes an animal, returns true if the animal is less than 2 years old  wade  sheba  sheba[“age”] < 2  wade[“age”] < 2  animal[“age”] < 2  animal  name domain range  # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |
| **examples:**  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |
| **fun** \_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |

**Define a function called nametag, prints out each animal's name in big red letters.**

|  |  |
| --- | --- |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  *(animal :: Row)*  *Image*  *Number(animal :: Row)*  *nametag*  name domain range  *Consumes an animal, and produces an image of their name in big, red letters*  # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |
| **examples:**  text(sasha[“name”], 50, “red”)  sasha  nametag  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  text(animal[“name”], 50, “red”)  text(felix[“name”], 50, “red”)  animal  felix  nametag  nametag  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |
| **fun** \_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |

**Define a function called is-kitten, which consumes a Row of the animals table and produces true if it’s a cat younger than two years old.**

|  |  |
| --- | --- |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  Boolean  (animal :: Row)  is-kitten  name domain range  Consumes an animal, returns true if it’s a cat less than two years old  # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |
| **examples:**  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  (snuggles[“species”] == “cat”) and (snuggles[“age”] < 2)  is-kitten  is-kitten  is-kitten  snuggles  wade  animal  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  (wade[“species”] == “cat”) and (wade[“age”] < 2)  **end** |
| **fun** \_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  (animal[“species”] == “cat”) and (animal[“age”] < 2)  **end** |

is-kitten

is-kitten

is-kitten

snuggles

(snuggles[“species”] == “cat”) and (snuggles[“age”] < 2)

wade

animal

(wade[“species”] == “cat”) and (wade[“age”] < 2)

(animal[“species”] == “cat”) and (animal[“age”] < 2)

# **Unit 4**

* **Methods** are special functions that are attached to pieces of data*.* We use them to manipulate Tables.
* They are different from functions in several ways:
  + - Their names can’t be used alone: they can only be used as part of data, separated by a dot. (For example, animals.order-by)
    - Their contracts are different: they include the type of the data as part of their names. (eg, <table>.order-by :: (column :: String) 🡪 Table)
    - They have a “secret” argument, which is the data they are attached to
* We will use three **Table Methods** to manipulate our datasets:
  + <Table>.order-by – order the rows of a table based on a column
  + <Table>.filter – create a **subset** of the data, with only certain rows
  + <Table>.build-column – use the columns of a table to make a new one

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# Reviewing Functions

1. **One of the examples for the last function is broken!** Fix this example in the Definitions Area.

4

1. How many *values* are defined in this file? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7

1. How many *functions* are defined in this file? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

is-old-dog

1. What is the *name* of the last function? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Row

1. What is the *Domain* of the last function? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Boolean

1. What is the *Range* of the last function? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

animal

1. What is the variable name that the last function uses? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

is-kitten

1. Which function will tell us if an animal is a kitten? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

sentence

1. Which function will print out “<name> the <species>”? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

is-old-dog

1. Which function will tell us if an animal is a dog older than 10? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

is-fixed

1. Which function will tell us if an animal has been fixed? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

nametag

1. Which function will draw a nametag for an animal? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Plans for the Animals Dataset

**What are two ways you might want to *order* the animals dataset?**

Order by weight

1)

Order by age

2)

**What are two subsets into which you might *filter the animals* *dataset*?**

Filter animals heavier than 20 pounds

1)

Filter animals that have been fixed

2)

**What are two new columns you might want to *build* from the animals dataset?**

Add a column for time in the shelter by months

1)

Add a column for whether or not each animal is a kitten

2)

# Methods

Methods are a lot like functions, but they differ in three important ways:

* They can only be called as **part of a value**, using the **dot-accessor**. For example: **animals.**row-n(2)
* Their Contracts are different, because they contain a **Type** as part of their name. For example: **<Table>**.row-n :: (index :: Number) -> Row
* They have a “secret argument”, which is the value they are attached to. In the examples above, the row-n method consumes only a Number as part of its Domain, but it *also* consumes the Table to which it is attached.

Here is the Contract for a method, which consumes the name of a food and produces True if the person likes that food:

*<Person>*.likes :: (*food :: String) 🡪 Boolean*

Table

1. What Type of data is the method *attached to?* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

likes

1. What is the name of this method? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1

1. How many things are in its Domain? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

food

1. What is the name of the argument in its Domain? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

String

1. What is the Type of the argument in its Domain? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Boolean

1. What Type of data will this method will produce? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Below are 3 expressions. Based on the contract above, circle the correct one.

emma.likes(“pizza”) likes(“pizza”) likes(emma, pizza)

1. On the line below, write your own expression that uses this method, replacing emma and “pizza” with your own name and a food *you* like.

amy.likes(“chocolate”)

# Playing with Methods

You have the following functions defined below (read them carefully!):

**fun** is-fixed(animal): animal[“fixed”] **end**

**fun** is-young(animal): animal[“age”] < 4 **end**

**fun** nametag(animal): text(animal["name"], 20, "red") **end**

The table **t** below represents four animals at the shelter:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **name** | **gender** | **age** | **fixed** | **weight** |
| “Toggle” | “female” | 3 | true | 48 |
| “Fritz” | “male” | 4 | true | 92 |
| “Nori” | “female” | 6 | true | 35.3 |
| “Maple” | “female” | 3 | true | 51.6 |

Match each Pyret expression (left) to the description of what it does (right).

|  |  |
| --- | --- |
| t.order-by(“age”, true) | Produces a table containing *only* Toggle and Maple |
| t.filter(is-fixed) | Produces a table, sorted oldest-to-youngest. |
| t.build-column(“sticker”, nametag) | Produces a table, sorted youngest-to-oldest |
| t.filter(is-young) | Produces a table with an extra column, named “sticker” |
| t.order-by(“age”, false) | Produces a table containing Maple and Toggle, in that order. |
| t  .filter(is-young)  .order-by(“weight”, false) | Produces a table containing the same four animals. |
| t  .order-by(“age”, true)  .build-column(“sticker”, nametag) | Produces a table with an extra “sticker” column, sorted youngest-to-oldest |

# **Unit 5**

* Functions can contain value definitions
* We use **Table Plans** to help us use table methods correctly, without making mistakes:
  + - * Like functions, we start with a Contract and Purpose Statement
      * But instead of writing *programmed examples*, we sketch out **Start** and **End** **Tables**, based on the Contract and Purpose.
      * Then we define the function based on our Start and End Tables. Every function includes both the table definition (using methods) and a table expression.

