# How to SQL (Sierra)

## *Part 2*

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# Recap

- Getting started
- PGAdmin III
- Basic Query Statement:
  - Clauses: **`SELECT`**, **`FROM`**, **`WHERE`**, **`GROUP BY`**, etc.
    - Order is important!
  - Comments: `--`
    - used to add comments to statement, or to prevent execution of statement

# Recap: Relational Database

- Sierra SQL database is a **relational database**
  - Data is structured in tables
  - Relationships between tables are often defined by **keys**
    - **primary** key
    - **foreign** key

# Recap: Keys

sierra_view
record_metadata

primary key

foreign key

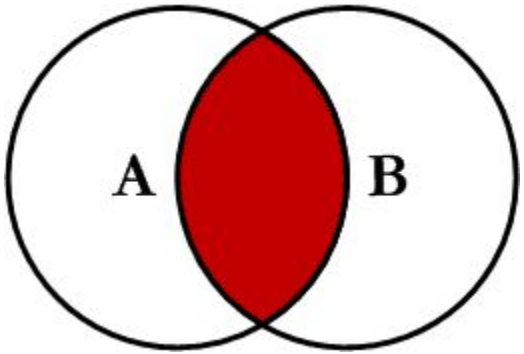
| | id<br>bigint | record_type_code<br>character(1) | record_num<br>integer | creation_date_gmt<br>timestamp with time zone |
|---|---|---|---|---|
| 1 | 420907795009 | b | 1000001 | 2012-06-19 18:48:06-04 |
| 2 | 420907795010 | b | 1000002 | 2012-06-19 18:48:07-04 |
| 3 | 420907795011 | b | 1000003 | 2012-06-19 18:48:07-04 |
| 4 | 420907795012 | b | 1000004 | 2012-06-19 18:48:07-04 |
| 5 | 420907795013 | b | 1000005 | 2012-06-19 18:48:08-04 |

sierra_view
bib_record_property

| | id<br>integer | bib_record_id<br>bigint | best_title<br>character varying(1000) | publish_year<br>integer |
|---|---|---|---|---|
| 1 | 357762 | 420907795009 | Water monsters : opposing viewpoints | 1991 |
| 2 | 357763 | 420907795010 | Seeking the old paths, and other sermons; | 1899 |
| 3 | 357764 | 420907795011 | The Foundation grants index. | 1971 |
| 4 | 357765 | 420907795012 | The religion of tomorrow | 1899 |
| 5 | 357766 | 420907795013 | Upward steps | 1899 |

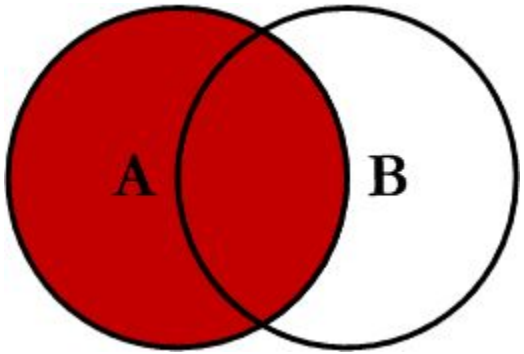
# Recap: Join

- `JOIN` (or `INNER JOIN`)
  - Given two sets `A` (left) and `B` (right), performing a `JOIN` will return a set containing all elements of set `A` that also belong to set `B`



# Recap: Left Join

- `LEFT JOIN` (or `LEFT OUTER JOIN`)
  - Given two sets `A` (left) and `B` (right) performing this join will return a set containing ALL elements of set `A` AND elements of set `A` that also belong to set `B`



# Recap: Left Join (cont.)

- **`LEFT JOIN`** operation will still return data for sets to the *left* when no data exists in the sets to the (right)
  - As you see below, `NULL` values are returned in columns from **`sierra_view.bib_record_property`**

| | id<br>bigint | record_type_code<br>character(1) | record_num<br>integer | creation_date_gmt<br>timestamp with time zone | deletion_date_gmt<br>date | num_revisions<br>integer | bib_record_id<br>bigint | best_title<br>character varying(1000) |
|---|---|---|---|---|---|---|---|---|
| 1 | 420907795049 | b | 1000041 | 2012-06-19 18:48:16-04 | | 2 | 420907795049 | Richard's cork leg. |
| 2 | 420907795050 | b | 1000042 | 2012-06-19 18:48:16-04 | 2016-01-21 | 2 | | |
| 3 | 420907795051 | b | 1000043 | 2012-06-19 18:48:16-04 | | 2 | 420907795051 | Initiative and refe |
| 4 | 420907795052 | b | 1000044 | 2012-06-19 18:48:17-04 | | 2 | 420907795052 | A country without s |
| 5 | 420907795053 | b | 1000045 | 2012-06-19 18:48:17-04 | | 2 | 420907795053 | A new parliamentary |

