Placeholder page for
Front-Cover

Placeholder page for
Inside-Cover

Unit 1

(and room for notes!)

Expressions, Values, and Errors

For each expression, if it produces an error when evaluated,
write what kind of error occurs:

- For division by zero errors, write "division by 0".
- For errors where the operator is given the wrong type, write "wrong type".
- Otherwise, write what the expression evaluates to.

Expression	Value, or Error?
`8 - 5.3`	
`2 / 0`	
`"Three" * 2`	
`(3 + 5) * 3`	
`1.5 * "6"`	
`(2 / (3 - (2 + 1)))`	

Identifiers and Expressions

Imagine the program below has been written in your definitions window:

```
x = (3 * 2) - 2
y = x * 1.5
```

For each expression, if it produces an error when evaluated, write what kind of error occurs:

- For division by zero errors, write "division by 0".
- For errors where a variable hasn't been defined, write "unbound id"
- Otherwise, write what the expression evaluates to.

Expression	Value, or Error?
`y`	
`x - 3`	
`(y - 1) * z`	
`(x + y) / 2`	
`x + y`	

Unit 2

"What is the relationship between calories and sugar?"

I hypothesize…

I found…

Animals

Animal	Number-of-legs
"Human"	2
"Ant"	6
"Spider"	8
"Bear"	4
"Snake"	0

1. How many rows does this table have? _____
2. How many columns does this table have? _____
3. What are the names of the columns? _____
4. For the row with value "Human" in the **Animal** column, what is the value in the **Number-of-legs** column? _____
5. Circle the header row of this table

Presidents and Nutrition

Answer the following questions about the `presidents` and `nutrition` tables, using your Unit-2 Pyret program:

1. How many columns does the `presidents` table have? _____

2. What are the names of the columns? _____

3. How many rows does the `presidents` table have? _____

4. Is the `party` column quantitative or categorical? _____

5. Is the data in the `home-state` column categorical? _____

6. If so, how many categories are there? _____

7. What is the home state of Millard Fillmore? _____

8. Who was the first president from the Federalist party? _____

9. How many columns does the nutrition table have? _____

10. How many rows does the nutrition table have? _____

11. How many grams of cholesterol does the Hamburger have? _____

12. Which food has the largest serving size? _____

13. Is the data in the `calories` column quantitative? If so, why?

_____

Unit 3

"The average US Household makes more than $45,000/yr[1]. So why are so many people living in poverty?"

I hypothesize…

I found…

[1] https://web.archive.org/web/20060903121944/http://www.census.gov/hhes/income/histinc/h13.html

Mean, Median, Mode Practice

Using pencil & paper, calculate the 3 numbers that measure the center of each list. If a list contains more than one mode, write the number with the smallest value.

These lists are bound to variables a, b, c, d, e in the Unit 3 template file, so you can check your answers with Pyret.

List	Mean	Median	Mode
a = [list: 1, 1, 4]			
b = [list: 3, 4, 5]			
c = [list: 3, 3, 4, 6]			
d = [list: -1, 0.5, 2, 0.5, 2, 6]			
e = [list: 2, 11, 7, 4]			

Measuring Center in Pyret

1. What is the mode of the `calories-list`? _____

2. What is the mean amount of `sodium` for menu items? _____

3. What is the median GDP for all the countries in `countries`? _____

4. What is the median of `life-expectancy-list`? _____

Imagine the following code is in your definitions window:

```
mystery-list = [list: 1, 2, 3, 4, 5, 6, 7, 8, 9]
```

5. What is the median of this mystery-list? _____

Now imagine these lists (which contain the same elements as `mystery-list`) are in your definitions window:

```
mystery1 = [list: 1, 4, 7]
mystery2 = [list: 2, 3, 8]
mystery3 = [list: 5, 6, 9]
```

6. What is the median of `mystery1`? _____

7. What is the median of `mystery2`? _____

8. What is the median of `mystery3`? _____

9. What is the median of a list containing these 3 medians? _____

10. Is this different from the median of `mystery-list`? _____

Unit 4

Reading Charts

1. Which menu item has the most sodium? _____
2. Which menu item has the least sodium? _____
3. Do french fries have more sodium than hamburgers? _____
4. Which country has the largest GDP? _____
5. What percent of the total world GDP is from China? _____

Frequency Bar Chart

First	Last	Eye-Color
"John"	"Doe"	"Green"
"Jane"	"Smith"	"Brown"
"Javon"	"Jackson"	"Brown"
"Angela"	"Enriquez"	"Hazel"
"Jack"	"Thompson"	"Blue"
"Dominique"	"Rodriguez"	"Hazel"
"Sammy"	"Carter"	"Blue"
"Andrea"	"Garcia"	"Brown"

1. How many students have Brown eyes? _____
2. How many students have Green eyes? _____
3. How many students have Hazel eyes? _____
4. How many students have Blue eyes? _____
5. Above the "Blue" label on this bar chart, add a bar with height that corresponds to the number of students with Blue eyes.