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# Review

* 1. In the Interactions Area, use table methods to sort your table by one column. **Try sorting your table in both ascending and descending order.**
  2. If a researcher is looking at a dataset of students, they might want to divide the data into separate populations of boys and girls. A veterinarian might want to look at only the cats at a shelter. **Come up with one criteria you could use for animals at the shelter, and describe it below.**

Filter animals heavier than 20 pounds

* 1. In the space below, **use the Design Recipe to write a function that checks if a row in your dataset fits that criteria.** Whatever criteria you choose, it should be true for some rows and false for others. **Type this function into the Definitions Area.**

|  |  |
| --- | --- |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  Boolean  (animal :: Row)  is-large  name domain range  Consumes an animal and produces true if its weight is greater than 20 lbs  # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |
| **examples:**  \_\_\_\_\_\_\_\_\_\_\_\_(sample1) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  sample2[“weight”] > 20  sample1[“weight”] > 20  is-large  is-large  \_\_\_\_\_\_\_\_\_\_\_\_(sample2) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |
| **fun** \_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  animal  animal[“weight”] > 20  is-large  **end** |

* 1. **Use the function to filter your dataset.**
  2. Instead of using the function you wrote to *filter* your dataset, **use another table method to build a new column** that shows whether or not each row meets the criteria.

# Table Plan

On Kitten Day, the shelter prints up a list of all the cats in their database that are less than 2 years old, and makes nametags for them. They need a function that will help them out! Define a function called get-kittens-tags, which takes in the dataset and produces the correct table.

|  |
| --- |
| **Contract and Purpose**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Table*  *(animals :: Table)*  *get-kittens-tags*    *# Consume a table of animals, and produce a table containing kittens with nametags, sorted by name*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Example Tables**  Make a Start Table and a result based on that table.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **name** | **species** | **age** | **fixed** | **legs** | **weight** | **adopt** | **tag** | | Sasha | cat | 1 | FALSE | 4 | 6.5 | 4 | Sasha | | Wade | cat | 1 | FALSE | 4 | 3.2 | 4 | Wade |   animals-table 🡪 get-kittens-tags(animals-table)   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **name** | **species** | **age** | **fixed** | **legs** | **weight** | **adopt** | | Sasha | cat | 1 | FALSE | 4 | 6.5 | 4 | | Toggle | dog | 3 | TRUE | 4 | 48 | 3 | | Buddy | lizard | 2 | FALSE | 4 | 0.3 | 12 | | Wade | cat | 1 | FALSE | 4 | 3.2 | 4 | | Mittens | cat | 2 | TRUE | 4 | 7.4 | 5 | |
| **Define the function**  Use the relevant methods (circle your helper functions!), then produce a result with the new table.  **fun** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_):  *animals*  *get-kittens-tags*  *Define the table*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *t = animals*  *.build-column(* nametag *)*  *.filter(* is-kitten *)*  *.order-by(* “name”, true *)*  *t*  *Are there more columns? Are there fewer rows? Are the rows ordered?*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Produce the result*  **end** |

# Table Plan

The first weekend of every month, the shelter holds a “meet the dogs” picnic, to encourage families to adopt their dogs. Write a function called get-dogs-by-age, that takes their database and produces a table of all the dogs in the shelter, sorted from youngest to oldest.

|  |
| --- |
| **Contract and Purpose**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Table*  *(animals :: Table)*  *get-dogs-by-age*    *# Consume a table of animals, and produce a table containing only the dogs, sorted by age*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Examples**   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **name** | **species** | **age** | **fixed** | **legs** | **weight** | **adopt** | | Toggle | dog | 3 | TRUE | 4 | 48 | 3 | | Fritz | dog | 4 | TRUE | 4 | 92 | 6 |   Make a Start Table and a result based on that table.  animals-table 🡪 get-dog-by-age(animals-table)   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **name** | **species** | **age** | **fixed** | **legs** | **weight** | **adopt** | | Snowcone | cat | 2 | TRUE | 4 | 6.1 | 5 | | Wade | cat | 1 | FALSE | 4 | 3.2 | 4 | | Hercules | cat | 3 | FALSE | 4 | 13.4 | 7 | | Toggle | dog | 3 | TRUE | 4 | 48 | 3 | | Fritz | dog | 4 | TRUE | 4 | 92 | 6 | |
| **Define the function**  Use the relevant methods (circle your helper functions!), then produce a result with the new table.  **fun** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_):  animals  get-dogs-by-age  *Define the table*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *t = animals*  *.build-column( )*  *.filter( )*  *.order-by( )*  *Are there more columns? Are there fewer rows? Are the rows ordered?*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  is-dog  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  “age”, true  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Produce the result*  **end** |

# Table Plan

It’s important for animals to stay healthy, especially when they get older. The veterinarians at the shelter want to put some of the dogs on a diet! They need a regular report of all the older dogs, sorted from heaviest-to-lightest. Define a function old-dogs-diet, which does just that!

|  |
| --- |
| **Contract and Purpose**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  Table  (animals :: Table)  old-dogs-diet    # Consumes a table of animals, and produces a table with only old dogs, sorted heaviest to lightest  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Examples**  Make a Start Table and a result based on that table.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **name** | **species** | **age** | **fixed** | **legs** | **weight** | **adopt** | | Mr. PB | dog | 10 | FALSE | 4 | 161 | 6 | | Boo-boo | dog | 11 | TRUE | 4 | 123 | 24 |   animals-table 🡪 old-dogs-diet(animals-table)   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **name** | **species** | **age** | **fixed** | **legs** | **weight** | **adopt** | | Snowcone | cat | 2 | TRUE | 4 | 6.1 | 5 | | Lucky | dog | 3 | TRUE | 3 | 45.4 | 9 | | Mr. PB | dog | 10 | FALSE | 4 | 161 | 6 | | Boo-boo | dog | 11 | TRUE | 4 | 123 | 24 | | Snuggles | tarantula | 2 | FALSE | 8 | 0.1 | 1 | |
| **Define the function**  Use the relevant methods (circle your helper functions!), then produce a result with the new table.  **fun** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_):  animals  old-dogs-diet  *Define the table*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *t = animals*  *.build-column( )*  *.filter(* is-old-dog *)*  *.order-by(* “weight”, false *)*  *Are there more columns? Are there fewer rows? Are the rows ordered?*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Produce the result*  **end** |

