Numeric Data Types and Summary Functions

SQL FOR EXPLORATORY DATA ANALYSIS

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Numeric types: integer

Name	Storage Size	Description	Range
`integer` *or* `int` *or* `int4`	4 bytes	typical choice	-2147483648 to +2147483647

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`integer` *or* `int` *or* `int4`	4 bytes	typical choice	-2147483648 to +2147483647
`smallint` *or* `int2`	2 bytes	small-range	-32768 to +32767
`bigint` *or* `int8`	8 bytes	large-range	-9223372036854775808 to +9223372036854775807

Numeric types: integer

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`integer` *or* `int` *or* `int4`	4 bytes	typical choice	-2147483648 to +2147483647
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`bigint` *or* `int8`	8 bytes	large-range	-9223372036854775808 to +9223372036854775807
`serial`	4 bytes	auto-increment	1 to 2147483647
`smallserial`	2 bytes	small auto-increment	1 to 32767

Numeric types: decimal

Name	Storage Size	Description	Range
`decimal` *or* `numeric`	variable	user-specified precision, exact	up to 131072 digits before the decimal point; up to 16383 digits after the decimal point

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`decimal` *or* `numeric`	variable	user-specified precision, exact	up to 131072 digits before the decimal point; up to 16383 digits after the decimal point
`real`	4 bytes	variable-precision, inexact	6 decimal digits precision
`double precision`	8 bytes	variable-precision, inexact	15 decimal digits precision

Division

```
-- integer division
SELECT 10/4;
```

```
2
```

```
-- numeric division
SELECT 10/4.0;
```

```
2.500000000
```

Range: min and max

```
SELECT min(question_pct)
  FROM stackoverflow;
```

```
 min
-----
   0
(1 row)
```

```
SELECT max(question_pct)
  FROM stackoverflow;
```

```
      max
-------------
 0.071957428
(1 row)
```

Average or mean

```
SELECT avg(question_pct)
  FROM stackoverflow;
```

```
         avg
---------------------
 0.0037949462005931 9
(1 row)
```

Variance

Population Variance

```
SELECT var_pop(question_pct)
  FROM stackoverflow;
```

```
       var_pop
---------------------
 0.000140268640974167
(1 row)
```

Sample Variance

```
SELECT var_samp(question_pct)
  FROM stackoverflow;
```

```
       var_samp
---------------------
 0.000140271571051059
(1 row)
```

```
SELECT variance(question_pct)
  FROM stackoverflow;
```

```
       variance
---------------------
 0.000140271571051059
(1 row)
```

Standard deviation

Sample Standard Deviation

```
SELECT stddev_samp(question_pct)
  FROM stackoverflow;
```

```
     stddev_samp
--------------------
 0.0118436299778007
(1 row)
```

```
SELECT stddev(question_pct)
  FROM stackoverflow;
```

```
       stddev
--------------------
 0.0118436299778007
(1 row)
```

Population Standard Deviation

```
SELECT stddev_pop(question_pct)
  FROM stackoverflow;
```

```
      stddev_pop
--------------------
 0.0118435062787237
(1 row)
```

Round

```
SELECT round(42.1256, 2);
```

```
42.13
```

Summarize by group

```
-- Summarize by group with GROUP BY
SELECT tag,
       min(question_pct),
       avg(question_pct),
       max(question_pct)
  FROM stackoverflow
 GROUP BY tag;
```

```
          tag             |     min     |         avg          |     max
--------------------------+-------------+----------------------+-------------
 amazon-sqs               |    6.91e-05 | 8.08328877005347e-05 |     9.6e-05
 amazon-kinesis           |     2.1e-05 |  3.3924064171123e-05 |    4.64e-05
 android-pay              |    2.97e-05 | 3.16712477396022e-05 |    3.29e-05
 amazon-cloudformation    |     4.8e-05 | 9.34518997326204e-05 |  0.00015246
 citrix                   |     3.6e-05 | 3.95804407713499e-05 |    4.39e-05
 amazon-ec2               | 0.001058039 |  0.00122817236730946 | 0.001378872
 actionscript             | 0.000551486 |  0.00067589990909091 | 0.000856132
 amazon-ecs               |    1.17e-05 | 3.40544117647059e-05 |    6.51e-05
 mongodb                  |   0.0049625 |  0.00577465885069125 |  0.00631164
 amazon-redshift          | 0.000117294 | 0.000160832181818182 | 0.000212208
...
```

Let's work with numbers!