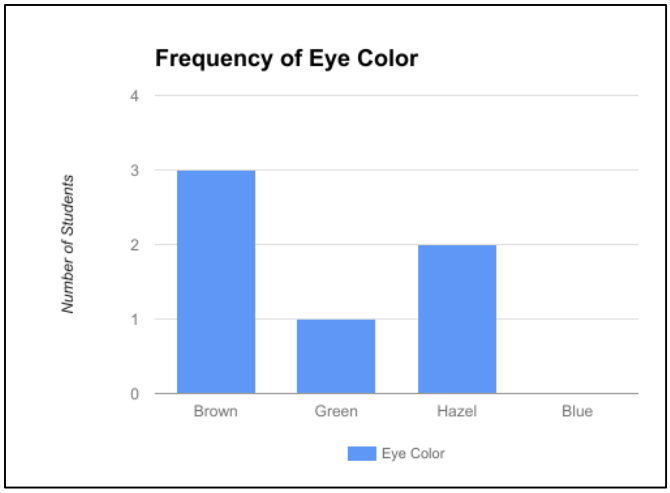
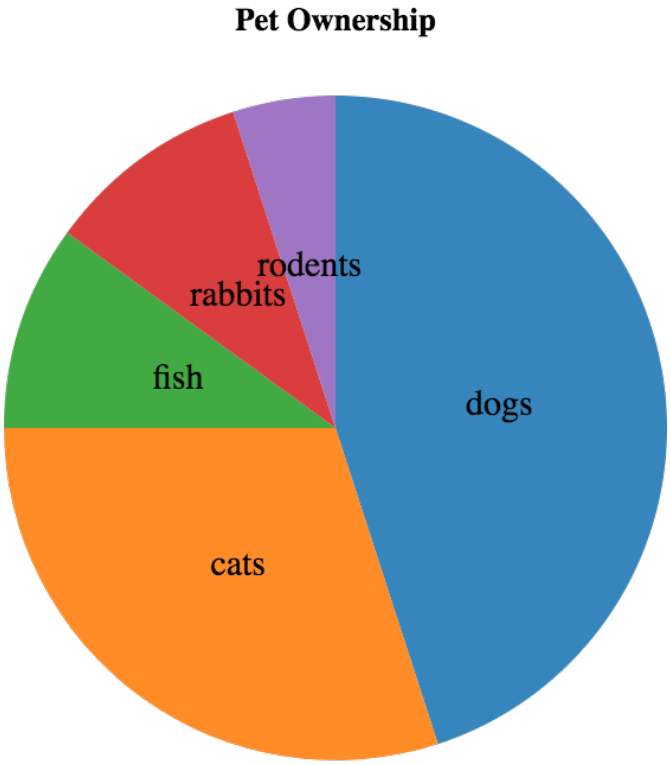
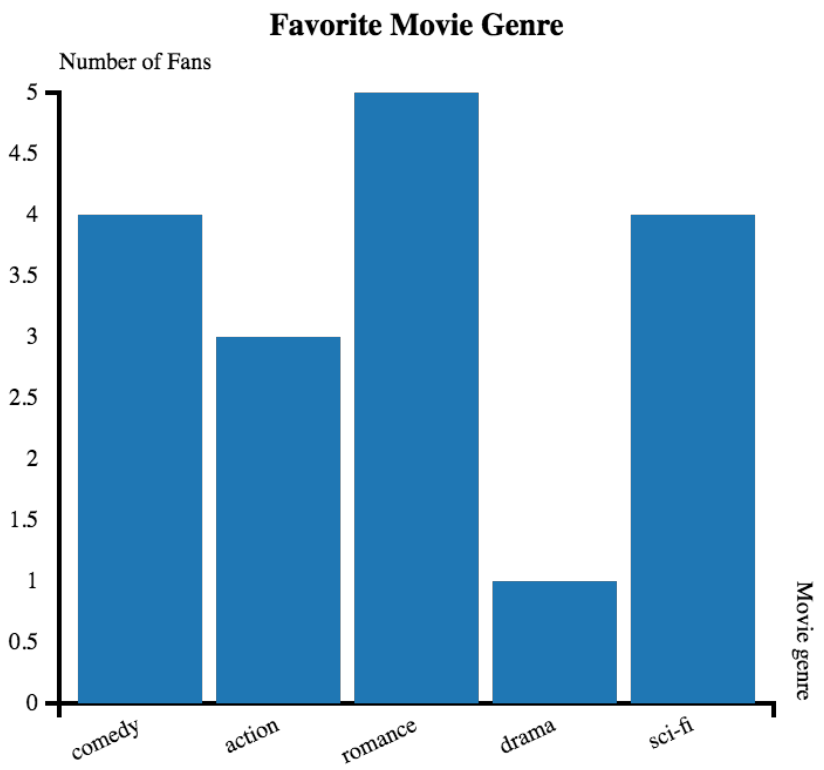