# Recap: Left Join (cont.)

SQL statement that produced the previous output:

```
SELECT
r.id, r.record_type_code,
r.record_num, r.creation_date_gmt,
r.deletion_date_gmt, r.num_revisions,
p.bib_record_id, p.best_title

FROM
sierra_view.record_metadata AS r

LEFT OUTER JOIN
sierra_view.bib_record_property AS p
ON
p.bib_record_id = r.id
```

# Recap: Subqueries

- Useful for breaking up query into logical, more understandable parts, as well as constraining one-to-many relationships
- Examples:
  - Get names of bib record titles that have a creation date within the last 12 hours
    https://iug2019-sql.github.io/figs/figure_2.1.html
  - Get all patron notes by patron record number (subquery in `SELECT` clause)
    https://iug2019-sql.github.io/figs/figure_2.1.1.html

# Agenda

- Why Use SQL
- Let's build a query from a scenario:
  - We want to start producing reports concerning holds that patrons create on different record types
  - Explore a number of concepts along the way
    - Aggregates, case, temp tables, indexes, data types and casting
- Tips and tricks
  - Working with strings
- Some further examples and resources

# Why Use SQL?

- **Advantages over other Sierra tools:**
  - Powerful text searching, parsing, formatting
  - Aggregation of data
  - Incorporate mathematical calculations into output
  - Fully customizable
- **Extract otherwise inaccessible data**
  - Sierra user permissions
  - Order and checkin record data across accounting units
  - Reading History
  - Network access table

# Why Use SQL (cont.)

- **“Simplicity” / Standardization of SQL Language:**
  - Resources for creating meaningful queries are plentiful
  - SQL skills are transferable to other applications.
- **Can incorporate queries into many useful external applications**
  - Automate reports
  - Add live Sierra data to websites
  - Combine with Sierra APIs to streamline workflows

# Let’s build a query

- Good place to start is with the Sierra DNA documentation:
  - https://techdocs.iii.com/sierradna/
    - Table concerning holds is in the section `Transactions` -> `Circulation` as table `sierra_view.hold`

hold

Each row of hold describes a bibliographic, item, or volume hold.

| Column | Data Type | Not NULL? | Comment |
|---|---|---|---|
| id | bigint | false | System-generated sequential ID. |
| patron_record_id | bigint | false | Foreign key to patron_record. |
| record_id | bigint | false | Foreign key to record. |
| placed_gmt | timestamp | false | Date the hold was placed. |
| is_frozen | boolean | false | Specifies whether the hold is frozen (suspended). |
| delay_days | int | false | Stores the "not wanted before" date as a number of days after the date the hold was placed. The maximum value is "180". If a "not wanted before" date was not specified, the value is '0'. |
| location_code | varchar | false | For bib or volume-level holds, the branch location from which to fill the hold, if the hold is set for 'Limit to Location'. Does not apply to item-level holds (blank). |
| expires_gmt | timestamp | false | "Not needed after" date. |