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Exploring distributions

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Count values

```
SELECT unanswered_count, count(*)
  FROM stackoverflow
 WHERE tag='amazon-ebs'
 GROUP BY unanswered_count
 ORDER BY unanswered_count;
```

```
 unanswered_count | count
------------------+-------
               37 |    12
               38 |    40
...
               43 |    10
               44 |     8
               45 |    17
               46 |     4
               47 |     1
...
               54 |   131
               55 |    34
               56 |     1
(20 rows)
```

Truncate

```
SELECT trunc(42.1256, 2);
```

```
42.12
```

```
SELECT trunc(12345, -3);
```

```
12000
```

Truncating and grouping

```
SELECT trunc(unanswered_count, -1) AS trunc_ua,
       count(*)
  FROM stackoverflow
 WHERE tag='amazon-ebs'
 GROUP BY trunc_ua   -- column alias
 ORDER BY trunc_ua;  -- column alias
```

```
 trunc_ua | count
----------+-------
       30 |    74
       40 |   194
       50 |   480
(3 rows)
```

Generate series

```
SELECT generate_series(start, end, step);
```

Generate series

```
SELECT generate_series(1, 10, 2);
```

```
 generate_series
-----------------
               1
               3
               5
               7
               9
(5 rows)
```

```
SELECT generate_series(0, 1, .1);
```

```
 generate_series
-----------------
               0
             0.1
             0.2
             0.3
             0.4
             0.5
             0.6
             0.7
             0.8
             0.9
             1.0
(11 rows)
```

Create bins: output

```
 lower | upper | count
-------+-------+-------
    30 |    35 |     0
    35 |    40 |    74
    40 |    45 |   155
    45 |    50 |    39
    50 |    55 |   445
    55 |    60 |    35
    60 |    65 |     0
(7 rows)
```

Create bins: query

```
-- Create bins
WITH bins AS (
      SELECT generate_series(30,60,5) AS lower,
             generate_series(35,65,5) AS upper),









               ;
```

Create bins: query

```
-- Create bins
WITH bins AS (
      SELECT generate_series(30,60,5) AS lower,
             generate_series(35,65,5) AS upper),
     -- Subset data to tag of interest
     ebs AS (
      SELECT unanswered_count
        FROM stackoverflow
       WHERE tag='amazon-ebs')









              ;
```

Create bins: query

```
-- Create bins
WITH bins AS (
      SELECT generate_series(30,60,5) AS lower,
             generate_series(35,65,5) AS upper),
     -- Subset data to tag of interest
     ebs AS (
      SELECT unanswered_count
        FROM stackoverflow
       WHERE tag='amazon-ebs')
-- Count values in each bin
SELECT lower, upper, count(unanswered_count)
  -- left join keeps all bins
  FROM bins
       LEFT JOIN ebs
              ON unanswered_count >= lower
             AND unanswered_count < upper



               ;
```

Create bins: query

```
-- Create bins
WITH bins AS (
      SELECT generate_series(30,60,5) AS lower,
             generate_series(35,65,5) AS upper),
     -- Subset data to tag of interest
     ebs AS (
      SELECT unanswered_count
        FROM stackoverflow
       WHERE tag='amazon-ebs')
-- Count values in each bin
SELECT lower, upper, count(unanswered_count)
  -- left join keeps all bins
  FROM bins
       LEFT JOIN ebs
              ON unanswered_count >= lower
             AND unanswered_count < upper
 -- Group by bin bounds to create the groups
 GROUP BY lower, upper
 ORDER BY lower;
```

Create bins: output

```
 lower | upper | count
-------+-------+-------
    30 |    35 |     0
    35 |    40 |    74
    40 |    45 |   155
    45 |    50 |    39
    50 |    55 |   445
    55 |    60 |    35
    60 |    65 |     0
(7 rows)
```

Time to explore some distributions!

