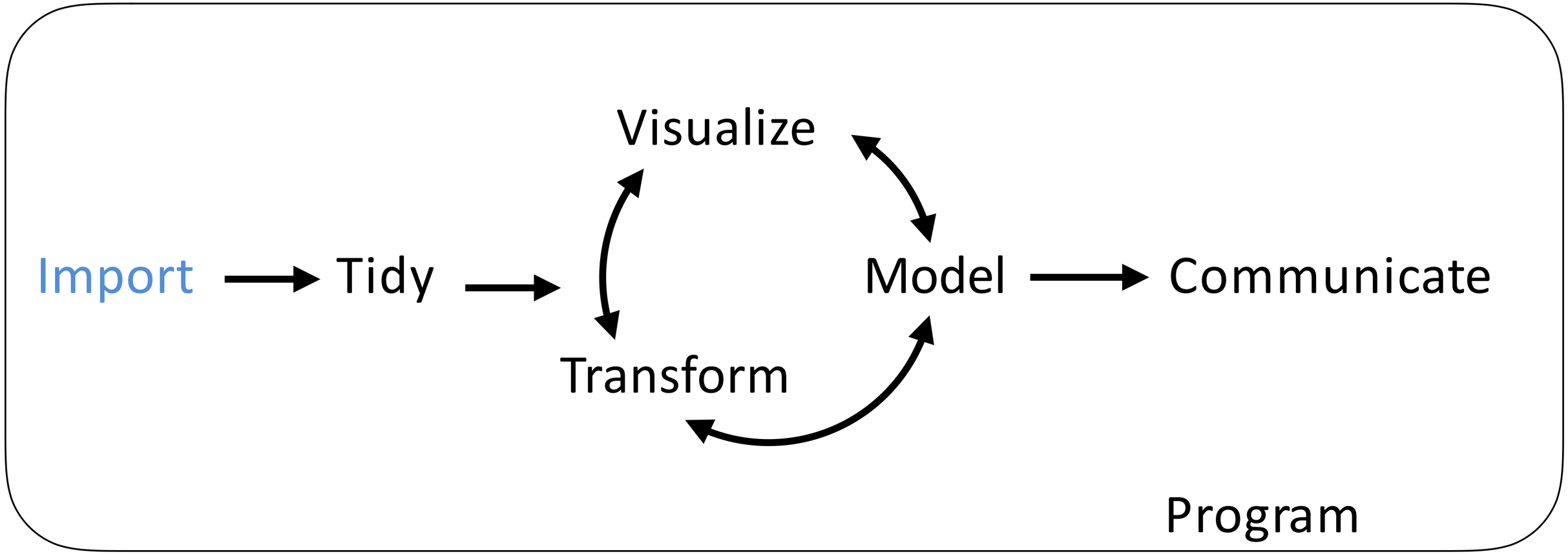
Import

DBI

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

–Willie Sutton

(Applied) Data Science



Connecting to SQL Server

Connecting to SQL

1. Click Database
2. Click Driver Manager
3. Click New
4. Put the following settings:
   a) Driver Type: Generic
   b) Driver Name: SQL Server
   c) Class Name: com.microsoft.sqlserver.jdbc.SQLServerDriver
   d) URL Template: jdbc:sqlserver://{host}[:{port}][;databaseName={database}]
   e) Default Port: 1433
   f) Default Database: master
5. Move to the Libraries tab

