Database Administration

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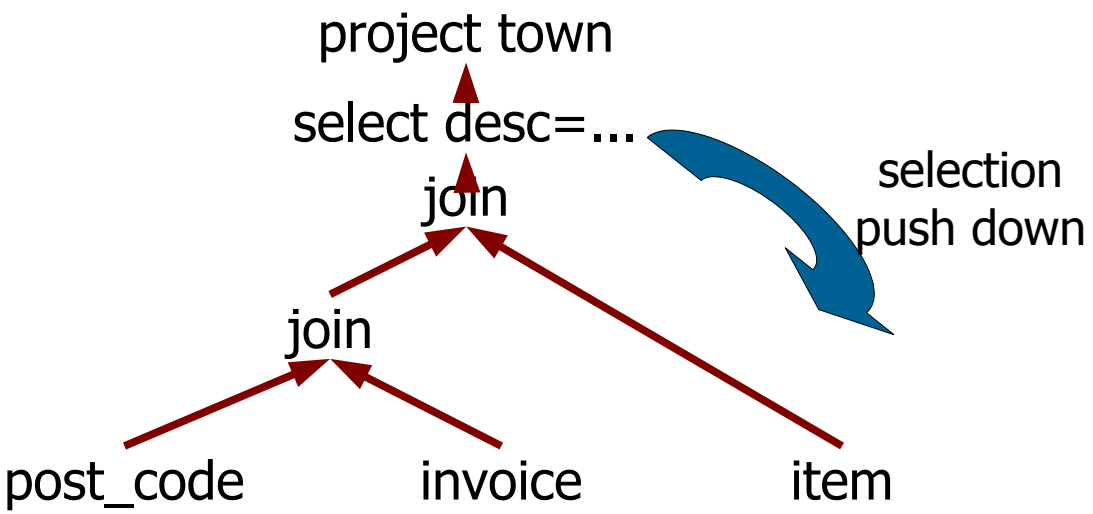
Query optimization

- Two independent logical stages:
  - Generate multiple plans
  - Select the least costly plan
- In practice:
  - Compute the cost of partial plans
  - Avoid exploring alternatives that are not interesting

Example

```
select town from
 post_code natural join invoice
 natural join item where desc=...
```



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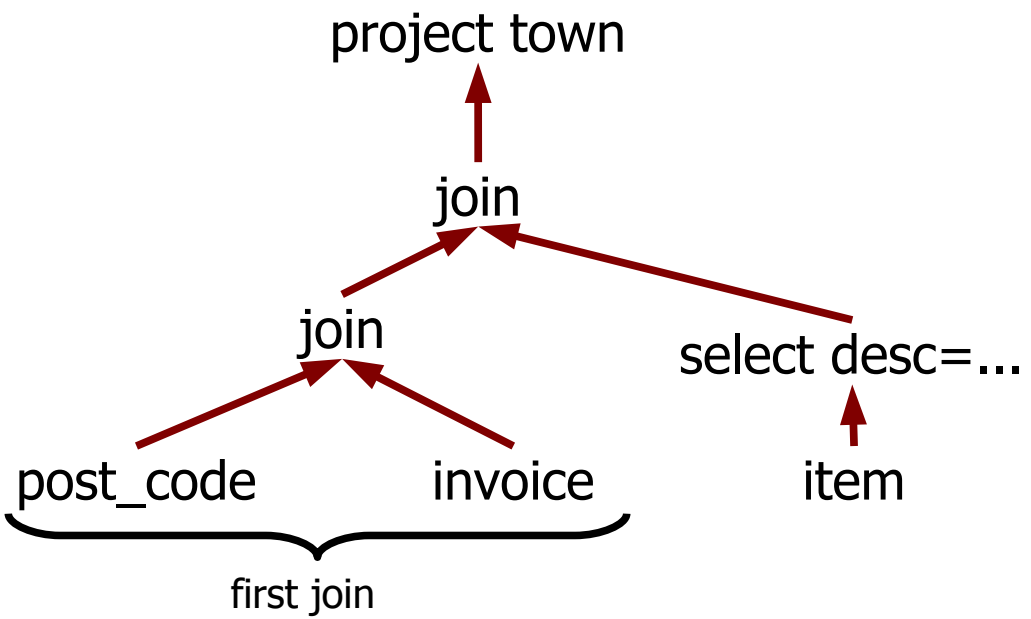

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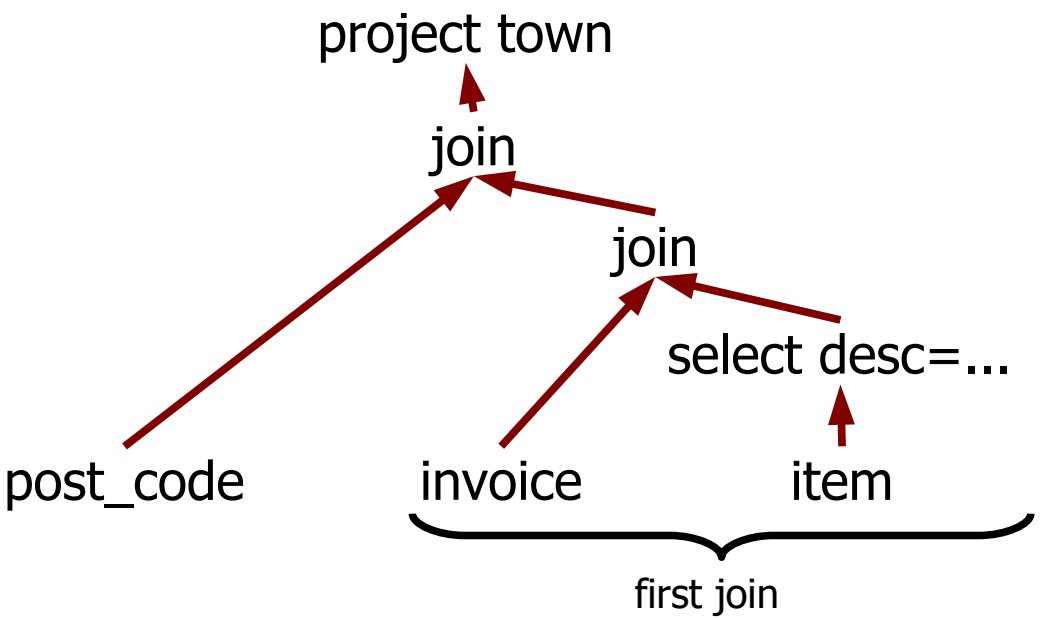