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More Summary Functions

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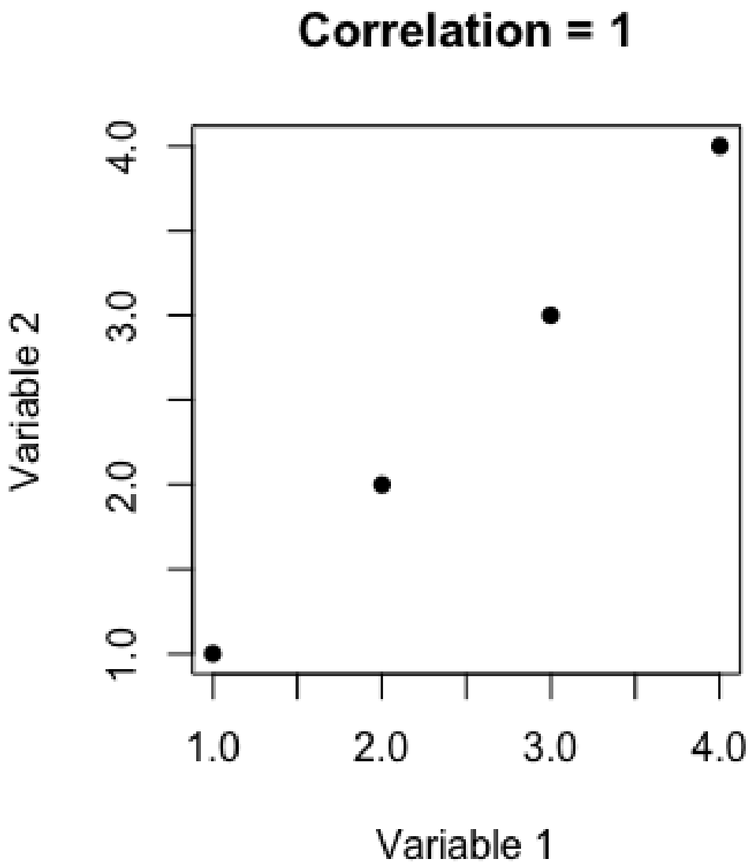
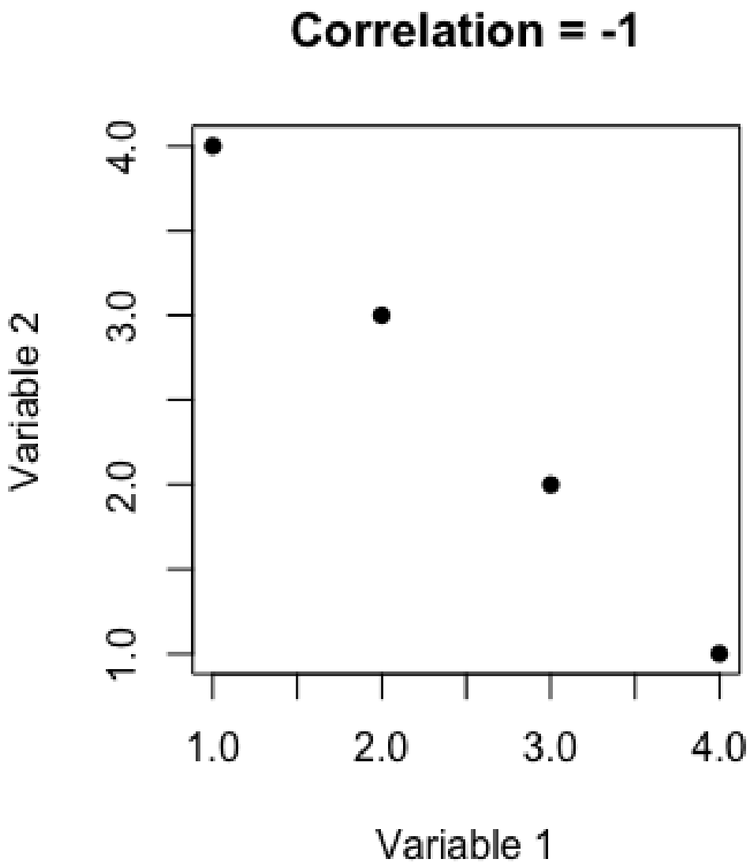
Correlation





