Hi! Welcome to 61A Discussion :)

We will begin at **8:10**!

Attendance form and skeleton notes:

cs61a.bencuan.me

Secret word:

Announcements

- Do your course evals!!!

- Request alt final time: go.cs61a.org/final-alt

- No discussion next week (this is the last one!!)

  - Topical review sessions: go.cs61a.org/topical-review-sessions

Agenda

- Attendance
- SQL
- Final review (poll)

SQL

SQL Basics

- **declarative programming language**
  - Tell it what you want and you get it
- **Databases** have **tables** which have **rows** and **columns**
- Create **queries** to get useful information from databases

A basic SQL query

```sql
SELECT column1, column2…
    FROM table
    WHERE [conditions]
    ORDER BY column [DESC]
```

SELECT

- Columns separated by commas

- Must be part of original table

- Use * for selecting all columns

WHERE

- Valid comparisons: =, <, >, !=

- Combine multiple comparisons with AND, OR (similar to python)

Q1: Oliver Employees

Write a query that outputs the names of employees that Oliver Warbucks directly supervises.

```
sql> select * from records;
```

name	division	title	salary	supervisor
Alyssa P Hacker	Computer	Programmer	40000	Ben Bitdiddle
Ben Bitdiddle	Computer	Wizard	60000	Oliver Warbucks
Cy D Fect	Computer	Programmer	35000	Ben Bitdiddle
Eben Scrooge	Accounting	Chief Accountant	75000	Oliver Warbucks
Lem E Tweakit	Computer	Technician	25000	Ben Bitdiddle
Louis Reasoner	Computer	Programmer Trainee	30000	Alyssa P Hacker
Oliver Warbucks	Administration	Big Wheel	150000	Oliver Warbucks
Robert Cratchet	Accounting	Scrivener	18000	Eben Scrooge

Q2: Self Supervisor

Write a query that outputs all information about employees that supervise themselves.

```
sql> select * from records;
```

name	division	title	salary	supervisor
Alyssa P Hacker	Computer	Programmer	40000	Ben Bitdiddle
Ben Bitdiddle	Computer	Wizard	60000	Oliver Warbucks
Cy D Fect	Computer	Programmer	35000	Ben Bitdiddle
Eben Scrooge	Accounting	Chief Accountant	75000	Oliver Warbucks
Lem E Tweakit	Computer	Technician	25000	Ben Bitdiddle
Louis Reasoner	Computer	Programmer Trainee	30000	Alyssa P Hacker
Oliver Warbucks	Administration	Big Wheel	150000	Oliver Warbucks
Robert Cratchet	Accounting	Scrivener	18000	Eben Scrooge

Q3: Rich Employees

Write a query that outputs the names of all employees with salary greater than 50,000 in alphabetical order.

name
Ben Bitdiddle
Eben Scrooge
Oliver Warbucks

```
sql> select * from records;
```

name	division	title	salary	supervisor
Alyssa P Hacker	Computer	Programmer	40000	Ben Bitdiddle
Ben Bitdiddle	Computer	Wizard	60000	Oliver Warbucks
Cy D Fect	Computer	Programmer	35000	Ben Bitdiddle
Eben Scrooge	Accounting	Chief Accountant	75000	Oliver Warbucks
Lem E Tweakit	Computer	Technician	25000	Ben Bitdiddle
Louis Reasoner	Computer	Programmer Trainee	30000	Alyssa P Hacker
Oliver Warbucks	Administration	Big Wheel	150000	Oliver Warbucks
Robert Cratchet	Accounting	Scrivener	18000	Eben Scrooge

Hint: use ORDER BY

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Joins

```
SELECT a.column1, b.column2...
   FROM table1 as a, table2 as b...
   WHERE [conditions]
   ORDER BY column [DESC]
```

Join Complications

- # of rows of resulting table = (# rows in table1 * # rows in table2 * ... * # rows in table_n)