# Table Plan

The shelter is tracking birth-years for all the animals who’ve been fixed. They need a function that takes in their database and returns a table that contains the birth-year for each one. Define get-fixed-birth that will do this for them.

|  |
| --- |
| **Contract and Purpose**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  Table  (animals :: Table)  get-fixed-birth    # Consumes a table of animals, produces a new table of animals who have been fixed, with a new column for birth year  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Examples**  Make a Start Table and a result based on that table.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **name** | **species** | **age** | **fixed** | **legs** | **weight** | **adopt** | **year** | | Snowcone | cat | 2 | TRUE | 4 | 6.1 | 5 | 2015 | | Lucky | dog | 3 | TRUE | 3 | 45.4 | 9 | 2014 | | Toggle | dog | 3 | TRUE | 4 | 48 | 3 | 2014 |   animals-table 🡪 get-fixed-by-legs(animals-table)   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **name** | **species** | **age** | **fixed** | **legs** | **weight** | **adopt** | | Snowcone | cat | 2 | TRUE | 4 | 6.1 | 5 | | Lucky | dog | 3 | TRUE | 3 | 45.4 | 9 | | Hercules | cat | 3 | FALSE | 4 | 13.4 | 7 | | Toggle | dog | 3 | TRUE | 4 | 48 | 3 | | Snuggles | tarantula | 2 | FALSE | 8 | 0.1 | 1 | |
| **Define the function**  Use the relevant methods (circle your helper functions!), then produce a result with the new table.  **fun** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_):  animals  get-fixed-birth  *Define the table*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *t = animals*  *.build-column(* birth-year *)*  *.filter(* is-fixed  *)*  *.order-by( )*  *Are there more columns? Are there fewer rows? Are the rows ordered?*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Produce the result*  **end** |

# My Dataset

**What are two ways you might want to *order* this dataset?**

[specific to each student]

1)

2)

**What are two subsets into which you might *filter this dataset*?**

1)

2)

**What are two new columns you might want to *build* from this dataset?**

1)

2)

# **Unit 6**

* **Bar charts** show the *absolute* quantity of each row in a dataset. The larger the quantity, the longer the bar. Bar charts provide a visual representation of values in a dataset.
* **Pie charts** show the *relative* quantity of each row in a dataset. The greater the percentage, the larger the pie slice. Pie charts provide a visual representation of proportions in a dataset.
* **Choosing a Sample Table** is important when coming up with small examples for Table Plans. A good sample table has:
  1. At least all the relevant columns
  2. Enough rows to accurately represent the dataset
  3. Rows that are randomly-ordered

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# Statements about Columns

Use the Table below to help you answer the questions.

|  |  |  |  |
| --- | --- | --- | --- |
| **name** | **species** | **age** | **pounds** |
| Sasha | cat | 1 | 6.5 |
| Felix | cat | 16 | 9.2 |
| Wade | cat | 1 | 3.2 |
| Boo-boo | dog | 11 | 123 |
| Maple | dog | 3 | 51.6 |
| Nori | dog | 6 | 35.3 |
| Nibblet | rabbit | 6 | 4.3 |

Boo-boo

1. Which animal(s) is/are the heaviest? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sasha, Wade

1. Which animal(s) is/are the youngest? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

22%

1. How much of the *total weight* comes from Maple? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

13%

1. How much of the *combined age* comes from Nori? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Would these questions be harder to answer if the table had 100 rows? If so, why?

Much harder if you were estimating, because it is harder to calculate a

large number of entries without using software.

# Visualizing Quantity

In the table below, there are two observations drawn from the following charts. Add two more.

|  |  |
| --- | --- |
|  |  |
| Animals Ages (yrs) | Animals Weights (lbs) |

|  |  |
| --- | --- |
| **Based on a \_\_\_\_\_ chart of \_\_\_\_\_\_\_\_\_** | **I notice that \_\_\_\_\_\_\_\_\_\_\_** |
| Based on a **bar chart** of 7 animals’ ages  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | Felix is by far the oldest  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| Based on a **pie chart** of 7 animals’ weights  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | Boo-boo weighs more than the other six animals combined!  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| Based on a **bar chart** of 7 animals’ ages  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | Wade and Sasha are the youngest animals  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| Based on a **pie chart** of 7 animals’ weights  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | Maple is as large as the five smallest animals  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |

# Table Plan

Dogs are generally a lot bigger heavier than cats, so the shelter wants to look at a chart of *only* the dogs to determine who needs more exercise time. Define a function pie-dog-weight, which will make a pie chart showing the relative weights of all the dogs in the shelter.

|  |
| --- |
| **Contract and Purpose**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  Image  (animals :: Table)  pie-dog-weight    # Consumes a table of animals, produces a pie chart of only the dogs and their weights  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Examples**  Make a Start Table and a result based on that table.  animals-table 🡪 pie-dog-weight(animals-table)   |  |  |  | | --- | --- | --- | | **name** | **…** | **pounds** | | Snowcone | … | 6.1 | | Lucky | … | 45.4 | | Hercules | … | 13.4 | | Toggle | … | 48 | | Snuggles | … | 0.1 | |
| **Define the function**  Use the relevant methods (circle your helper functions!), then produce a result with the new table.  **fun** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_):  animals  pie-dog-weight  *Define the table*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *t = animals*  *.build-column( )*  *.filter(* is-dog *)*  *.order-by( )*  pie-chart(t, “name”, “pounds”)  *Are there more columns? Are there fewer rows? Are the rows ordered?*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Produce the result*  **end** |

# Bad Sample Tables!

For each word problem, a Sample Table must have (1) all the columns that matter, (2) a representative sample of the rows, and be in (3) random order. For each problem below, check the boxes to determine if the Sample Table meets those criteria.

