

# POIR 613: Computational Social Science

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# Introduction to SQL

# Databases

- ▶ **Database systems:** computerized mechanisms to store and retrieve data.
- ▶ **Relational databases:** data is represented as tables linked based on common keys (to avoid redundancy).

*Customer*

<i>cust_id</i>	<i>fname</i>	<i>lname</i>
1	George	Blake
2	Sue	Smith

*Account*

<i>account_id</i>	<i>product_cd</i>	<i>cust_id</i>	<i>balance</i>
103	CHK	1	\$75.00
104	SAV	1	\$250.00
105	CHK	2	\$783.64
106	MM	2	\$500.00
107	LOC	2	0

*Product*

<i>product_cd</i>	<i>name</i>
CHK	Checking
SAV	Savings
MM	Money market
LOC	Line of credit

*Transaction*

<i>txn_id</i>	<i>txn_type_cd</i>	<i>account_id</i>	<i>amount</i>	<i>date</i>
978	DBT	103	\$100.00	2004-01-22
979	CDT	103	\$25.00	2004-02-05
980	DBT	104	\$250.00	2004-03-09
981	DBT	105	\$1000.00	2004-03-25
982	CDT	105	\$138.50	2004-04-02
983	CDT	105	\$77.86	2004-04-04
984	DBT	106	\$500.00	2004-03-27

# SQL

- ▶ SQL (pronounced S-Q-L or SEQUEL) is a language designed to **query relational databases**
- ▶ Used by most financial and commercial companies
- ▶ The result of an SQL query is always a table
- ▶ It's a **nonprocedural language**: define inputs and outputs; how the statement is executed is left to the *optimizer*
- ▶ How long SQL queries depends on optimization that is opaque to user (which is great!)
- ▶ SQL is a language that works with many commercial products:
  - ▶ Oracle Database, SQL Server (MS), MySQL, PostgreSQL, SQLite (all three open-source), Google BigQuery, Amazon Redshift...
  - ▶ Performance will vary, but generally faster than standard data frame manipulation in R (and much more scalable)

# Components of a SQL query

- ▶ **SELECT** columns
  - ▶ **FROM** a table in a database
  - ▶ **WHERE** rows meet a condition
  - ▶ **GROUP BY** values of a column
  - ▶ **ORDER BY** values of a column when displaying results
  - ▶ **LIMIT** to only X number of rows in resulting table
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- ▶ Always required: **SELECT** and **FROM**. Rest are optional.
  - ▶ **SELECT** can be combined with operators such as **SUM**, **COUNT**, **AVG**...
  - ▶ To merge multiple tables, you can use **JOIN**

# SQL at scale

## Google BigQuery

- ▶ One of many commercial SQL databases available (Amazon RedShift, Microsoft Azure, Oracle Live SQL...)
- ▶ Used by many financial and commercial companies
- ▶ **Advantages:**
  - ▶ Integration with other Google data storage solutions (Google Drive, Google Cloud Storage)
  - ▶ Scalable: same SQL syntax for datasets of *any* size
  - ▶ Easy to collaborate and export results
  - ▶ Affordable pricing and cost control
  - ▶ API access allows integration with R or python
  - ▶ Excellent documentation