Chart Practice

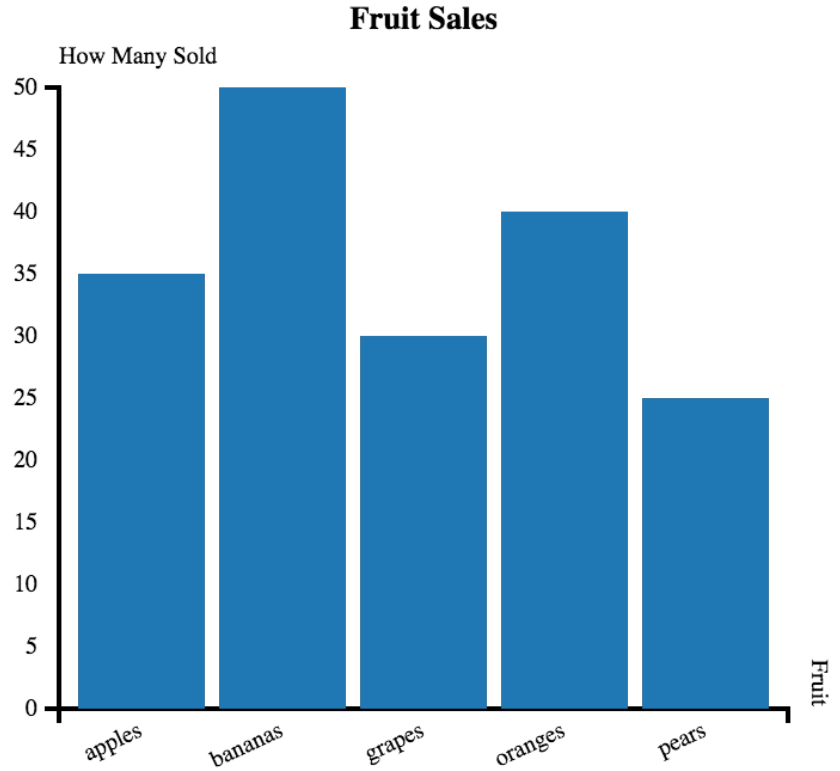


1. Is this a pie chart, or a bar chart? _____
2. Which pet is the most popular? _____
3. Which pet is the least popular? _____
4. Which are more popular, fish or rodents? _____



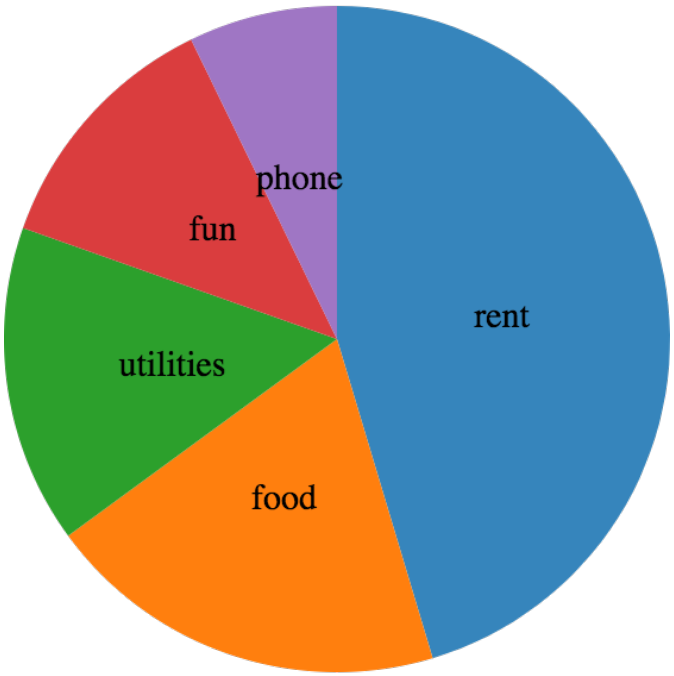
1. Is this a bar chart or a pie chart? _____
2. What genre is most popular? _____
3. What are the labels of this chart? _____
4. What are the values of this chart? _____
5. Is this a frequency bar chart? _____

More Chart Practice



1. Are apples more popular than grapes? _____
2. How many categories of fruit are there? _____
3. How many pears were sold? _____
4. What fruit is least popular? _____

Monthly Budget



1. Which expense needs the least amount of money? _____

2. Which expense takes up almost half of the budget? _____

3. Suppose a person has a $2000 monthly budget, and they spend 15% on food. How many dollars is spent on food in a single month? _____

Unit 5

Roll two dice, and guess the sum of the roll. Guess right and you win. Guess wrong and you lose.

"What are your chances of winning?"