- If joining table with itself, must use **aliasing**

  - `SELECT * FROM table AS a, table AS b`

  - `SELECT a.name FROM table AS a`

Q4: Oliver Employee Meetings

Write a query that outputs the meeting days and times of all employees directly supervised by Oliver Warbucks.

```
sql> select * from records;
```

name	division	title	salary	supervisor
Alyssa P Hacker	Computer	Programmer	40000	Ben Bitdiddle
Ben Bitdiddle	Computer	Wizard	60000	Oliver Warbucks
Cy D Fect	Computer	Programmer	35000	Ben Bitdiddle
Eben Scrooge	Accounting	Chief Accountant	75000	Oliver Warbucks
Lem E Tweakit	Computer	Technician	25000	Ben Bitdiddle
Louis Reasoner	Computer	Programmer Trainee	30000	Alyssa P Hacker
Oliver Warbucks	Administration	Big Wheel	150000	Oliver Warbucks
Robert Cratchet	Accounting	Scrivener	18000	Eben Scrooge

```
sql> select * from meetings;
```

division	day	time
Accounting	Monday	9am
Administration	Monday	11am
Administration	Wednesday	4pm
Computer	Wednesday	4pm

day	time
Wednesday	4pm
Monday	9am
Monday	11am
Wednesday	4pm

Q5: Different Division

Write a query that outputs the names of employees whose supervisor is in a different division.

```
sql> select * from records;
```

name	division	title	salary	supervisor
Alyssa P Hacker	Computer	Programmer	40000	Ben Bitdiddle
Ben Bitdiddle	Computer	Wizard	60000	Oliver Warbucks
Cy D Fect	Computer	Programmer	35000	Ben Bitdiddle
Eben Scrooge	Accounting	Chief Accountant	75000	Oliver Warbucks
Lem E Tweakit	Computer	Technician	25000	Ben Bitdiddle
Louis Reasoner	Computer	Programmer Trainee	30000	Alyssa P Hacker
Oliver Warbucks	Administration	Big Wheel	150000	Oliver Warbucks
Robert Cratchet	Accounting	Scrivener	18000	Eben Scrooge

```
sql> select * from meetings;
```

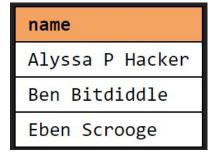| division	day	time
Accounting	Monday	9am
Administration	Monday	11am
Administration	Wednesday	4pm
Computer	Wednesday	4pm

name
Ben Bitdiddle
Eben Scrooge

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Q6: Middle Manager

A middle manager is a person who is both supervising someone and is supervised by someone different. Write a query that outputs the names of all middle managers.

```
sql> select * from records;
```

name	division	title	salary	supervisor
Alyssa P Hacker	Computer	Programmer	40000	Ben Bitdiddle
Ben Bitdiddle	Computer	Wizard	60000	Oliver Warbucks
Cy D Fect	Computer	Programmer	35000	Ben Bitdiddle
Eben Scrooge	Accounting	Chief Accountant	75000	Oliver Warbucks
Lem E Tweakit	Computer	Technician	25000	Ben Bitdiddle
Louis Reasoner	Computer	Programmer Trainee	30000	Alyssa P Hacker
Oliver Warbucks	Administration	Big Wheel	150000	Oliver Warbucks
Robert Cratchet	Accounting	Scrivener	18000	Eben Scrooge

```
sql> select * from records;
```

name	division	title	salary	supervisor
Alyssa P Hacker	Computer	Programmer	40000	Ben Bitdiddle
Ben Bitdiddle	Computer	Wizard	60000	Oliver Warbucks
Cy D Fect	Computer	Programmer	35000	Ben Bitdiddle
Eben Scrooge	Accounting	Chief Accountant	75000	Oliver Warbucks
Lem E Tweakit	Computer	Technician	25000	Ben Bitdiddle
Louis Reasoner	Computer	Programmer Trainee	30000	Alyssa P Hacker
Oliver Warbucks	Administration	Big Wheel	150000	Oliver Warbucks
Robert Cratchet	Accounting	Scrivener	18000	Eben Scrooge

