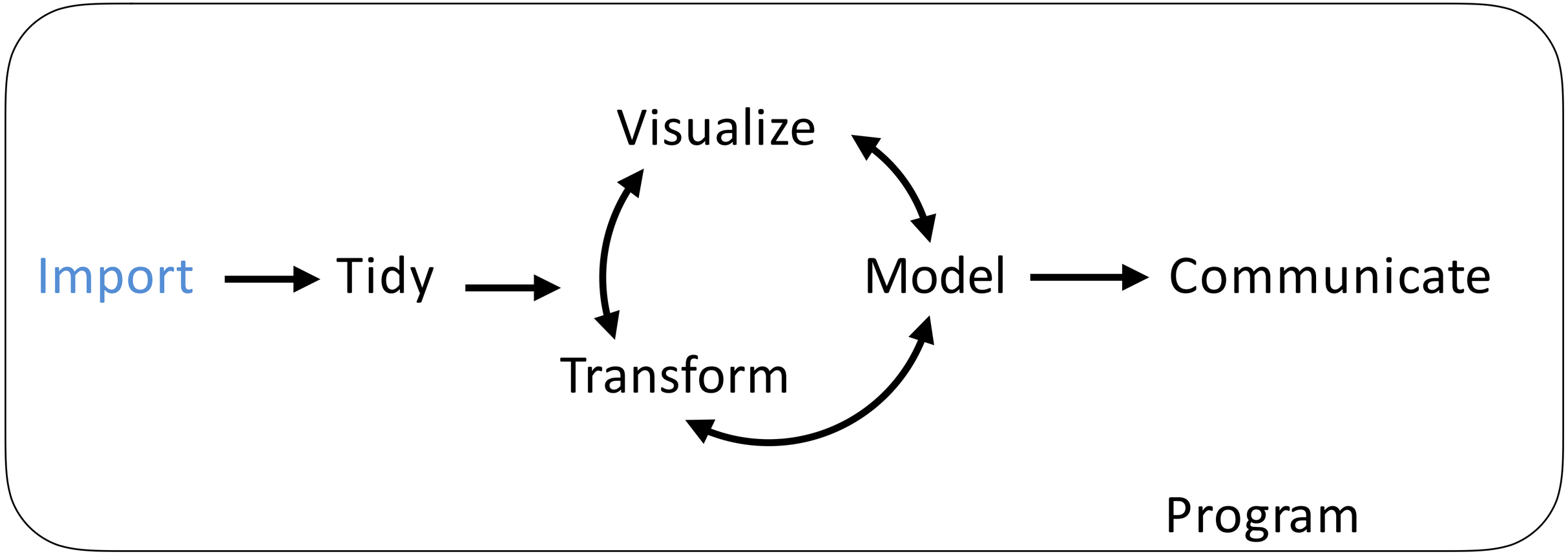
Import

DBI

“I ~~rob banks~~ use databases because its where the ~~money~~ data is.”

–Willie Sutton

(Applied) Data Science



Writing SQL

SQL IDE’S

- There are a bunch of SQL IDE’s each database provider has their own
- If you’re in a workplace like mine with no standard then I suggest something like DBeaver because it connects to pretty much everything
- If not, then use whatever comes standard with the platform

SQL

“SQL is a domain specific language used in programming and … data held in a relational database management system”

–Wikipedia

Structuring a Query

QUERIES

ORDER	CLAUSE	FUNCTION
1	from	Choose and join tables to get base data.
2	where	Filters the base data.
3	group by	Aggregates the base data.
4	having	Filters the aggregated data.
5	select	Returns the final data.
6	order by	Sorts the final data.
7	limit	Limits the returned data to a row count.

Source: periscope data

EXERCISE

- Open Dbeaver
- Highlight the Dev Warehouse Connection
- Create a new SQL Script
  - SQL > New SQL Script (or CRTL+])
- Build a query that selects Vaccine Site locations from the Health_SalesForce_Site table

SOLUTION

```
SELECT * FROM ACHD.Health_SalesForce_Site
```

DBeaver Short Cut:

- Right click the table you want to start a query from in the Database Navigator
- Click Read data in SQL console
  - Note: This method names all of the columns instead of using *

WHERE

BETWEEN … AND

- BETWEEN
  - *Grab Values between two other values, like IN but for numeric values*
  - *Works like < and >*

```
SELECT column_name(s)
FROM table_name
WHERE column_name BETWEEN value1
        AND value2;
```

IN STATEMENTS

- Useful for when you have an input that returns multiple
- This works the same way %in% does in R
- Checks to see if the value in the column matches *any* of the values in your list

```
SELECT column_name(s)
FROM table_name
WHERE column_name IN (value1, value2, ...)
```

EXERCISE

- This time let’s target Health_SalesForce_Appointment
- Use the BETWEEN function as a WHERE filter to get Second Dose appointments from April 1st to the 30th in 2021.