Connecting to SQL

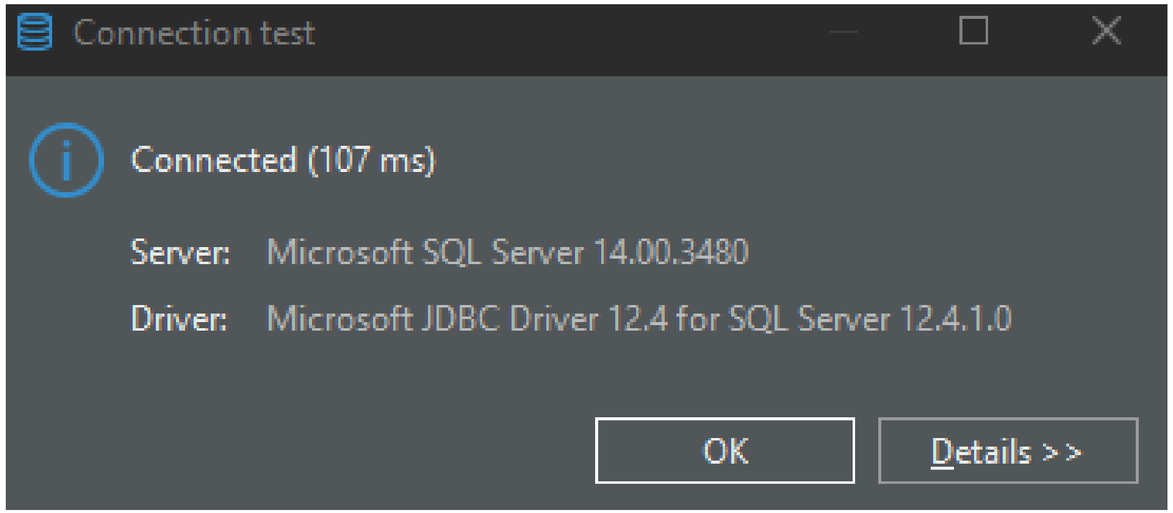
1. On the Libraries Tab
2. Click Add File
   a) Navigate to C:/Program Files/Dbeaver/plugins
   b) Open mssql-jdbc-12.4.1.jre11.jar
3. Click Add File again
   a) Navigate to C:/Program Files/Dbeaver/jre/bin
   b) Change the file type selector to *.*
   c) Open mssql-jdbc_auth-12.4.1.x64.dll
4. Click Ok
5. Click Database
6. Click New Database Connection

Connecting to SQL

1. Select your Generic SQL Server from the All tab
2. Enter the following properties
   a) Host: DEVSQL17\CountyStat_DW
   b) Port: 50900
   c) Database/Schema: HealthCare_DataWarehouse
   d) Username: Your T#
   e) Password: Your Windows Password
3. Click Ok
4. Double Click the new connection from the Database Navigator
   a) The connection should fail
5. Right click the Connection and select Edit Connection

Connecting to SQL

1. Navigate to the Driver properties Tab
   a) Verify the encrypt property is set to true
   b) Set the integratedSecurity property to true
   c) Set the trustServerCertificate property to true
2. Click Test Connection
   a) If you get this screen click OK
   b) If not raise your hand



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

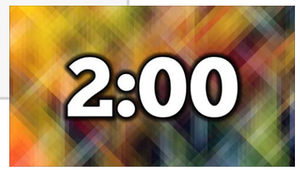
QUERIES

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

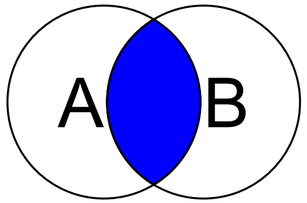
R equivalent?

paste()/paste0()

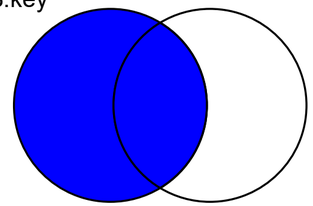
JOINS

SQL JOINS

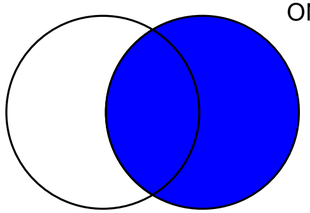
SELECT <fields>
FROM TableA A
INNER JOIN TableB B
ON A.key = B.key



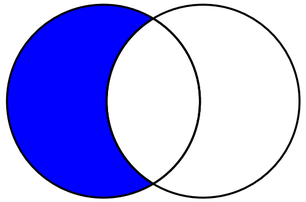
SELECT <fields>
FROM TableA A
LEFT JOIN TableB B
ON A.key = B.key



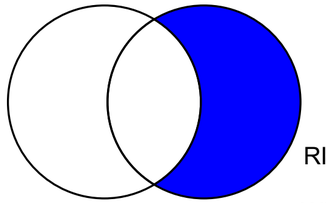
SELECT <fields>
FROM TableA A
RIGHT JOIN TableB B
ON A.key = B.key