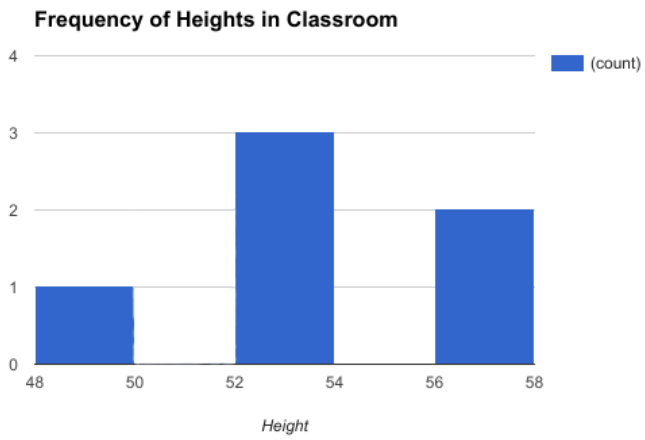
I hypothesize…

I found…

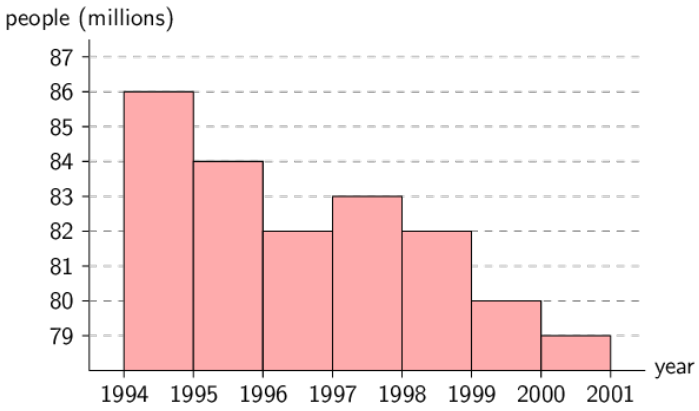
Introducing Histograms

First	Last	Height
"John"	"Doe"	52.0
"Jane"	"Smith"	49.1
"Javon"	"Jackson"	57.7
"Angela"	"Enriquez"	52.5
"Jack"	"Thompson"	53.0
"Dominique"	"Rodriguez"	51.1
"Sammy"	"Carter"	56.2
"Andrea"	"Garcia"	50.8

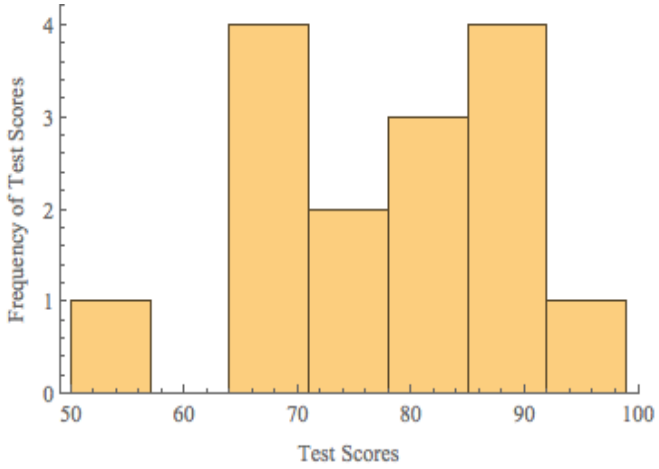
1. How many students are between 48 and 50 inches tall? _____
2. How many students are between 50 and 52 inches tall? _____
3. How many students are between 52 and 54 inches tall? _____
4. How many students are between 54 and 56 inches tall? _____
5. How many students are between 56 and 58 inches tall? _____
6. Add a bar to this histogram for students who are between 50 and 52 inches tall.



Histogram Practice



1. How many people were born between 1996 and 1997? _____
2. On what year were the most number of people born? _____
3. How many bins does this histogram have? _____
4. Were more people born in 1994 or 1995? _____



1. How many bins does this histogram have? _____
2. What is (are) the bins with the highest frequency of scores? _____
3. How many students scored between 85 and 92? _____

Unit 6

"Are more expensive restaurants generally better than cheaper ones?"