# Let’s build a query (cont.)

```
SELECT
*
FROM
sierra_view.hold
LIMIT 10
```

| | id<br>bigint | patron_record_id<br>bigint | record_id<br>bigint | placed_gmt<br>timestamp with time zone | is_frozen<br>boolean | delay_days<br>integer | location_code<br>character varying(5) | expires_gmt<br>timestamp with time zone | status<br>character(1) | is_ir<br>boolean | pickup_location_code<br>character varying(5) | is_ill<br>boolean | note<br>character varying(128) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 37117139 | 481038165105 | 450980825801 | 2019-01-27 07:44:00-05 | f | 0 | | 2020-01-27 07:44:00-05 | i | f | sm | f | |
| 2 | 37231411 | 481037768851 | 450981851733 | 2019-02-07 12:25:03-05 | f | 0 | | | t | f | ge | f | |
| 3 | 35366619 | 481037418872 | 420910189903 | 2018-11-18 15:20:41-05 | t | 255 | | 2019-11-18 15:20:41-05 | 0 | f | re | f | |
| 4 | 37183136 | 481038642774 | 450980504541 | 2019-01-18 10:09:50-05 | f | 0 | | 2020-01-18 10:09:50-05 | i | f | sh | f | |
| 5 | 36578403 | 481038443877 | 420910081748 | 2019-02-01 17:35:48-05 | f | 42 | | | 0 | f | ba | f | Breezy Book Club/Gina Daly BCC 4/28 mee |
| 6 | 36578404 | 481038443877 | 420910081748 | 2019-02-01 17:35:49-05 | f | 42 | | | 0 | f | ba | f | Breezy Book Club/Gina Daly BCC 4/28 mee |
| 7 | 36564557 | 481037632873 | 420910207645 | 2019-01-31 21:16:59-05 | f | 0 | | 2020-01-31 21:16:59-05 | 0 | f | an | f | |
| 8 | 35739819 | 481038680592 | 420909504006 | 2018-12-12 16:34:53-05 | f | 0 | | 2019-12-12 16:34:53-05 | 0 | f | gh | f | |
| 9 | 37231501 | 481037841117 | 450981854942 | 2019-03-06 00:20:28-05 | f | 0 | | 2020-03-05 00:20:28-05 | t | f | dt | f | |
| 10 | 36226206 | 481037502223 | 420908367087 | 2019-01-13 15:25:42-05 | f | 0 | | 2020-01-13 15:25:42-05 | 0 | f | sh | f | |

# Let's build a query: Aggregate

- Getting a sense of the scope of the holds:
  - Running a query to gather a **COUNT()**, by type (bib, item, volume level holds): We'll use the **GROUP BY** clause

```
SELECT
r.record_type_code,
COUNT(r.record_type_code) as count_holds

FROM
sierra_view.hold AS h

JOIN
sierra_view.record_metadata as r
ON
  r.id = h.record_id

GROUP BY
r.record_type_code
```

# Let's build a query: Aggregate (cont.)

- Output of that query breaks down the numbers by type:

| | record_type_code character(1) | count_holds bigint |
|---|---|---|
| 1 | b | 181033 |
| 2 | i | 51836 |
| 3 | j | 6780 |

`b` = bib level holds
`i` = item level holds
`j` = volume level holds

- How about next breaking that up by patron type?

# Let's build a query: Aggregate (cont.)

```
SELECT
r.record_type_code,
p.ptype_code,
COUNT(r.record_type_code) as count_holds
FROM
sierra_view.hold AS h
JOIN
sierra_view.record_metadata AS r
ON
  r.id = h.record_id
JOIN
sierra_view.patron_record AS p
ON
  p.record_id = h.patron_record_id
GROUP BY
r.record_type_code,
p.ptype_code
ORDER BY
r.record_type_code,
p.ptype_code
```

Figure 12

- Notice that we now **`JOIN sierra_view.patron_record`** to bring in the **`ptype_code`**
- **`sierra_view.patron_record`** was added to the **`GROUP BY`** clause to be aggregated as well
  - Note that all columns selected need to be in the **`GROUP BY`** clause as well
- The aggregate function **`COUNT()`** returns a count of those groupings

# Let's build a query: Aggregate (cont.)

Previous query output (partial)...

| | record_type_code character(1) | ptype_code smallint | count_holds bigint |
|---|---|---|---|
| 1 | b | 0 | 166991 |
| 2 | b | 1 | 93 |
| 3 | b | 2 | 58 |
| 4 | b | 3 | 122 |
| 5 | b | 5 | 23 |
| 6 | b | 6 | 60 |
| 7 | b | 10 | 1319 |
| 8 | b | 12 | 2298 |
| 9 | b | 15 | 204 |
| 10 | b | 22 | 1065 |
| 11 | b | 32 | 1092 |
| 12 | b | 51 | 38 |
| 13 | b | 196 | 7180 |
| 14 | i | 0 | 43661 |
| 15 | i | 1 | 218 |
| 16 | i | 2 | 68 |
| 17 | i | 3 | 76 |
| 18 | i | 5 | 41 |
| 19 | i | 6 | 54 |
| 20 | i | 10 | 2219 |
| 21 | i | 12 | 830 |