1. **The shelter wants to know the median age of all the cats**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **name** | **species** | **age** | **fixed** | **legs** | **pounds** | **weeks** |
| Sasha | cat | 1 | FALSE | 4 | 6.5 | 3 |
| Mittens | cat | 2 | TRUE | 4 | 7.4 | 5 |
| Sunfower | cat | 5 | TRUE | 4 | 8.1 | 10 |

✓ Relevant columns

✓ Representative sample of rows

✓ Random order

1. **The shelter wants a pie chart showing all the dogs’ weight**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **name** | **species** | **age** | **fixed** | **legs** | **pounds** | **weeks** |
| Sasha | cat | 1 | FALSE | 4 | 6.5 | 3 |
| Mittens | cat | 2 | TRUE | 4 | 7.4 | 5 |
| Sunfower | cat | 5 | TRUE | 4 | 8.1 | 10 |

|  |  |  |
| --- | --- | --- |
| **name** | **species** | **age** |
| Fritz | dog | 4 |
| Wade | cat | 2 |
| Nibblet | rabbit | 6 |
| Daisy | dog | 5 |

* Relevant columns

✓ Representative sample of rows

✓ Random order

1. **Sort all the animals alphabetically by name**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **name** | **species** | **age** | **fixed** | **legs** | **pounds** | **weeks** |
| Ada | dog | 2 | TRUE | 4 | 32 | 3 |
| Bo | dog | 4 | TRUE | 4 | 76.1 | 10 |
| Boo-boo | dog | 11 | TRUE | 4 | 123 | 10 |

✓ Relevant columns

* Representative sample of rows
* Random order

1. **Make a bar chart for all the fixed animals**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **name** | **species** | **age** | **fixed** | **legs** | **pounds** | **weeks** |
| Sasha | cat | 1 | FALSE | 4 | 6.5 | 3 |

* Relevant columns
* Representative sample of rows
* Random order

# Table Plan

Define a function bar-kitten-adoption, which takes in a Table of animals and creates a bar chart showing how many weeks it took for each kitten to be adopted

|  |
| --- |
| **Contract and Purpose**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  Image  (animals :: Table)  bar-kitten-adoption    # Consumes a table of animals, produces a bar chart showing the weeks it took for each kitten to be adopted  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Examples**  Make a Start Table and a result based on that table.  bar-kitten-adoption(animals-table)  animals-table  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **name** | **species** | **age** | **fixed** | **pounds** | **weeks** | | Sasha | cat | 1 | FALSE | 6.5 | 3 | | Wade | cat | 1 | FALSE | 7.4 | 1 | | Sunfower | cat | 5 | TRUE | 8.1 | 10 | | Boo-boo | dog | 11 | TRUE | 123 | 10 | |
| **Define the function**  Use the relevant methods (circle your helper functions!), then produce a result with the new table.  **fun** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_):  animals  bar-kitten-adoption  *Define the table*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *t = animals*  *.build-column( )*  *.filter(* is-kitten *)*  *.order-by( )*  bar-chart(t, “name”, “weeks”)  *Are there more columns? Are there fewer rows? Are the rows ordered?*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Produce the result*  **end** |

# Table Plan

|  |
| --- |
| **Contract and Purpose**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Examples**  Make a Start Table and a result based on that table.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   |  | | --- | |  | |  | |  | |  | |  | |  | |
| **Define the function**  Use the relevant methods (circle your helper functions!), then produce a result with the new table.  **fun** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_):  *Define the table*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *t =*  *Are there more columns? Are there fewer rows? Are the rows ordered?*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Produce the result*  **end** |

# Table Plan

|  |
| --- |
| **Contract and Purpose**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Examples**  Make a Start Table and a result based on that table.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   |  | | --- | |  | |  | |  | |  | |  | |  | |
| **Define the function**  Use the relevant methods (circle your helper functions!), then produce a result with the new table.  **fun** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_):  *Define the table*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *t =*  *Are there more columns? Are there fewer rows? Are the rows ordered?*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Produce the result*  **end** |

# Visualizing My Dataset

What quantity charts did you make, and what do you notice? Fill in the table below.

|  |  |
| --- | --- |
| **Based on a \_\_\_\_\_ chart of \_\_\_\_\_\_\_\_\_** | **I notice that \_\_\_\_\_\_\_\_\_\_\_** |
| **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |

# **Unit 7**

* There are three ways to measure the “center” of a dataset, to talk about a whole column of data using just one number:
  + 1. The **mean** of a dataset is the average of all the numbers
    2. The **median** of a dataset is a value that is smaller than half the dataset, and larger than the other half
    3. The **modes** of a dataset are the numbers that appear the most often.
* Data Scientists can also measure the “variation” of a dataset using a **five number summary:**
  + 1. The **minimum** – the smallest value in the dataset
    2. The **first, or “lower” quartile (Q1)** – the median value that separates the first quarter of the values in the dataset from the second quarter
    3. The **second quartile (Q2)** – the median value which separates the entire dataset into “top” and “bottom” halves.
    4. The **third, or “upper” quartile (Q3)** – the median value that separates the third quarter of the values in the dataset from the fourth quarter
    5. The **maximum** – the largest value in the dataset
* The **five number summary** can be used to draw a **box-and-whisker plot.**



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# Summarizing Columns in Animals

weeks

The column I choose to measure is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Measures of Center**

The three measures for this column are:

|  |  |  |
| --- | --- | --- |
| **Mean (Average)** | **Median** | **Mode(s)** |
| 6.0689 | 4 | 1 |

Based on the differences between mean and median, I conclude : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

On average, animals stay at the shelter for about 6 weeks, but half of all the animals were adopted after 4 weeks or less.