- Stretch goal: Use the IN Filter to get requests where the status is either "Day Of Screening Question Incomplete" or "Cancelled".

SOLUTION

```
SELECT * FROM ACHD.Health_SalesForce_Appointment
WHERE Dose_Number__c = 'Second Dose' AND
 Appointment_Date_Time__c BETWEEN '2021-04-01' AND '2021-04-30'
```

```
SELECT * FROM ACHD.Health_SalesForce_Appointment
WHERE Dose_Number__c = 'Second Dose' AND
 Appointment_Date_Time__c BETWEEN '2021-04-01' AND '2021-04-30' AND
 Status__c IN ('Cancelled', 'Day Of Screening Question Incomplete')
```

Pop Quiz

Tidyverse equivalent?

filter()

SELECT Functions and GROUP BY

SQL FUNCTIONS

- Sometimes you don’t just want the raw data
- You want to aggregate the data in SQL before you load it into R
  - Use another server to do the heavy lifting so you don’t have to!

DISTINCT

- DISTINCT()
  - Every unique value of a column.
  - Placing TWO columns inside will return unique instances of both columns:

```
DISTINCT(“REQUEST_TYPE”,  “DEPARTMENT”)
```

Pop Quiz

Tidyverse equivalent?

distinct()

MATH FUNCTIONS

- MIN()
  - Returns minimum value in a column(s)
- MAX()
  - Return max value in a column(s)

Pop Quiz

Tidyverse equivalent?

min(), max()

COUNT, AVERAGE, SUM

- COUNT() - returns the number of rows that your query returns
  - SELECT COUNT(column_name)
    FROM table_name
- AVG() - returns the average value of a numeric column.
  - SELECT AVG(column_name)
    FROM table_name
- SUM() - function returns the total sum - numeric columns only
  - SELECT SUM(column_name)
    FROM table_name

Pop Quiz

R/Tidyverse equivalents?

n(), mean(), sum()

GROUP BY

- This is helpful for when you are doing any of the summary functions mentioned in the previous slides. (COUNT, SUM, MAX etc)

- Any column that isn't handled with a function should be included in your GROUP BY

```
SELECT column_name(s), max(column_name)
FROM table_name
WHERE condition
GROUP BY column_name(s)
```

Pop Quiz

Tidyverse equivalent?

group_by()

EXERCISE

- This time we will use the Health_SalesForce_Contact table
- Count the number of people in each Zip Code

- Stretch Goal: Get the number by Zip Code that jave received a Second Dose

SOLUTION

```
SELECT
[MailingAddress.postalCode], COUNT(Id)
FROM HealthCare_DataWarehouse.ACHD.Health_SalesForce_Contact
GROUP BY [MailingAddress.postalCode]
```

```
SELECT
[MailingAddress.postalCode], COUNT(Id)
FROM HealthCare_DataWarehouse.ACHD.Health_SalesForce_Contact
WHERE Second_Dose_Received_Date__c IS NOT NULL
GROUP BY [MailingAddress.postalCode]
```

Other Functions

CASE

- CASE statements are for when you want to return categorical values based off of something else.

```
SELECT OrderID, Quantity,
CASE
    WHEN Quantity > 30 THEN "The quantity is greater than 30"
    WHEN Quantity = 30 THEN "The quantity is 30"
    ELSE "The quantity is under 30"
END AS QuantityText
FROM OrderDetails;
```

Pop Quiz

Tidyverse equivalent?