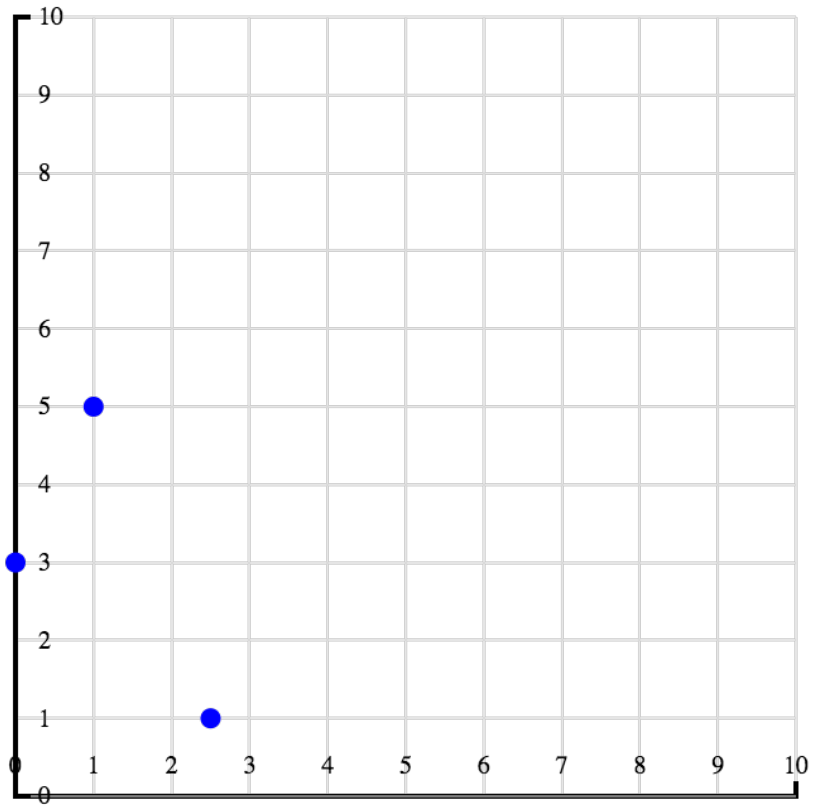
I hypothesize…

I found…

Creating a Scatter Plot

For each row in the following table, add a dot to the scatter plot. The first 3 rows have been completed for you. Use the values from the left column along the horizontal axis, and values from the right column along the vertical axis.

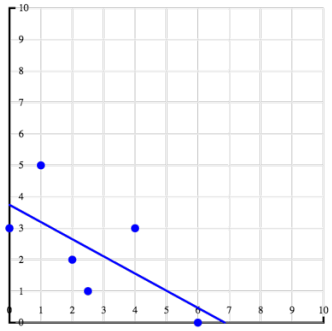
0	3
1	5
2.5	1
2	2
6	0
4	3

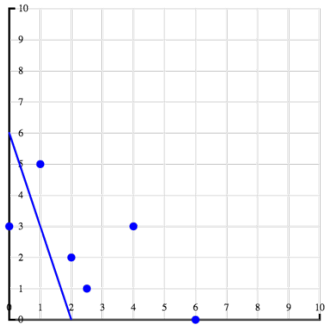


Grading Predictor Functions

Below are the scatterplots for 4 data sets, with two different predictors shown for each set. For each data set, **circle the plot with the predictor function that fits better**, and **give it a grade between 0 (worst possible fit) and 1 (best possible fit).**

1

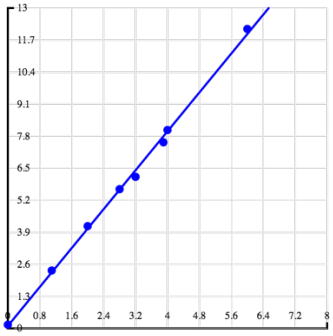


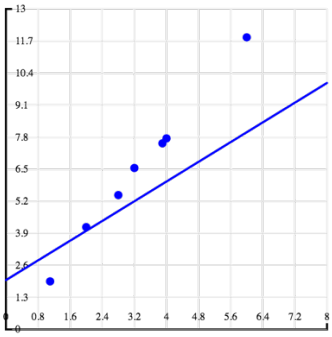


Grade for best predictor:

_____

2

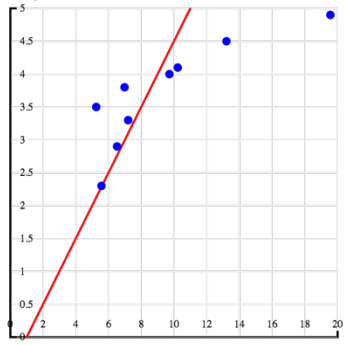


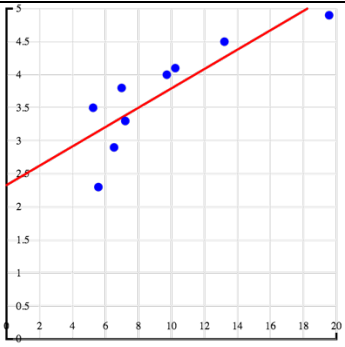


Grade for best predictor:

_____

3

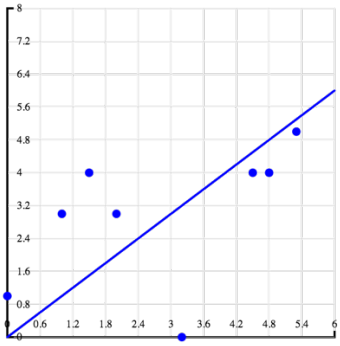


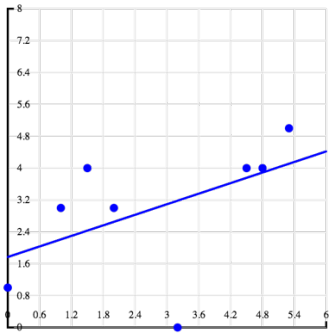


Grade for best predictor:

_____

4





Grade for best predictor:

_____

Checking for Understanding

1. In your own words, explain what a **predictor function** is.

2. In your own words, explain what the **r-squared** value of a predictor is.

Unit 7

Practice with `Select`

Below is a table bound to the variable name `animals`.

name	legs	eyes	lifespan
"Human"	2	2	71
"Garden Ant"	6	2	8
"Spider"	8	8	2.5
"Bear"	4	2	10

1. Draw the table produced by this code (don't forget the header row!):

```
select lifespan, name from animals end
```


2. What code produces the table shown here?

eyes
2
2
8
2

3. *Challenge:* Draw the table produced by this code:

```
table1 = select name, legs from animals end
select legs from mystery end
```


Table Plan: Anything Unnecessary?

We can use tables to do all sorts of things – but we need a plan. Each of the following questions involves some subset of the `animals` table. Read each one carefully, then write a table query that will *remove unnecessary columns* – keeping only those we need – and binds the new table to a variable you choose.

animals

name	legs	eyes	lifespan
"Human"	2	2	71
"Garden Ant"	6	2	8
"Spider"	8	8	2.5
"Bear"	4	2	10

1. We want to make a table listing only the `name` and `eyes` columns

Are any of the columns unnecessary?

myTable-selected =

```
select _____ from animals
end
```

2. We want to make a scatterplot of the relationship between `legs` and `eyes`.

Are any of the columns unnecessary?

_____ =

```
select _____ from animals
end
```

3. We want to search for a connection between `eyes` and `lifespan`

Are any of the columns unnecessary?

_____ =

```
select _____ from _____
end
```

Table Plan: Is there an order?

We can use tables to do all sorts of things – but we need a plan. Each of the following questions involves the `animals` table. Read each one carefully, then write a table query that will *orders the rows of the table* – in the correct order – and binds the new table to a variable you choose.

animals

name	legs	eyes	lifespan
"Human"	2	2	71
"Garden Ant"	6	2	8
"Spider"	8	8	2.5
"Bear"	4	2	10

1. We want a table that has the shortest-lived animal first and longest-lived last.

Do the rows need to be in some order?

_____myTable-ordered_____ =

select _____ **from** _____animals_____

end

2. We want to extract a list of legs, from most-to-least.

Do the rows need to be in some order?

_____ =

select _____ **from** _____animals_____

end

3. We want an alphabetized list of animal names.

Do the rows need to be in some order?

_____ =

select _____ **from** _____

end

What's the Table Plan?

The table on the left (`movies-start`) is where we start. The table on the right (`movies-end`) is where we need to end up. Your job is to write the queries that get us there.

movies-start

Movie Title	Studio	Total Gross	Domestic	Overseas	Year
Interstellar	Par.	675.1	188	487.1	2014
The Sixth Sense	BV	672.8	293.5	379.3	1999
Man of Steel	WB	668	291	377	2013
Kung Fu Panda 2	P/DW	665.7	165.2	500.4	2011
Ice Age: The Meltdown	Fox	660.9	195.3	465.6	2006

movies-end

Movie Title	Total Gross	Domestic
Ice Age: The Meltdown	660.9	188
Kung Fu Panda 2	665.7	293.5
Man of Steel	668	291
The Sixth Sense	672.8	165.2
Interstellar	675.1	195.3

Do the rows need to be in some order?

_____movies-ordered_____ = **order** _____movies-start_____:

_____

end

Are any of the columns unnecessary?

_____movies-end_____ =

select _____ **from** _____

end

What's the Table Plan?

The table on the left (`movies-start`) is where we start. The table on the right (`movies-end`) is where we need to end up. Your job is to write the queries that get us there.

movies-start

Movie Title	Studio	Total Gross	Domestic	Overseas	Year
Interstellar	Par.	675.1	188	487.1	2014
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Kung Fu Panda 2	P/DW	665.7	165.2	500.4	2011
Ice Age: The Meltdown	Fox	660.9	195.3	465.6	2006

movies-end

Title	Year
Interstellar	2014
Man of Steel	2013
Kung Fu Panda 2	2011
Ice Age: The Meltdown	2006
The Sixth Sense	1999

Do the rows need to be in some order?

movies-ordered = **order** movies-start :

_____

end

Are any of the columns unnecessary?

movies-end =

select _____ **from** _____

end

Unit 8

"How much of Asia's GDP does China generate?"

I hypothesize…

I found…

Booleans and Comparison

Suppose your program has the following definitions:

```
legs = 2
eyes = 2
class = "Mammal"
continent = "North America"
```

What will each of the following expressions evaluate to?

