ECPR Methods Summer School: Big Data Analysis in the Social Sciences

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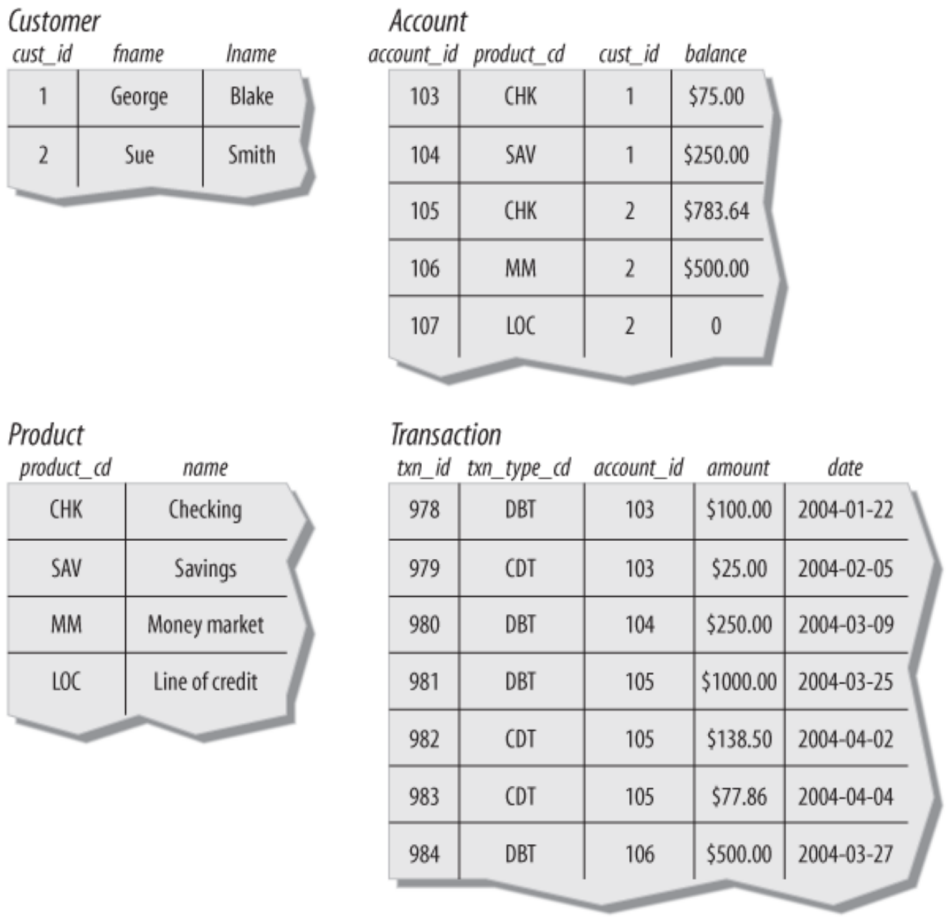
Introduction to SQL

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

cust_id	fname	lname
1	George	Blake
2	Sue	Smith

Account

account_id	product_cd	cust_id	balance
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

product_cd	name
CHK	Checking
SAV	Savings
MM	Money market
LOC	Line of credit

Transaction

txn_id	txn_type_cd	account_id	amount	date
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

- 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

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