`case_when()`

CONCAT

- CONCAT()
  - This is mostly used when you have multiple columns you need.
  - May look different depending on DB server

```
SELECT CONCAT(column1, " ", column2) AS ConcatenatedString;

                                    OR

SELECT column1|| " “ || column2 AS ConcatenatedString;
```

Pop Quiz

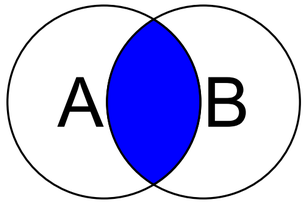
R equivalent?

paste()/paste0()

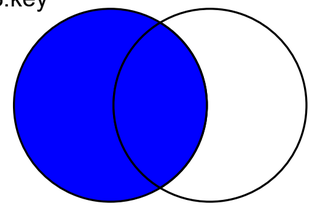
JOINS

SQL JOINS

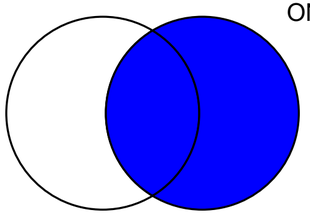
SELECT <fields>
FROM TableA A
INNER JOIN TableB B
ON A.key = B.key



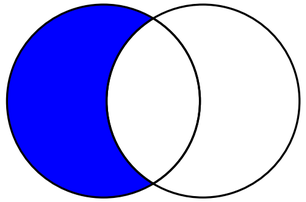
SELECT <fields>
FROM TableA A
LEFT JOIN TableB B
ON A.key = B.key



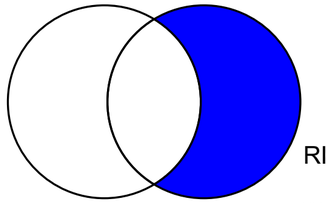
SELECT <fields>
FROM TableA A
RIGHT JOIN TableB B
ON A.key = B.key



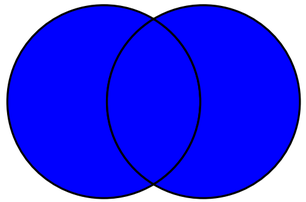
SELECT <fields>
FROM TableA A
LEFT JOIN TableB B
ON A.key = B.key
WHERE B.key IS NULL



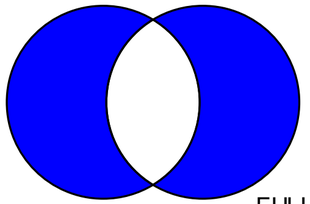
SELECT <fields>
FROM TableA A
RIGHT JOIN TableB B
ON A.key = B.key
WHERE A.key IS NULL



SELECT <fields>
FROM TableA A
FULL OUTER JOIN TableB B
ON A.key = B.key



SELECT <fields>
FROM TableA A
FULL OUTER JOIN TableB B
ON A.key = B.key
WHERE A.key IS NULL
OR B.key IS NULL



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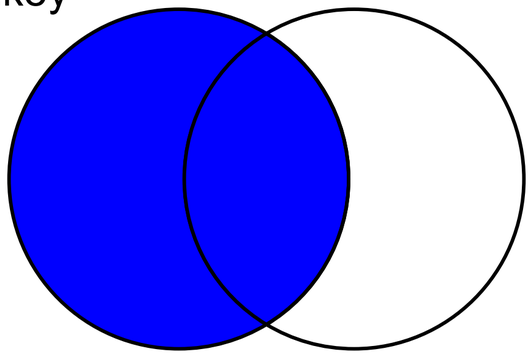
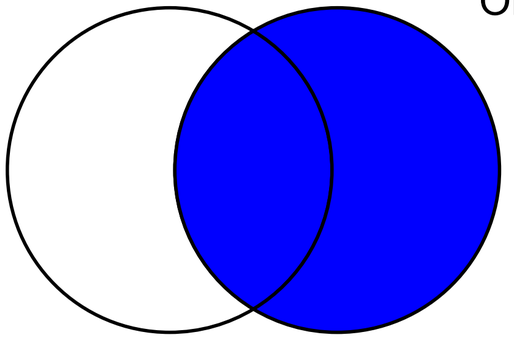
Left/Right Join

```
SELECT <fields>
FROM TableA A
LEFT JOIN TableB B
ON A.key = B.key
```



```
SELECT <fields>
FROM TableA A
RIGHT JOIN TableB B
ON A.key = B.key
```



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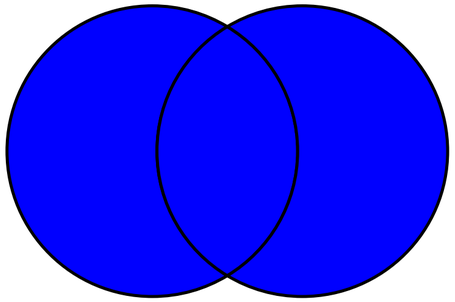
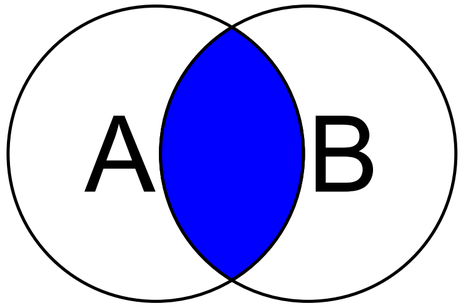
Author: http://commons.wikimedia.org/wiki/User:Arbeck