Expression	Value
`legs <= 4`	
`eyes == 2`	
`legs <> 4`	
`eyes <> 5 - 3`	
`legs == eyes`	

When you finish the first table try these challenge questions:

Expression	Value
`class == "Mammal"`	
`class == "Invertebrate"`	
`class <> "mammal"`	
`continent == "Asia"`	

What's the Table Plan?

The table on the left (`movies-start`) is where we start. The table on the right (`movies-end`) is where we need to end up. Your job is to write the queries that get us there.

movies-start

Movie Title	Studio	Total Gross	Domestic	Overseas	Year
Interstellar	Par.	675.1	188	487.1	2014
The Sixth Sense	BV	672.8	293.5	379.3	1999
Man of Steel	WB	668	291	377	2013
Kung Fu Panda 2	P/DW	665.7	165.2	500.4	2011
Ice Age: The Meltdown	Fox	660.9	195.3	465.6	2006

movies-end

Title	Year
Interstellar	2014
Man of Steel	2013
Kung Fu Panda 2	2011

Do I need to get rid of any rows?

movies-sieved = **sieve** _____ **using** _____:

_____

end

Do the rows need to be in some order?

movies-ordered = **order** _____:

_____

end

Are any of the columns unnecessary?

movies-end =

select _____ **from** _____

end

What's the Table Plan?

Starting with the table below, produce a table of `Titles` and `Overseas` profits, for all movies made before 2010, in ascending order of `Total Gross`. **Start by filling in what the `end` table should look like.**

`movies-start`

Movie Title	Studio	Total Gross	Domestic	Overseas	Year
Interstellar	Par.	675.1	188	487.1	2014
The Sixth Sense	BV	672.8	293.5	379.3	1999
Man of Steel	WB	668	291	377	2013
Kung Fu Panda 2	P/DW	665.7	165.2	500.4	2011
Ice Age: The Meltdown	Fox	660.9	195.3	465.6	2006

`movies-end`

Do I need to get rid of any rows?

_____movies-sieved_____ = **sieve** _____ **using** _____:

_____

end

Do the rows need to be in some order?

_____movies-ordered_____ = **order** _____:

_____

end

Are any of the columns unnecessary?

_____movies-end_____ =

`select` _____ **`from`** _____

`end`

Finding Bad Starter Tables

Four different data scientists create four different Starter Tables based on the `presidents` dataset. For each one, write down what makes it a bad starter table.

Starter Table

nth	name	home-state	yr-started	yr-ended	party
7	Andrew Jackson	Tennessee	1829	1837	Democratic

What's wrong?

nth	name	home-state	yr-started	yr-ended	party
7	Andrew Jackson	Tennessee	1829	1837	Democratic
35	John F. Kennedy	Massachusetts	1961	1963	Democratic
11	James K. Polk	Tennessee	1845	1849	Democratic
44	Barack Obama	Illinois	2009	2017	Democratic

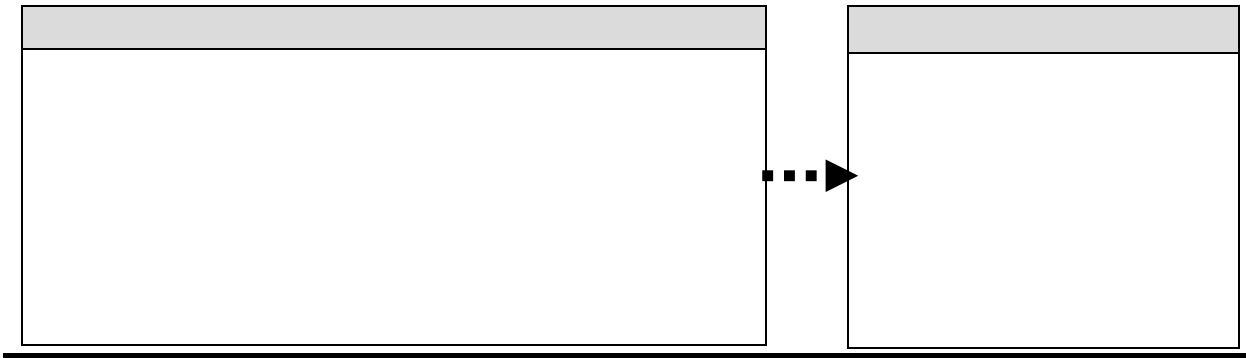
nth	name	home-state	yr-started	yr-ended	party
18	Ulysses S. Grant	Ohio	1869	1877	Republican
22	Grover Cleveland	New York	1885	1889	Democratic
20	James A. Garfield	Ohio	1881	1881	Republican
13	Millard Fillmore	New York	1850	1853	Whig

nth	name	home-state	yr-started	yr-ended	party
45	Donald Trump	New York	2017	2021	Republican
32	Franklin D. Roosevelt	New York	1933	1945	Democratic
21	Chester A. Arthur	New York	1881	1885	Republican
26	Theodore Roosevelt	New York	1901	1909	Republican

What's the Table Plan?

