SQL: Structured Query Language

Adam Peterson

University of Michigan: Department of Biostatistics
materials found at
https://github.com/apeterson91/computing_workshops/workshop_2

Agenda

1. Motivation
2. Keywords:
   - 'SELECT'
   - 'WHERE'
   - 'GROUP BY'
3. Inner queries
4. Joins
   - Inner
   - Outer
   - Left, Right

Motivation

- What is SQL and why is it important?
- SQL is a programming language that allows one to programmatically access data in databases
- i.e. With SQL we can *query* a database for just the information we want and nothing else.

Set-Up:1

Table : Student_Table

S_ID	First_Name	Last_Name	Student_Age	Student_Major
1	John	Smith	23	Biostatistics
2	Anne	Doroughty	21	Biostatistics
3	Anthony	Jones	19	Statistics

Set-Up:2

Loading Data into SAS for `PROC SQL` exercises

SELECT

SELECT: Formulaic

SELECT <ColumnNames> FROM <TableName>

SELECT: Example

SELECT First_Name FROM Student_Table;

First_Name
John
Anne
Anthony

SELECT example- SAS

Code fairly simple...

```
PROC SQL;
SELECT First_Name
FROM Student_Table;
QUIT;
```

Where

WHERE: Formulaic

SELECT <ColumnNames> FROM <TableName> WHERE <Condition>

WHERE: Example

SELECT First_Name FROM Student_Table WHERE Student_Age<22;

First_Name
Anne
Anthony

WHERE example- SAS

```
PROC SQL;
SELECT First_Name
FROM Student_Table
WHERE Student_Age > 22; QUIT;
```

GROUP BY: Formulaic

SELECT < Aggregate_Function(ColumnNames) > FROM <TableName> GROUPBY <GroupColumnName>

GROUP BY: Example

SELECT SUM(Student_Age) FROM Student_Table WHERE Student_Age >19 GROUP BY Student_Major;

Student_Major	SUM(Student_Age)
Biostatistics	44

Group By example- SAS

```
PROC SQL;
SELECT SUM(Student_Age)
FROM Student_Table
WHERE Student_Age > 19
GROUP BY Student_Major;
QUIT;
```

Inner Query: Formulaic

SELECT <ColumnNames> FROM (SELECT <ColumnNames> FROM <TableName>)

Inner Query: Example

SELECT First_Name FROM (SELECT * FROM Student_Table WHERE Student_Age<22) ;

First_Name
Anne
Anthony

Inner Query By example- SAS

```
PROC SQL;
SELECT First_Name FROM
(SELECT * FROM Student_Table WHERE Student_Age < 22) ;
QUIT;
```

Quick Aside: Relational Databases

Let's talk a bit about how data is stored in tables in a relational database

- Unique Identifiers
- One-To-Many Relationship
  - One student, multiple classes