**Measures of Variation**

My five-number summary is:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Minimum** | **Q1** | **Q2 (Median)** | **Q3** | **Maximum** |
| 1 | 2.5 | 4 | 8 | 30 |

A box plot can be drawn from this summary on the number line below:

From this summary and box-plot, I conclude: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The vast majority of animals are adopted before 8 weeks in the shelter, but there are a number of outliers (such as the maximum of 30)

# Table Plan

The shelter wants a summary of the variation in ages among the dogs. Write a function called variation-dog-age that will take in a table of animals and produce a box-plot that shows this variation.

|  |
| --- |
| **Contract and Purpose**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  Image  (animals :: Table)  variation-dog-age    # Consumes a table of animals, produces a box plot showing the variation of ages among only the dogs  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Examples**  Make a Start Table and a result based on that table.  animals-table 🡪 variation-dog-age(animals-table)   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **name** | **species** | **age** | **fixed** | **legs** | **weight** | **weeks** | | Snowcone | cat | 2 | TRUE | 4 | 6.1 | 5 | | Lucky | dog | 3 | TRUE | 3 | 45.4 | 9 | | Hercules | cat | 3 | FALSE | 4 | 13.4 | 7 | | Toggle | dog | 3 | TRUE | 4 | 48 | 3 | | Snuggles | tarantula | 2 | FALSE | 8 | 0.1 | 1 | |
| **Define the function**  Use the relevant methods (circle your helper functions!), then produce a result with the new table.  **fun** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_):  animals  variation-dog-age  *Define the table*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *t =* animals  *.build-column( )*  *.filter(* is-dog *)*  *.order-by( )*  box-plot(t, “age”)  *Are there more columns? Are there fewer rows? Are the rows ordered?*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Produce the result*  **end** |

# Interpreting Variation

Consider the following list dataset, representing the annual income of ten people:

$65k, $12k, $14k, $280k, $15k, $22k, $45k, $34k, $45k, $175k

1. In the space below, rewrite this dataset in **sorted order**.

$12k, $14k, $15k, $22k, $34k, $45k, $45k, $65k, $175k, $280k

1. In the table below, compute the **measures of center** for this dataset.

|  |  |  |
| --- | --- | --- |
| **Mean (Average)** | **Median** | **Mode(s)** |
| 70,700 | 39,500 | 45,000 |

1. In the table below, compute the **five number summary** of this dataset.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Minimum** | **Q1** | **Q2 (Median)** | **Q3** | **Maximum** |
| 12,000 | 15,000 | 39,500 | 65,000 | 280,000 |

1. On the number line below, draw a **box plot** for this dataset.
2. The following statements are *correct*…but misleading. Write down the reason why.

|  |  |
| --- | --- |
| **Statement** | **Why it’s misleading** |
| *“They’re rich! The average person makes more than $70k dollars!”* | While the mean is close to $70k, there are some very high earning outliers pushing the average up |
| *“It’s a middle-income list: the most common salary is $45k/yr!”* | Looking at the full dataset, more than half of the entries are people making less than $45k, making the mode misleading |
| *“This group is really diverse, with people making as little as 12k and as much as $280k!”* | While the spread of incomes is large, the vast majority are still making less than $65k, with very high earning outliers. |

# Summarizing a Column in My Dataset

[Specific to each student]

The column I choose to measure is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Measures of Center**

The three measures for this column are:

|  |  |  |
| --- | --- | --- |
| **Mean (Average)** | **Median** | **Mode(s)** |
|  |  |  |

Based on the differences between mean and median, I conclude : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Measures of Variation**

My five-number summary is:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Minimum** | **Q1** | **Q2 (Median)** | **Q3** | **Maximum** |
|  |  |  |  |  |

A box plot can be drawn from this summary on the number line below:

From this summary and box-plot, I conclude: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# **Unit 8**

* **Frequency Bar charts** show the number of rows belonging to a given category. The more rows in each category, the longer the bar. Frequency bar charts provide a visual representation of the frequency of values in a **categorical** column. Since categorical data cannot be ordered, there is no strict ordering of bars in a frequency bar chart.
* **Histograms** show the number of rows that fall within certain ranges, or “bins” of a dataset. The more rows that that fall within a particular “bin”, the longer the bar. Histograms provide a visual representation of the frequency of values in a **quantitative** column. Quantitative data can be ordered, so the bars of a histogram are always sorted.
* When dealing with histograms, it’s important to select a good **bin size**. If the bins are too small or too large, it is difficult to see the distribution in the dataset.

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# Visualizing Quantity (Review)

Use the charts below to help you answer the questions.

|  |  |
| --- | --- |
|  |  |
| Animals Weights (lbs) | |

Boo-boo

1. Which animal is the heaviest? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Wade

1. Which animal is the lightest? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

22.1%

1. How much of the *total weight* comes from Maple? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

15.1%

1. How much of the *total weight* comes from Nori? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Bar chart

1. Which chart did you use for questions 1 and 2? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Pie chart

1. Which chart did you use for questions 3 and 4? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Why are some questions easier to answer with one kind of chart or another?

Bar charts are better for finding the amount of something quickly, whereas pie charts are better for seeing the percentage of something relative to the total for other elements in a table.

# Visualizing Frequency

|  |  |  |  |
| --- | --- | --- | --- |
| **name** | **species** | **age** | **pounds** |
| "Sasha" | "cat" | 1 | 6.5 |
| "Boo-boo" | "dog" | 11 | 123 |
| "Felix" | "cat" | 16 | 9.2 |
| "Nori" | "dog" | 6 | 35.3 |
| "Wade" | "cat" | 1 | 3.2 |
| "Nibblet" | "rabbit" | 6 | 4.3 |
| "Maple" | "dog" | 3 | 51.6 |

3

1. How many cats are there? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3

1. How many dogs are there? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3

1. How many animals are between 3-6 years old? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2

1. How many weigh between 0-5 pounds? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Yes

1. Are there more animals weighing 0-5 than 6-10 pounds? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. The charts below are based on the Sample Table above. What is each one measuring? Write down your guess underneath each one.