Inner/Outer Join

SELECT <fields>
FROM TableA A
FULL OUTER JOIN TableB B
ON A.key = B.key



SELECT <fields>
FROM TableA A
INNER JOIN TableB B
ON A.key = B.key



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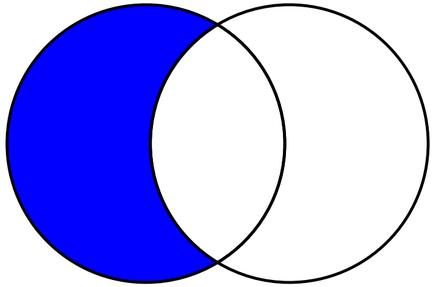
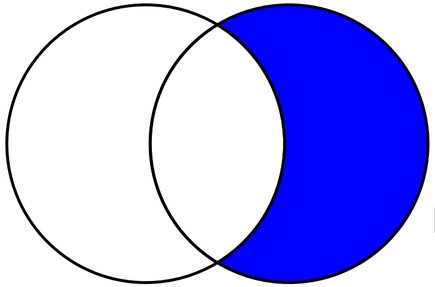
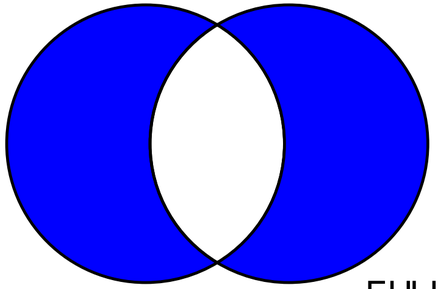
Anti-Joins

```
SELECT <fields>
FROM TableA A
LEFT JOIN TableB B
ON A.key = B.key
WHERE B.key IS NULL
```





```
SELECT <fields>
FROM TableA A
RIGHT JOIN TableB B
ON A.key = B.key
WHERE A.key IS NULL
```



```
SELECT <fields>
FROM TableA A
FULL OUTER JOIN TableB B
ON A.key = B.key
WHERE A.key IS NULL
OR B.key IS NULL
```

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DB Connections

CONNECTING

- Database connectors require that your computer has the necessary software.
  - This will depend on what database type you are trying to connect to

ALLOWING HANDSHAKES

- To setup database connections you will need to install the proper drivers.
  - The steps for this can be found here: https://db.rstudio.com/best-practices/drivers/
  - In general setup on Windows is a little bit easier since ODBC Data Source Administrator can be used
- Your machine may already have drives installed if you've already installed SQL IDE's such as: pgAdmin, DBeaver, or the MySQL Workbench

Storing Credentials

ENVIRONMENTAL VARIABLE OR FILE

- You should never “hard code” your credentials into an app.

- Instead you should store them as environmental variables, or in a hidden file that you ignore in the Git Repository

  - Why?

If something requires that you to login, we can assume that not just anybody should be able to access it.
Think of your credentials like your debit card and pin number

BUILDING AN ENVIRON FILE

- The usethis package has a function that will build your .Renviron file in your directory or for your entire profile.

```
usethis::edit_r_environ("project")
```

- How are .Renviron Files structured?

```
uid=some_username
pwd=aPassword
```

A new line for each variable

No spaces between variable name and value

LOADING VARIABLES

- Small difference between credentials in your profile or the project folder.
- The string argument is the name you gave your variable

Profile

```
uid <- Sys.getenv("uid")
pwd <- Sys.getenv("pwd")
```

.Renviron

```
readRenviron(".Renviron")

uid <- Sys.getenv("uid")
pwd <- Sys.getenv("pwd")
```

ESTABLISHING CONNECTIONS

- Each data base type has a different connection string and list of requirements.

```
conn <- dbConnect(odbc::odbc(), driver = "FreeTDS", server ="IP_or_HOST_ADDRESS", port
      = 1433, database = "DBName", uid = un, pwd=pw, TDS_Version = "8.0")
```

- More on connection strings: https://db.rstudio.com/best-practices/drivers/#connecting-to-a-database-in-r

Your Turn

Go to Rstudio and open the dbi_example.Rmd