Extreme Distributions in Postgres

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Phases of Statement Execution

- Parse
- Analyze
- Plan
- Execute
Planning execution

- Cost Model
- Cardinality Model
- Object Statistics
Cost Model

- random_page_cost
- seq_page_cost
- cpu_tuple_cost
- cpu_index_tuple_cost
- cpu_operator_cost
Cardinality Model

Size of intermediate Results

Based on object statistics

Uses probabilistic approach
Selectivity

column1 = a

\[ S(a) = \frac{1}{\# \text{ keys in column1}} \]
Independence of Predicates

c1 = a AND c2 = b

\[ P(a \cap b) = P(a) \times P(b) \]

- Dependencies in many domains
- Redundant Attributes
brand = “Honda” AND model = “Accord”

\[ P = 0.1 \times 0.01 \]

\[ = 0.001 \]
Object Statistics

Distribution of data

Importance mentioned always

Auto analyze enabled by default
View pg_stats

- uniform distributions
  - histogram_bounds
  - for <, <= ...
  - not =

- not uniform distributions
  - most_common_freqs
  - for =, <, <= ...
default_statistics_target

- number of rows inspected
- number of MCV
- number of buckets in histogram bounds
<table>
<thead>
<tr>
<th>tablename</th>
<th>sli_testdata</th>
</tr>
</thead>
<tbody>
<tr>
<td>attname</td>
<td>log4</td>
</tr>
<tr>
<td>inherited</td>
<td>f</td>
</tr>
<tr>
<td>null_frac</td>
<td>0</td>
</tr>
<tr>
<td>avg_width</td>
<td>4</td>
</tr>
<tr>
<td>n_distinct</td>
<td>4</td>
</tr>
<tr>
<td>most_common_vals</td>
<td>{DONE_A}</td>
</tr>
<tr>
<td>most_common_freqs</td>
<td>{0.900733}</td>
</tr>
<tr>
<td>histogram_bounds</td>
<td>{NEW, DONE_B, DONE_B}</td>
</tr>
<tr>
<td>correlation</td>
<td>0.845195</td>
</tr>
</tbody>
</table>
### Forensics After analyze

<table>
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<td>4</td>
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<tr>
<td>n_distinct</td>
<td>4</td>
</tr>
<tr>
<td>most_common_vals</td>
<td>{DONE_A, DONE_B, PROCESSING, NEW}</td>
</tr>
<tr>
<td>most_common_freqs</td>
<td>{0.899572, 0.09947, 0.0009475, 1.08333e-05}</td>
</tr>
<tr>
<td>histogram_bounds</td>
<td></td>
</tr>
<tr>
<td>correlation</td>
<td>0.845195</td>
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</table>
Compare Selectivity NEW

\[ S_{\text{before}} = \frac{1-\text{sum(mvf)}}{n_{\text{distinct}}-n_{\text{mcv}}} \]
\[ = \frac{1 - 0.9}{4 - 1} \]
\[ = 0.033 \]

\[ S_{\text{after}} = 0.000,01 \]
Test

- Sample Table with
  - 4 different status values
  - different Freq of NEW
- Run 100 times analyze
- Collect pg_stats values
Default Statistics Target

![Graph showing default statistics target](image)
# of NEW in Sample | Most Common Values | Histogram Bounds
--- | --- | ---
0 | \{DONE\_A, DONE\_B, PROCESSING\} | \{} 
1 | \{DONE\_A, DONE\_B\} | \{PROCESSING, NEW\} 
>1 | \{DONE\_A, DONE\_B, PROCESSING, NEW\} | \{}
Statistics Target

- 1 per 2700
- 1 per 17,000
- 1 per 100,000
- 1 per 286,000
Sample Size

- 1 per 2,700
- 1 per 17,000
- 1 per 100,000
- 1 per 286,000
On Which Column
Rowcount

- 100,000,000 rows
- 10,000,000 rows
- 1,000,000 rows
Summary

- Monitor
- Bump Statistics Target
- Archive
- Alternatives
Questions?