 

|  |  |  |
| --- | --- | --- |
| Amount of each species |  | Frequency of animal weights |
|  |  |  |
|  |  |  |
|  |  |  |

# Table Plan

Define a function freq-bar-gender, which takes in a Table of animals and creates a frequency bar chart showing how many animals are male v. female.

|  |
| --- |
| **Contract and Purpose**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  Image  (animals :: Table)  freq-bar-gender    # Consumes a table of animals and produces a frequency bar chart of their genders  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Examples**  Make a Start Table and a result based on that table.  freq-bar-gender(animals-table)  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  animals-table  \_   |  |  |  |  | | --- | --- | --- | --- | | **name** | **species** | **age** | **gender** | | Fritz | dog | 4 | male | | Wade | cat | 2 | male | | Nibblet | rabbit | 6 | male | | Daisy | dog | 5 | female | |
| **Define the function**  Use the relevant methods (circle your helper functions!), then produce a result with the new table.  **fun** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_):  freq-bar-gender  animals  *Define the table*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *t =* animals  freq-bar-chart(t, “gender”)  *fre*  *Are there more columns? Are there fewer rows? Are the rows ordered?*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Produce the result*  **end** |

# Table Plan

Define a function histogram-adoption, which takes in a Table of animals and creates a histogram showing how long it took for animals to get adopted

|  |
| --- |
| **Contract and Purpose**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  Image  (animals :: Table)  histogram-adoption    # Consumes a table of animals and produces a histogram showing how long it took for animals to get adopted  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Examples**  Make a Start Table and a result based on that table.  histogram-adoption(animals-table)  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  animals-table   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **name** | **species** | **age** | **fixed** | **legs** | **weight** | **weeks** | | Snowcone | cat | 2 | TRUE | 4 | 6.1 | 5 | | Lucky | dog | 3 | TRUE | 3 | 45.4 | 9 | | Hercules | cat | 3 | FALSE | 4 | 13.4 | 7 | | Toggle | dog | 3 | TRUE | 4 | 48 | 3 | | Snuggles | tarantula | 2 | FALSE | 8 | 0.1 | 1 | |
| **Define the function**  Use the relevant methods (circle your helper functions!), then produce a result with the new table.  **fun** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_):  animals  histogram-adoption  *Define the table*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *t =* animals  histogram(t, “weeks”, 1)  *Are there more columns? Are there fewer rows? Are the rows ordered?*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Produce the result*  **end** |

# Visualizing My Dataset

What frequency charts did you make, and what do you notice? Fill in the table below.

|  |  |
| --- | --- |
| **Based on a \_\_\_\_\_ chart of \_\_\_\_\_\_\_\_\_** | **I notice that \_\_\_\_\_\_\_\_\_\_\_** |
| **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |

# Matching Charts to Questions

For each of the questions below, draw a line to the chart that will best answer it. (You may find that more than one question is best answered by the same chart!)

|  |  |
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| 1. Are there more of the animals at the shelter fixed or unfixed? 2. How many weeks did each cat wait to be adopted? 3. How many male v. female dogs are there? 4. How many animals have 4 legs? 8? 3? 5. What percent of the total weight at the shelter is made up by Boo-boo? 6. What is the distribution of weights across all the animals older than 3? 7. How many animals are there of each species? 8. Who waited the longest to be adopted? | **Pie Chart**  **Bar Chart**  **Frequency Bar Chart**  **Histogram** |

# **Unit 9**

* **Scatter Plots** show the relationship between two quantitative columns. Each row in the dataset is represented by a point, with one column providing the x-value and the other providing the y-value. The resulting “point cloud” makes it possible to look for a relationship between those two columns.
* If the points in a scatter plot appear to follow a pattern, it is possible that a relationship – or **correlation** – exists between those two columns.
* Ifthere is a pattern to the points in a scatter plot, points that are far away from the pattern are called **outliers**.
* We can express this correlation by drawing line through the data cloud, so that the distance between the line and each of the points is as small as possible. This line is called the **line of best fit** – or **predictor function** - and allows us to make predictions based on the dataset.

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# (Dis)Proving a Claim

***“Younger animals are cuter, so they get adopted faster.”***

*Do you agree? If so, why?*

I hypothesize…

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| that younger animals *will* get adopted faster, possibly because they are considered cuter, but there may be other factors causing them to get adopted faster. |
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| [specific to each student] |
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*What would you look for in the dataset to see if you are right?*

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| I would look at both the ages and number of weeks until adoption for each animal to see if there was a correlation. I would also want to collect more data, such as conduct a survey of adopters. |
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# Creating a Scatter Plot



|  |  |  |  |
| --- | --- | --- | --- |
| **name** | **species** | **age** | **weeks** |
| "Sasha" | "cat" | 1 | 3 |
| "Boo-boo" | "dog" | 11 | 5 |
| "Felix" | "cat" | 16 | 4 |
| "Buddy" | "lizard" | 2 | 24 |
| "Nori" | "dog" | 6 | 9 |
| "Wade" | "cat" | 1 | 2 |
| "Nibblet" | "rabbit" | 6 | 12 |
| "Maple" | "dog" | 3 | 2 |

1. **For each row in the Sample Table on the left, add a point to the scatter plot on the right**. The first 3 rows have been completed for you. Use the values from the age column for the x-axis, and values from the weeks column for the y-axis.
2. Do you see a pattern? Do the points seem to shift up or down as age increases? **Draw a line on the scatter plot to show this pattern**.

Slightly upwards

1. Does the line slope upwards or downwards? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

A few points are close to the line, but as ages increase the points get much farther apart.

1. Are the points mostly close to the line? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Table Plan

Define a function dogs-age-weeks, which takes in a Table of animals and creates a scatter plot of all the dogs, tracking their age on the x-axis and the number of weeks it took for them to be adopted on the y-axis.

|  |
| --- |
| **Contract and Purpose**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  Image  (animals :: Table)  dog-age-weeks    # Consumes a table of animals and produces a scatter plot showing the relationship between age and weeks to adoption  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Examples**  Make a Start Table and a result based on that table.  dog-age-weeks(animals-table)  animals-table  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **name** | **species** | **age** | **fixed** | **legs** | **weight** | **weeks** | | Snowcone | cat | 2 | TRUE | 4 | 6.1 | 5 | | Lucky | dog | 3 | TRUE | 3 | 45.4 | 9 | | Hercules | cat | 3 | FALSE | 4 | 13.4 | 7 | | Toggle | dog | 3 | TRUE | 4 | 48 | 3 | | Snuggles | tarantula | 2 | FALSE | 8 | 0.1 | 1 | |
| **Define the function**  Use the relevant methods (circle your helper functions!), then produce a result with the new table.  **fun** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_):  dog-age-weeks animals  *Define the table*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *t =* animals-table    .filter( is-dog )  scatter-plot(t, “age”, “weeks”)  *Are there more columns? Are there fewer rows? Are the rows ordered?*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Produce the result*  **end** |