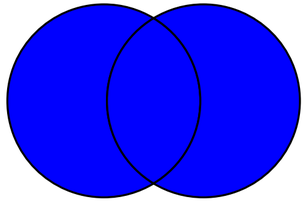
SELECT <fields>
FROM TableA A
LEFT JOIN TableB B
ON A.key = B.key
WHERE B.key IS NULL



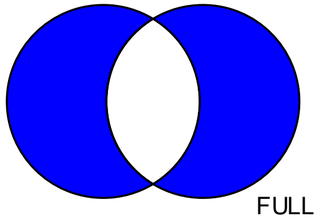
SELECT <fields>
FROM TableA A
RIGHT JOIN TableB B
ON A.key = B.key
WHERE A.key IS NULL



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

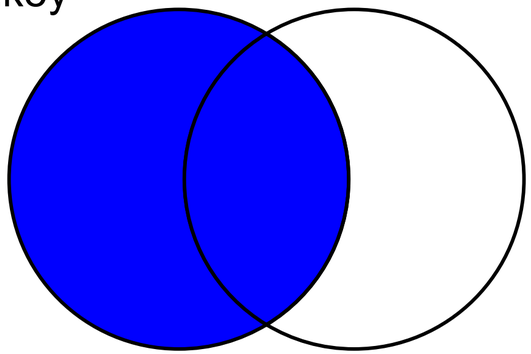


SELECT <fields>
FROM TableA A
FULL OUTER JOIN TableB B
ON A.key = B.key
WHERE A.key IS NULL
OR B.key IS NULL

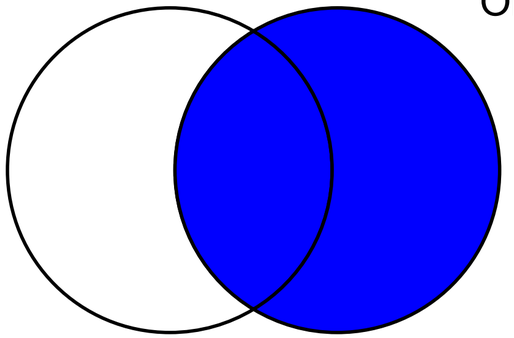


Left/Right Join

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

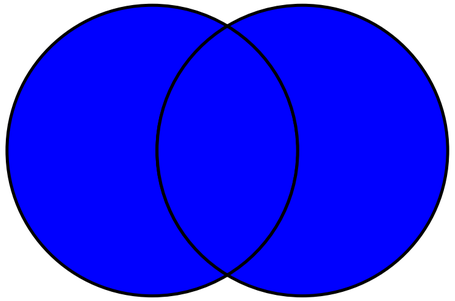


```
SELECT <fields>
FROM TableA A
RIGHT JOIN TableB B
ON A.key = B.key
```

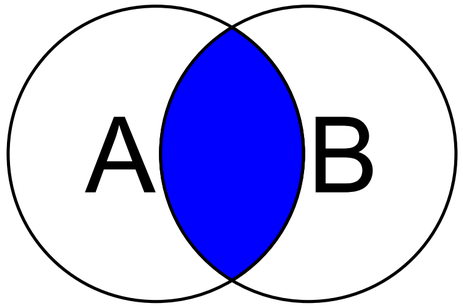


Inner/Outer Join

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

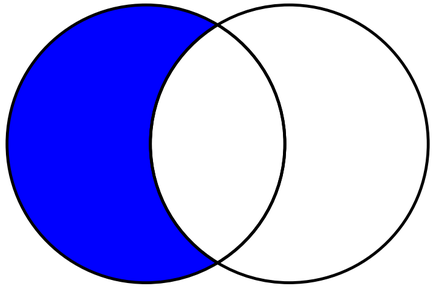


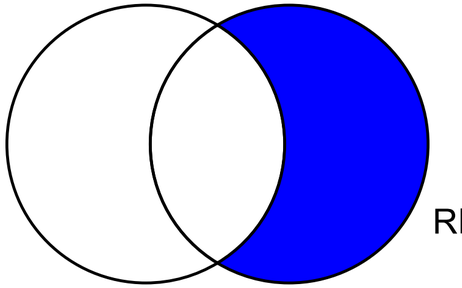
SELECT <fields>
FROM TableA A
INNER JOIN TableB B
ON A.key = B.key



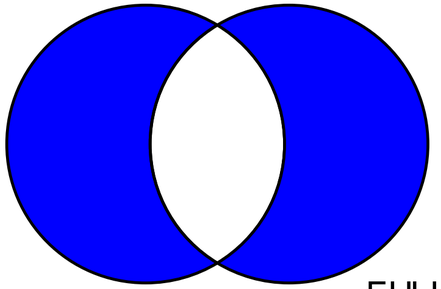
Anti-Joins

```
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
```

VIEWS

Creating Views

Once you have generated a SQL Query that you would like to save you can create a VIEW.

