# 61A Lecture 33

Wednesday, November 19

## Announcements

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(Demo)

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## SQL Execution

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## Interpreting Select Statements

## A Select Class

The SQL parser creates an instance of the Select class for each select statement

Simplified version of http://composingprograms.com/examples/sql/sql_exec.py

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        def execute(self, env):
            """Join, filter, and map rows from tables to columns."""
            from_rows = join(self.tables, env)
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        def filter_fn(self, row):
            if self.condition:
                return eval(self.condition, row)
            else:
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        row = namedtuple("Row", names)
        return lambda env: row(*[eval(e, env) for e in expressions])
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(Demo)

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>>> def make_env(rows, names):
        """Create an environment of names bound to values."""
        env = dict(zip(names, rows))
```

(Demo)

## Joining Rows

Joining creates a dictionary with all names and aliases for each combination of rows

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>>> from itertools import product
>>> def join(tables, env):
        """Return an iterator over dictionaries from names to values in a row."""
        names = tables.split(", ")
        joined_rows = product(*[env[name] for name in names])
        return map(lambda rows: make_env(rows, names), joined_rows)
>>> def make_env(rows, names):
        """Create an environment of names bound to values."""
        env = dict(zip(names, rows))
        for row in rows:
            for name in row._fields:
                env[name] = getattr(row, name)
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(Demo)

## SQL Interpreter Examples

## Interpreting SQL Using Python

`Fill in the blanks in this interactive Python session that interprets these SQL statements`

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Fill in the blanks in this interactive Python session that interprets these SQL statements

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create table cities as
  select 38 as lat, 122 as lon, "Berkeley" as name union
  select 42,        71,         "Cambridge"        union
  select 45,        93,         "Minneapolis";
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>>> cities = [City(38, 122, "Berkeley"), City(42,  71, "Cambridge"), City(43,  93, "Minneapolis")]
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How many times is eval called during this call to s.execute? (Demo)

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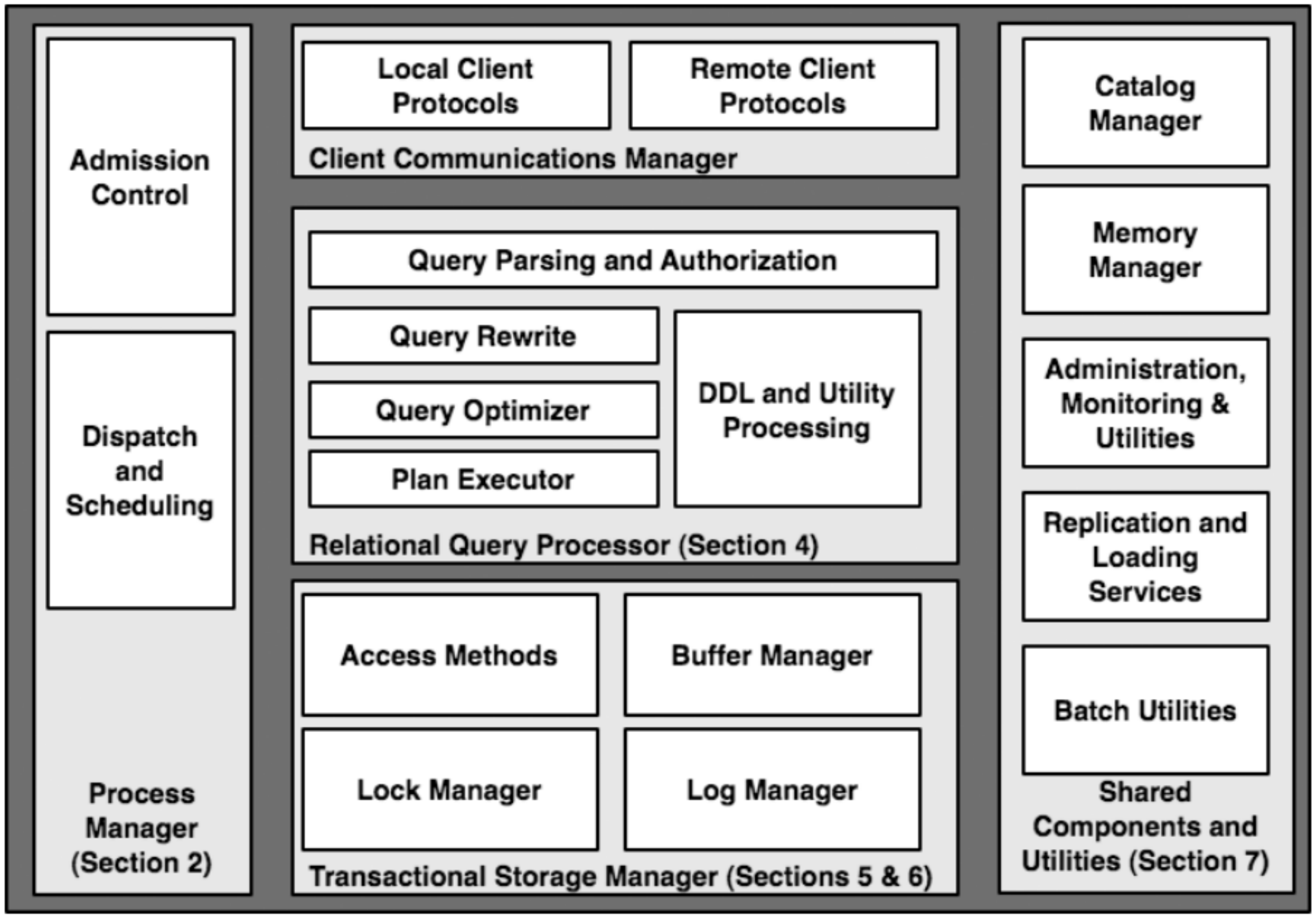
## Database Management Systems

## Database Management System Architecture



Admission Control
Dispatch and Scheduling
Process Manager (Section 2)
Local Client Protocols
Remote Client Protocols
Client Communications Manager
Query Parsing and Authorization
Query Rewrite
Query Optimizer
Plan Executor
DDL and Utility Processing
Relational Query Processor (Section 4)
Access Methods
Buffer Manager
Lock Manager
Log Manager
Transactional Storage Manager (Sections 5 & 6)
Catalog Manager
Memory Manager
Administration, Monitoring & Utilities
Replication and Loading Services
Batch Utilities
Shared Components and Utilities (Section 7)

`Architecture of a Database System by Hellerstein, Stonebreaker, and Hamilton`

## Query Planning

The manner in which tables are filtered, sorted, and joined affects execution time

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select parent from parents, dogs
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Filter dogs by fur = "curly", join result with all rows of parents, filter by child = name

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