# Drawing Predictors

For each of the scatter plots below, draw a **predictor line** that fits best.

|  |  |  |
| --- | --- | --- |
| **A** | fat (g) v. calories-from-fat in common menu items | **Direction**: Positive Negative None  **Strength**: Strong Weak |
| **B** | fat (g) v. sodium (g) in common menu items | **Direction**: Positive Negative None  **Strength**: Strong Weak |
| **C** | sodium (g) v. cholesterol (mg) in common menu items | **Direction**: Positive Negative None  **Strength**: Strong Weak |
| **D** | fat (g) v. sugar (g) in common menu items | **Direction**: Positive Negative None  **Strength**: Strong Weak |

# Correlations in My Dataset

1) There may be a correlation between \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. I think it is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ correlation, because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

positive / negative

strong / weak

column

column

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. It would be stronger if I looked at \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

a subset or extension of my data

1) There may be a correlation between \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. I think it is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ correlation, because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

positive / negative

strong / weak

column

column

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. It would be stronger if I looked at \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

a subset or extension of my data

1) There may be a correlation between \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. I think it is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ correlation, because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

positive / negative

strong / weak

column

column

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. It would be stronger if I looked at \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

a subset or extension of my data

# **Unit 10**

* Given a **predictor function** and a scatter plot, we can compute the error by adding the squares of all the distances between the function and each point in the plot. The error is called the **r2** **statistic**, which tells us *how much of the variation in the y-axis can be explained by the x-axis.*
* A **strong correlation** will have a larger2. A **weak correlation** will have a small r2.
* A **positive correlation** means the slope of the line of best fit is positive. A **negative correlation** means the slope is negative.
* **Linear Regression** is a way of computing the **line of best fit**, by taking a scatter plot and deriving the slope and y-intercept for a line that has the smallest possible r2.
* **Correlation is not causation**!Correlation only suggests that two measures are *related*, but does not tell us if one *causes* the other. For example, hot days are *correlated* with people running their air conditioners, air conditioners do not *cause* hot days!

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# Grading Predictors

Below are the scatter plots for data sets A-D, with two different lines predictor lines drawn on top. For plots A-D:

1. Circle the plot with the line that fits better
2. Give the plot you circled a grade between 0 (no correlation) and 1 (perfect correlation)

|  |  |  |  |
| --- | --- | --- | --- |
| **A** | wb-pred-a-1.png | wb-pred-a-2.png | Strength of Correlation:  0.2  \_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **B** | wb-pred-b-2.png | wb-pred-b-1.png | Strength of Correlation:  0.95  \_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **C** | wb-pred-c-2.png | wb-pred-c-1.png | Strength of Correlation:  0.65  \_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **D** | wb-pred-d-2.png | wb-pred-d-1.png | Strength of Correlation:  0.4  \_\_\_\_\_\_\_\_\_\_\_\_\_ |

# Findings in the animals Dataset

|  |
| --- |
| I performed a linear regression on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and  a weak (r2=0.25), positive  dogs at the shelter  dataset or subset  found \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ correlation between \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. From this, I conclude that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  25% of the variability in adoption time is explained  by the age of the dog  number of weeks to be adopted  r2 % of the variation in [y-axis] is explained by [x-axis]  [x-axis] [y-axis]  age of the dogs (in weeks)  a strong/weak (r2=…), positive/negative  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. |
| I performed a linear regression on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and  a weak (r2=0.025), positive  cats at the shelter  dataset or subset  found \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ correlation between \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. From this, I conclude that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  by the weight of the cat  2.5% of the variability in adoption time is explained  number of weeks to be adopted  weight of the cats (in pounds)  r2 % of the variation in [y-axis] is explained by [x-axis]  [x-axis] [y-axis]  a strong/weak (r2=…), positive/negative  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. |
| I performed a linear regression on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and  a weak (r2=0.025), positive  fixed animals at the shelter  dataset or subset  found \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ correlation between \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. From this, I conclude that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  by the age of the animal  2.5% of the variability in weight is explained  age of the animal  weight of the animal (in pounds)  r2 % of the variation in [y-axis] is explained by [x-axis]  [x-axis] [y-axis]  a strong/weak (r2=…), positive/negative  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. |

# Correlations in My Dataset

|  |
| --- |
| I performed a linear regression on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and  dataset or subset  found \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ correlation between \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. From this, I conclude that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  r2 % of the variation in [y-axis] is explained by [x-axis]  [x-axis] [y-axis]  a strong/weak (r2=…), positive/negative  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. |
| I performed a linear regression on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and  dataset or subset  found \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ correlation between \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. From this, I conclude that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  r2 % of the variation in [y-axis] is explained by [x-axis]  [x-axis] [y-axis]  a strong/weak (r2=…), positive/negative  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. |
| I performed a linear regression on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and  dataset or subset  found \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ correlation between \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. From this, I conclude that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  r2 % of the variation in [y-axis] is explained by [x-axis]  [x-axis] [y-axis]  a strong/weak (r2=…), positive/negative  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. |

# **Unit 11**

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# Fake News!

**Every claim below is *wrong*!** Your job is to figure out why, by looking at the data.

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|  | **Data** | **Claim** | **Why it’s *wrong***  The average is based on all the players, and there may be outliers pushing the average height up-average tells you nothing about the majority of the players. |
| **1** | The average player on a basketball team is 6’1”. | *“Most of the players on the team are taller than 6’.”* |  |
| **2** | After performing linear regression on census data, a positive correlation (r2=0.18) was found between people’s height and salary. | *“Taller people get paid more.”* | Only 18% of the variation in salary is based on height, which is not a large enough r-squared value to say that taller people get paid more. |
| **3** |  | *“According to the predictor function indicated here, the value on the x-axis is will predict the value on the y-axis 63.6% of the time.”* | The r-squared value of 0.636 does not mean how often the y-value will be predicted, rather what percent of variation in the y-value is based on the x-value. |
| **4** | Bar Chart of Pet Ages | *“According to this bar chart, Felix makes up a little more than 15% of the total ages of all the animals in the dataset.”* | Bar charts are not the most appropriate image for showing the percentage of each measurement based on the total- pie charts should be used for that info. This bar chart shows that Felix is a little more than 15 years old. |
| **5** |  | *“According to this histogram, most animals weigh between 40 and 60 pounds.”* | More animals fit into the histogram bin between 40-60 lbs than any other bin, but that doesn’t mean that most animals weigh between 40-60 lbs. |
| **6** | After performing linear regression, a negative correlation (r2=0.91) was found between the number of hairs on a person’s head and their likelihood of owning a wig. | *“Owning wigs causes people to go bald.”* | Though there is a strong correlation between hair and owning a wig, correlation does NOT equal causation. |