name
Alyssa P Hacker
Ben Bitdiddle
Ben Bitdiddle
Ben Bitdiddle
Eben Scrooge

name
Alyssa P Hacker
Ben Bitdiddle
Eben Scrooge

Aggregation

- Group up all rows in a column that have the same value

- Use **aggregation functions** (COUNT, MIN, MAX, SUM) to get useful information

Aggregation Query

```
SELECT column1, column2…
    FROM table
    WHERE [conditions]
    GROUP BY column
    HAVING [conditions]
    ORDER BY column [DESC]
```

HAVING vs WHERE

- HAVING is for aggregation functions
  - `HAVING COUNT(*) > 3`
  - `HAVING MIN(time) = 1`
- WHERE does not support aggregation

Q7: Supervisor Sum Salary

Write a query that outputs each supervisor and the sum of salaries of all the employees they supervise.

```sql
sql> select * from records;
```

name	division	title	salary	supervisor
Alyssa P Hacker	Computer	Programmer	40000	Ben Bitdiddle
Ben Bitdiddle	Computer	Wizard	60000	Oliver Warbucks
Cy D Fect	Computer	Programmer	35000	Ben Bitdiddle
Eben Scrooge	Accounting	Chief Accountant	75000	Oliver Warbucks
Lem E Tweakit	Computer	Technician	25000	Ben Bitdiddle
Louis Reasoner	Computer	Programmer Trainee	30000	Alyssa P Hacker
Oliver Warbucks	Administration	Big Wheel	150000	Oliver Warbucks
Robert Cratchet	Accounting	Scrivener	18000	Eben Scrooge

supervisor	SUM(salary)
Alyssa P Hacker	30000
Ben Bitdiddle	100000
Eben Scrooge	18000
Oliver Warbucks	285000

Q8: Num Meetings

Write a query that outputs the days of the week for which fewer than 5 employees have a meeting. You may assume no department has more than one meeting on a given day.

```
sql> select * from records;
```

name	division	title	salary	supervisor
Alyssa P Hacker	Computer	Programmer	40000	Ben Bitdiddle
Ben Bitdiddle	Computer	Wizard	60000	Oliver Warbucks
Cy D Fect	Computer	Programmer	35000	Ben Bitdiddle
Eben Scrooge	Accounting	Chief Accountant	75000	Oliver Warbucks
Lem E Tweakit	Computer	Technician	25000	Ben Bitdiddle
Louis Reasoner	Computer	Programmer Trainee	30000	Alyssa P Hacker
Oliver Warbucks	Administration	Big Wheel	150000	Oliver Warbucks
Robert Cratchet	Accounting	Scrivener	18000	Eben Scrooge

```
sql> select * from meetings;
```

division	day	time
Accounting	Monday	9am
Administration	Monday	11am
Administration	Wednesday	4pm
Computer	Wednesday	4pm

day
Monday

Q9: Rich Pairs

Write a query that outputs all divisions for which there is more than one employee, and all pairs of employees within that division that have a combined salary less than 100,000.

```
sql> select * from records;
```

name	division	title	salary	supervisor
Alyssa P Hacker	Computer	Programmer	40000	Ben Bitdiddle
Ben Bitdiddle	Computer	Wizard	60000	Oliver Warbucks
Cy D Fect	Computer	Programmer	35000	Ben Bitdiddle
Eben Scrooge	Accounting	Chief Accountant	75000	Oliver Warbucks
Lem E Tweakit	Computer	Technician	25000	Ben Bitdiddle
Louis Reasoner	Computer	Programmer Trainee	30000	Alyssa P Hacker
Oliver Warbucks	Administration	Big Wheel	150000	Oliver Warbucks
Robert Cratchet	Accounting	Scrivener	18000	Eben Scrooge

division
Accounting

Final Review

Everything we've covered so far