Define a table showing the names and GDPs of all countries in Asia, starting with the `countries` table. ***Start out*** *by creating a realistic "start table", using a sample of rows from the* `countries` *table, then a desired "end table" showing only the rows and columns you want, in the order you want them.*

countries **asian-GDPs**



Do I need to get rid of any rows?

_____ = **sieve** _____ **using** _____:

_____

end

Do the rows need to be in some order?

_____ = **order** _____:

_____

end

Are any of the columns unnecessary?

_____ =

select _____ **from** _____

end

Unit 9

Extending Tables

Below is a table named containing the number of points scored by different NBA players in their first 3 games of a season. For each row, fill in the value of the **total-points** column, by adding the **game-1, game-2, game-3** columns together.

player	game-1	game-2	game-3	total
"Lebron James"	30	28	36	
"Steph Curry"	26	32	29	
"Kyrie Irving"	21	24	27	
"John Wall"	27	30	25	
"Isaiah Thomas"	25	22	24	

1. Which player has scored the most points so far? _____

Below is a table named **stores** containing the prices of packs of socks for several different stores. Each store sells different size packs, for different prices. For each row, fill in the values of the **price-per-sock**.

name	price	socks	price-per-sock
"Super Store"	2.50	4	
"Clothes Galore"	5.40	4	
"Bargain Mart"	4.50	6	
"Fashion Statement"	15.00	12	
"Sock Emporium"	7.00	10	

2. Which store has the best deal on socks? _____

Table Plan: `Countries`

The United Nations wants us to find the top 5 countries in Asia, in terms of highest GDP per capita?

Do I need to add a column?

_____-extended_ = **extend** _____ **using** _____:

    _____ : _____

end

Do I need to get rid of any rows?

_____-sieved_ = **sieve** _____ **using** _____:

    _____

end

Do the rows need to be in some order?

_____-ordered_ = **order** _____:

    _____

end

Are any of the columns unnecessary?

_____-selected_ =

    select _____ **from** _____

end

Table Plan: `Nutrition`

Your aunt is a bodybuilder, and wants to a healthy menu item. Healthy food is food with less than 80 grams of cholesterol. Starting with the `nutrition` table, what are the top 5 healthy menu items with the highest protein per gram?

Do I need to add a column?

_____-extended_ = **extend** _____ **using** _____:

_____ : _____

end

Do I need to get rid of any rows?

_____-sieved_ = **sieve** _____ **using** _____:

_____

end

Do the rows need to be in some order?

_____-ordered_ = **order** _____:

_____

end

Are any of the columns unnecessary?

_____-selected_ = **select** _____

from _____

end

Table Plan: `Presidents`

For how many years was each Democratic president in office? We'd like to make a histogram showing how many democratic presidents served between 0 - 4 years, or 4 - 8 years. How do we make the necessary table?

Do I need to add a column?

_____-extended_ = **extend** _____ **using** _____:

_____ : _____

end

Do I need to get rid of any rows?

_____-sieved_ = **sieve** _____ **using** _____:

_____

end

Do the rows need to be in some order?

_____-ordered_ = **order** _____:

_____

end

Are any of the columns unnecessary?

_____-selected_ =

select _____ **from** _____

end

Rainfall Table Plan Practice

Given a table recording how much rain has fallen in a garden, make a scatter plot of how much rain fell in the first 99 days. Is the amount of rain per day increasing or decreasing? What's the mean rainfall of the first 99 days?

Do I need to add a column?

_____-extended_ = **extend** _____ **using** _____:

_____ : _____

end

Do I need to get rid of any rows?

_____-sieved_ = **sieve** _____ **using** _____:

_____

end

Do the rows need to be in some order?

_____-ordered_ = **order** _____:

_____

end

Are any of the columns unnecessary?

_____-selected_ =

select _____ **from** _____

end

Countries Table Plan Practice

Make a histogram of per-capita GDP for countries with universal health care. Do most of these countries have a per-capita GDP that is higher than the average per-capita GDP of all countries?

Do I need to add a column?

_____-extended_ = **extend** _____ **using** _____:

    _____ : _____

end

Do I need to get rid of any rows?

_____-sieved_ = **sieve** _____ **using** _____:

    _____

end

Do the rows need to be in some order?

_____-ordered_ = **order** _____:

    _____

end

Are any of the columns unnecessary?

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    select _____ **from** _____

end

Table Plan

Do I need to add a column?

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    _____ : _____

end

Do I need to get rid of any rows?

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    _____

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Do the rows need to be in some order?

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end

Do I need to get rid of any rows?

_____ = **sieve** _____ **using** _____:

    _____

end

Do the rows need to be in some order?

_____ = **order** _____:

    _____

end

Are any of the columns unnecessary?

_____ =

    select _____ **from** _____

end

Contracts

Name	Domain	Range	Example
`num-max`			`num-max(-1, 3)`
`string-length`			`string-length("pyret")`
`string-repeat`	`String Number`	`String`	