# **Blank Recipes, Table Plans,**

# **and References**

# Design Recipes

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| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  name domain range  # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |
| **examples:**  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |
| **fun** \_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |

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| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  name domain range  # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |
| **examples:**  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |
| **fun** \_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |
| Design Recipes  |  |  | | --- | --- | | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  name domain range  # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | | **examples:**  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** | | **fun** \_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |  |  |  | | --- | --- | | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  name domain range  # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | | **examples:**  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** | | **fun** \_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** | | Design Recipes  |  |  | | --- | --- | | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  name domain range  # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | | **examples:**  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** | | **fun** \_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** |  |  |  | | --- | --- | | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_  name domain range  # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | | **examples:**  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_(\_\_\_\_\_\_\_\_) **is** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** | | **fun** \_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_) : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **end** | | |

# Table Plan

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| **Contract and Purpose**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Examples**  Make a Start Table and a result based on that table.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   |  | | --- | |  | |  | |  | |  | |  | |  | |
| **Define the function**  Use the relevant methods (circle your helper functions!), then produce a result with the new table.  **fun** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_):  *Define the table*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *t =*  *Are there more columns? Are there fewer rows? Are the rows ordered?*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Produce the result*  **end** |

# Table Plan

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| **Contract and Purpose**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Examples**  Make a Start Table and a result based on that table.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   |  | | --- | |  | |  | |  | |  | |  | |  | |
| **Define the function**  Use the relevant methods (circle your helper functions!), then produce a result with the new table.  **fun** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_):  *Define the table*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *t =*  *Are there more columns? Are there fewer rows? Are the rows ordered?*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Produce the result*  **end** |

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| **Contract and Purpose**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_::\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
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| **Define the function**  Use the relevant methods (circle your helper functions!), then produce a result with the new table.  **fun** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_):  *Define the table*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *t =*  *Are there more columns? Are there fewer rows? Are the rows ordered?*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *Produce the result*  **end** |

Contracts

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| **Name** | **Domain** | **Range** |
| triangle | :: (side-length :: *Number*, style :: *String*, color :: *String*) | 🡪 *Image* |
| circle | :: (radius :: *Number*, style :: *String*, color :: *String*) | 🡪 *Image* |
| star | :: (radius :: *Number*, style :: *String*, color :: *String*) | 🡪 *Image* |
| rectangle | :: (width :: *Num*, height :: *Num,* style :: *Str*, color :: *Str*) | 🡪 *Image* |
| ellipse | :: (width :: *Num*, height :: *Num,* style :: *Str*, color :: *Str*) | 🡪 *Image* |
| square | :: (side-length :: *Number*, style :: *String*, color :: *String*) | 🡪 *Image* |
| text | :: (str :: *String*, size :: *Number*, color :: *String*) | 🡪 *Image* |
| overlay | :: (img1 :: *Image*, img2 :: *Image*) | 🡪 *Image* |
| rotate | :: (degree :: *Number*, img :: *Image*) | 🡪 *Image* |
| scale | :: (factor :: *Number*, img :: *Image*) | 🡪 *Image* |
| string-repeat | :: (text :: *String*, repeat :: *Number*) | 🡪 *String* |
| string-contains | :: (text :: *String*, search-for :: *String*) | 🡪 *Boolean* |
| num-sqr | :: (n :: *Number*) | 🡪 *Number* |
| num-sqrt | :: (n :: *Number*) | 🡪 *Number* |
| num-min | :: (a :: *Number, b:: Number*) | 🡪 *Number* |
| num-max | :: (a :: *Number, b:: Number*) | 🡪 *Number* |
| get-row | :: (t :: *Table, index :: Number*) | 🡪 *Row* |

Contracts

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| **Name** | **Domain** | **Range** |
| *<Table>.*row-n | :: (n :: *Number*) | 🡪 *Row* |
| *<Table>.*order-by | :: (col :: *String, increasing* :: *Boolean*) | 🡪 *Table* |
| *<Table>.*filter | :: (test :: *(Row 🡪 Boolean*) ) | 🡪 *Table* |
| *<Table>.*build-column | :: (col :: *String, builder* :: *(Row 🡪 Value)* ) | 🡪 *Table* |
| mean | :: (t:: *Table,* col :: *String*) | 🡪 *Number* |
| median | :: (t:: *Table,* col :: *String*) | 🡪 *Number* |
| modes | :: (t:: *Table,* col :: *String*) | 🡪 *List<Number>* |
| bar-chart | :: (t:: *Table,* labels :: *String*, values :: *String*) | 🡪 *Image* |
| pie-chart | :: (t:: *Table,* labels :: *String*, values :: *String*) | 🡪 *Image* |
| box-plot | :: (t:: *Table,* col:: *String*) | 🡪 *Image* |
| freq-bar-chart | :: (t:: *Table,* values :: *String*) | 🡪 *Image* |
| histogram | :: (t:: *Table,* values :: *String*, bin-width :: *Number*) | 🡪 *Image* |
| scatter-plot | :: (t:: *Table,* xs :: *String*, ys :: *String*) | 🡪 *Image* |
| labeled-scatter-plot | :: (t:: *Table,* labels :: *String*, xs :: *String*, ys :: *String*) | 🡪 *Image* |
| lr-plot | :: (t:: *Table,* xs :: *String*, ys :: *String*) | 🡪 *Image* |
| labeled-lr-plot | :: (t:: *Table,* labels :: *String*, xs :: *String*, ys :: *String*) | 🡪 *Image* |