



SQL: Structured Query Language

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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?



Motivation



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- SQL is a programming language that allows one to programmatically access data in databases

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 Keyword

SELECT

SELECT: Formulaic

```
SELECT <ColumnNames> FROM <TableName>
```

SELECT: Example

```
SELECT First_Name FROM Student_Table;
```

First_Name
John
Anne
Anthony



SELECT Keyword

SELECT example- SAS

Code fairly simple...



SELECT Keyword

SELECT example- SAS

Code fairly simple...

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



WHERE Keyword

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 Keyword

GROUP BY: Formulaic

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

GROUP BY: Example

```
SELECT Student_Major, 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



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

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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



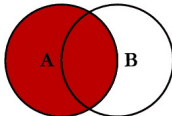
Type of Joins

- 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...

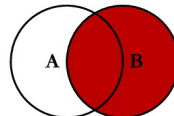


Type of Joins

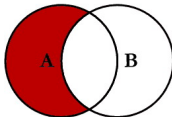
SQL JOINS



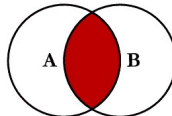
```
SELECT <select_list>
FROM TableA A
LEFT JOIN TableB B
ON A.Key = B.Key
```



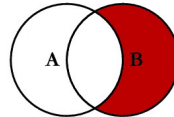
```
SELECT <select_list>
FROM TableA A
RIGHT JOIN TableB B
ON A.Key = B.Key
```



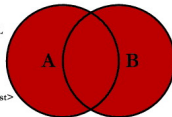
```
SELECT <select_list>
FROM TableA A
LEFT JOIN TableB B
ON A.Key = B.Key
WHERE B.Key IS NULL
```



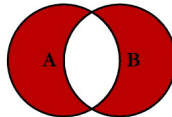
```
SELECT <select_list>
FROM TableA A
INNER JOIN TableB B
ON A.Key = B.Key
```



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



```
SELECT <select_list>
FROM TableA A
FULL OUTER JOIN TableB B
ON A.Key = B.Key
```



```
SELECT <select_list>
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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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?