Views are stored SQL code that anyone who has access to the Schema can call just like a table in another SQL query.

```
CREATE VIEW
ACHD.SOME_NAME_V AS

<<SQL Query Code>>
```

Updating Views

If you ever have to add, remove or change anything about a view simply use the ALTER command instead of CREATE

```
ALTER VIEW
ACHD.SOME_NAME_V AS

<<SQL Query Code>>
```

View Pros & Cons

Pros:

- You don’t need to save SQL code in your R Scripts
- Easier to share queries you made (so long as the table is named properly)
- DB Admin can create INDEXES in the source tables to speed-up large queries

Cons:

- Cannot use ORDER BY in Views
- Can take longer to pull data if only querying from one table
- Anyone with access to the SCHEMA can update the script

DB Connections in R

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

- How are .Renviron Files structured?

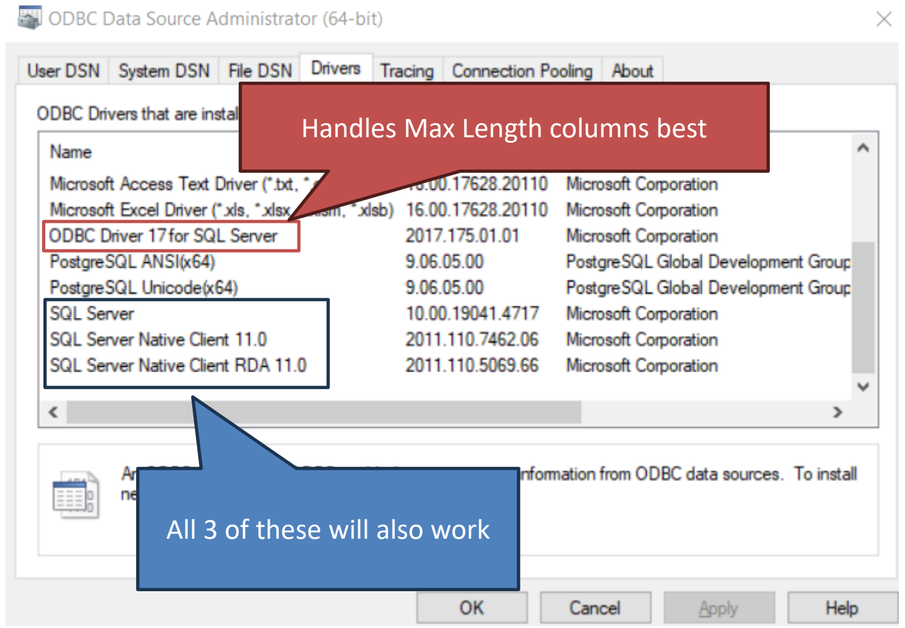
```
uid=some_username
pwd=Password
```

A new line for each variable

No spaces between variable name and value

SQL Drivers

- Checking Installed Drivers
  - Open ODBC Data Source Administrator (64-bit)
  - Ask DIT to install the one you need if it's missing




```
driver = "{ODBC Driver 17 for SQL Server}"
```

LOADING VARIABLES

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

Profile

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

.Renviron

```
readRenviron(".Renviron")

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

ESTABLISHING CONNECTIONS

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

```
conn <- dbConnect(odbc::odbc(), driver = "{Driver Name}",  server =
      "IP_or_HOST_ADDRESS",  port  = port#, database   = "DBName", uid = un, pwd = pwd)
```

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

Running a Query

- If you want to load the whole table:

```
tbl <- dbReadTable(con, SQL("Schema.TableNameHere"))
```

- If you want to run a custom query:

```
tbl <- dbReadTable(con, "Text of your SQL Query")
```

Your Turn

Go to Rstudio and open the dbi_example.Rmd and follow instructions and run the code chunks up to disconnect.

Use case Gathering

What data sources would it be useful to have?