Correlation function

```
SELECT corr(assets, equity)
  FROM fortune500;
```

```
       corr
--------------------
 0.637710143588615
(1 row)
```

Median

```
1 1 4 4 4 5 6 7 13 19 20 20 21 21 22
              ^
           median
        50th percentile

^                                   ^
0th percentile      100th percentile
```

Percentile functions

```
SELECT percentile_disc(percentile) WITHIN GROUP (ORDER BY column_name)
  FROM table;

-- percentile between 0 and 1
```

- Returns a value from column

```
SELECT percentile_cont(percentile) WITHIN GROUP (ORDER BY column_name)
  FROM table;
```

- Interpolates between values

Percentile examples

```
SELECT val
  FROM nums;
```

```
 val
-----
   1
   3
   4
   5
(4 rows)
```

```
SELECT percentile_disc(.5) WITHIN GROUP (ORDER BY val),
       percentile_cont(.5) WITHIN GROUP (ORDER BY val)
  FROM nums;
```

```
 percentile_disc | percentile_cont
-----------------+-----------------
               3 |             3.5
```

Common issues

- Error codes
  - Examples: 9, 99, -99
- Missing value codes
  - NA, NaN, N/A, #N/A
  - 0 = missing or 0?
- Outlier (extreme) values
  - Really high or low?
  - Negative values?
- Not really a number
  - Examples: zip codes, survey response categories

Let's practice!

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Creating Temporary Tables

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Syntax

Create Temp Table Syntax

```
-- Create table as
CREATE TEMP TABLE new_tablename AS
-- Query results to store in the table
SELECT column1, column2
  FROM table;
```

Select Into Syntax

```
-- Select existing columns
SELECT column1, column2
  -- Clause to direct results to a new temp table
  INTO TEMP TABLE new_tablename
  -- Existing table with exisitng columns
  FROM table;
```

Create a table

```
CREATE TEMP TABLE top_companies AS
SELECT rank,
       title
  FROM fortune500
 WHERE rank <= 10;
```

```
SELECT *
  FROM top_companies;
```

```
 rank |       title
------+--------------------
    1 | Walmart
    2 | Berkshire Hathaway
    3 | Apple
    4 | Exxon Mobil
    5 | McKesson
    6 | UnitedHealth Group
    7 | CVS Health
    8 | General Motors
    9 | AT&T
   10 | Ford Motor
(10 rows)
```

Insert into table

```
INSERT INTO top_companies
SELECT rank, title
  FROM fortune500
 WHERE rank BETWEEN 11 AND 20;
```

```
SELECT * FROM top_companies;
```

```
 rank |          title
------+--------------------------
    1 | Walmart
    2 | Berkshire Hathaway
    3 | Apple
...
    9 | AT&T
   10 | Ford Motor
   11 | AmerisourceBergen
   12 | Amazon.com
   13 | General Electric
   14 | Verizon
   15 | Cardinal Health
   16 | Costco
   17 | Walgreens Boots Alliance
   18 | Kroger
   19 | Chevron
   20 | Fannie Mae
(20 rows)
```

Delete (drop) table

```
DROP TABLE top_companies;
```

```
DROP TABLE IF EXISTS top_companies;
```

Time to create some tables!

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