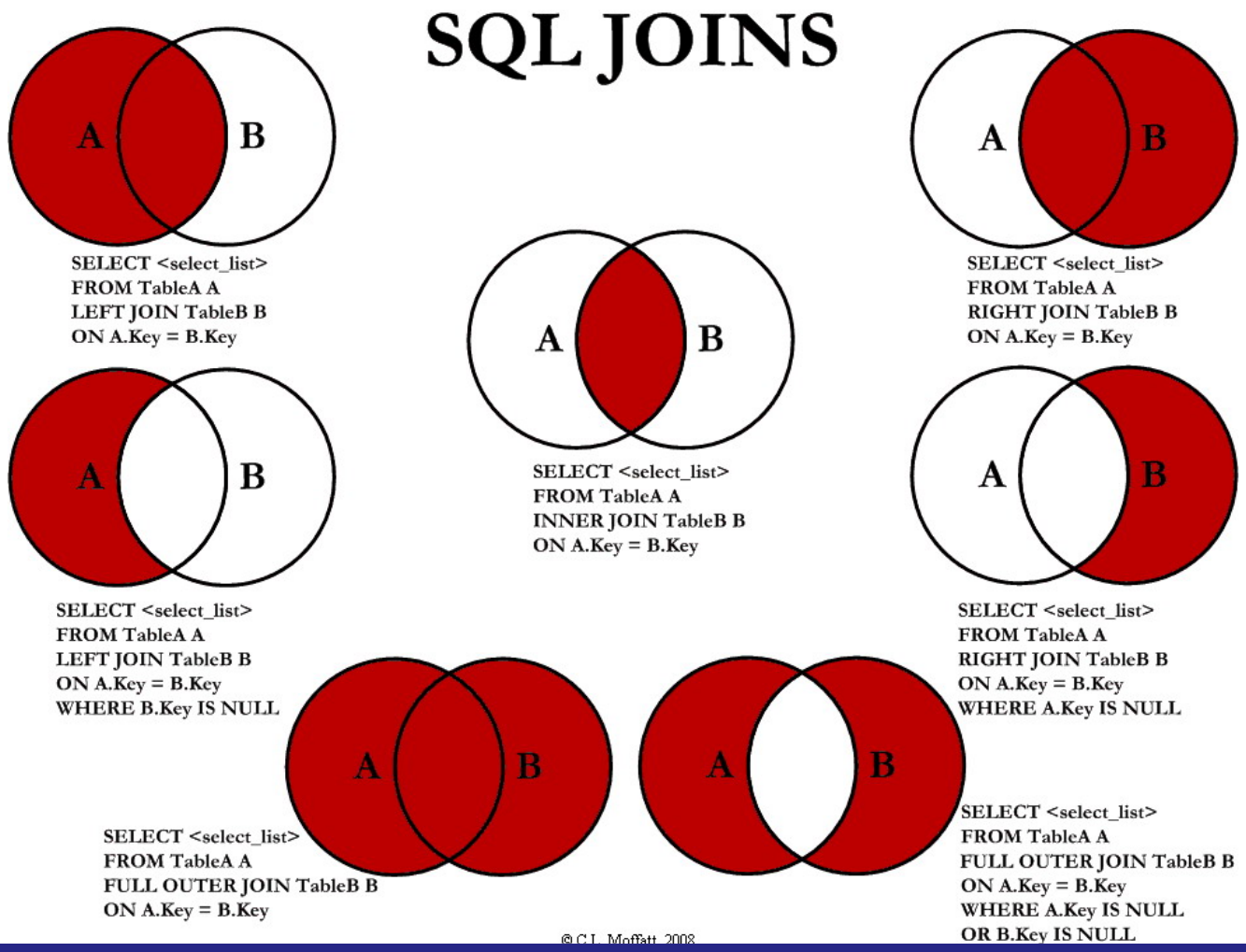
StuClass_Table

S_ID	Class_Num	Class_Name	Class_Dept
1	602	Statistical Inference II	Biostatistics
1	651	Applied Linear Regression II	Biostatistics
2	516	Epidemiology II	Epidemiology
3	601	Statistical Inference I	Biostatistics
3	531	Analysis of Time Series	Statistics

Type of Joins

- Left Outer
  - Get everything from 'left' table, matching items from right
- Right Outer
  - Get everything from 'right' table, matching items from left
- Inner
  - Only items that are found in both tables
- More...

Type of Joins



Join: Example

Join: Formulaic

SELECT Table_1.<ColumnNames>, Table_2.<ColumnNames>
FROM <TableName> <Type> JOIN

Join: Example

SELECT Student_Table.First_Name StuClass_Table.Class_Name
FROM Student_Table INNER JOIN StuClass_Table ON
Student_Table.S_ID = StuClass_Table.S_ID;

Join: Example

Join: Example

```
SELECT Student_Table.First_Name, StuClass_Table.Class_Name
FROM Student_Table INNER JOIN StuClass_Table ON
Student_Table.S_ID = StuClass_Table.S_ID;
```

Student_ID	First_Name	Class_Name
1	John	Statistical Inference II
1	John	Applied Linear Regression II
2	Anne	Epidemiology II
3	Anthony	Statistical Inference I
3	Anthony	Analysis of Time Series

SAS - Join Example

```
PROC SQL;
SELECT Student_Table.First_Name,
StuClass_Table.Class_Name
FROM Student_Table
INNER JOIN StuClass_Table
ON Student_Table.S_ID = StuClass_Table.S_ID ;
QUIT;
```

Resources for Further Learning

- pandasql
- sqldf
- CodeAcademy's SQL Course
- W3 - great reference

Questions

Any Questions?