Alternative plans

- Reasons for alternative plans:
  - Join order (permutations)
  - Indexes
  - Alternative physical operators

Plan selection

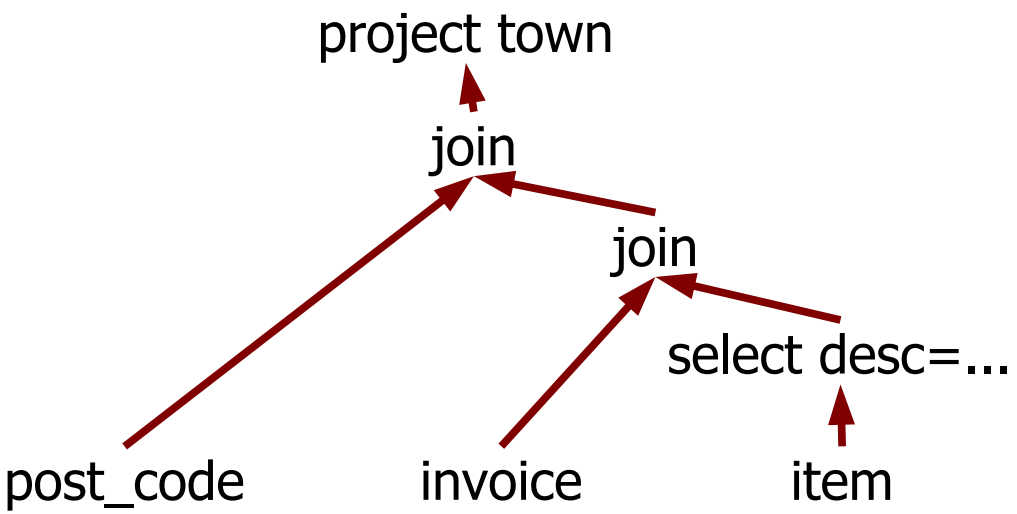
- Predict resource usage:
  - CPU =~ #records processed
  - Disk I/O =~ #blocks visited
    - =~ #records used (with index)
    - =~ #records in relation (with scan)
- Memory is limiting when physical operator materializes results:
  - =~ #records

#Records?

Relative weights?

Estimating #records

- Easy for stored relations
- What about intermediate results?



Estimating #records - Selection

- Know #distinct
  - Expected copies of each tuple:
    - #records / #distinct
- Real data are usually not evenly distributed:
  - 80/20 rule
  - Power law

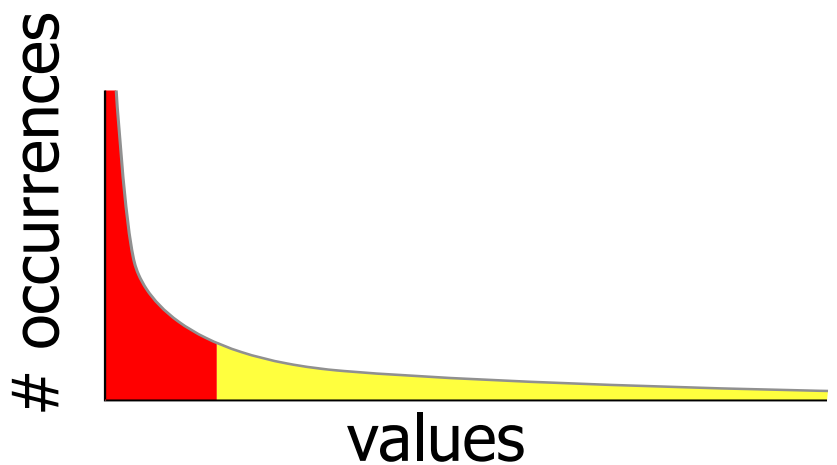


Image source: Wikipedia

Estimating #records - Selection

- Know most popular and #occurrences
- Compute estimated #occurrences of others as uniformly distributed

Estimating #records - Selection

- Know histogram:
  - % of occurrences in each interval
    or
  - interval for fixed % of occurrences
- Compute #occurrences as uniformly distributed within each interval

Estimating #records - Join

- Product:
  - Multiply #records
- Join:
  - Select after product
  - For equi-join:
    - Predict matching records

Statistics

- Required statistics:
  - # distinct / # records
  - most popular
  - histogram
  - correlation
- Computing statistics:
  - Full computation is costly
  - Sampling provides good enough results

Conclusions

- Make sure that the best option is available:
  - Indexes and materialized views
  - Sufficient memory for all operators
- Make sure the best option is selected:
  - Tune relative weights
  - Provide current and sufficiently detailed statistics