- Output still consists of **record_type_code**, but now also aggregates on another column, **ptype_code**
- These two columns are aggregated together in the **COUNT()** function and are represented by the column **count_holds**

Figure 13

# Let's build a query: Aggregate (cont.)

- Suppose now we wanted to filter or constrain the results to groups of `**ptype_code**` that had a **COUNT()** of holds above a certain threshold?
  - **WHERE** clause **won't** work on aggregates
  - **HAVING** clause **will** work on aggregates

# Let's build a query: Aggregate (cont.)

```
SELECT
r.record_type_code,
p.ptype_code,
COUNT(*) as count_holds
FROM
sierra_view.hold AS h
JOIN
sierra_view.record_metadata AS r
ON
  r.id = h.record_id
JOIN
sierra_view.patron_record AS p
ON
  p.record_id = h.patron_record_id
GROUP BY
r.record_type_code,
p.ptype_code
HAVING
COUNT(*) > 1000
ORDER BY
r.record_type_code,
p.ptype_code
```

- Using the **HAVING** clause below, we're able to limit to the patron types having more than 1000 holds of each of the hold level types (`b`, `i`, `j`)

Figure 14:
https://iug2019-sql.github.io/figs/figure_2.14.html

# Let's build a query: Aggregate (cont.)

Previous query results ...

| | record_type_code character(1) | ptype_code smallint | count_holds bigint |
|---|---|---|---|
| 1 | b | 0 | 166940 |
| 2 | b | 10 | 1394 |
| 3 | b | 12 | 2275 |
| 4 | b | 22 | 1065 |
| 5 | b | 32 | 1080 |
| 6 | b | 196 | 7308 |
| 7 | i | 0 | 42152 |
| 8 | i | 10 | 2106 |
| 9 | i | 196 | 4130 |
| 10 | j | 0 | 6455 |

Figure 15

# Let's build a query: Aggregate (cont.)

- Other useful aggregates:
  - MIN()
  - MAX()
  - AVG()
  - SUM()

```
SELECT
MIN(h.placed_gmt) AS min_hold_placed,
MAX(h.placed_gmt) AS max_hold_placed,
AVG(
        AGE(h.placed_gmt)
) AS avg_age_hold,
-- this isn't very useful to us, but demonstrates `SUM()`
EXTRACT(
        YEARS FROM SUM(
                AGE(h.placed_gmt)
        )
) AS sum_years_holds

FROM
sierra_view.hold as h
```

Figure 16

# Let's build a query: Aggregate (cont.)

- Previous query output...

| | min_hold_placed<br>timestamp with time zone | max_hold_placed<br>timestamp with time zone | avg_age_hold<br>interval | sum_years_holds<br>double precision |
|---|---|---|---|---|
| 1 | 2012-07-04 01:01:01-04 | 2019-03-15 11:34:23-04 | 1 mon 21 days 18:48:33.415516 | 27058 |

Figure 17

# Let's build a query: Temp Tables

- We're interesting in examining holds now from a "**supply and demand**" perspective:
  - We'd like to **resolve** each hold to a `bib_record_id` so we could get a sense of the counts of holds on each title.
  - A hold in the hold table is on a `record_id`, which could be for bib (`b`), item (`i`), or volume (`j`) level
  - Lets create a `TEMPORARY TABLE` (or, `TEMP TABLE`) with data from multiple tables to help simplify things…
    - These tables are removed after a session is ended
      https://www.postgresql.org/docs/current/sql-createtable.html#AEN67422

# Let's build a query: Temp Tables (cont.)

```
DROP TABLE IF EXISTS temp_hold_data;

CREATE TEMP TABLE temp_hold_data AS
SELECT
r.record_type_code, r.record_num,
p.ptype_code, h.*
FROM
sierra_view.hold AS h
JOIN
sierra_view.record_metadata AS r
ON
  r.id = h.record_id
JOIN
sierra_view.patron_record AS p
ON
  p.record_id = h.patron_record_id
;
```

Figure 18

- **DROP TABLE** clause helps if you're going to modify the query, and re-run it (to avoid an error on multiple runs)
- We bring in data about the record type (`**r.record_type_code**`),the patron type (`**p.ptype_code**`), and all the rest of the data concerning the hold (`**h.***`)
- We can work with our temp table in subsequent statements, as long as it's the **same session**

# Let's build a query: Temp Tables (cont.)

- The previous **`TEMP TABLE`** query only tells us what ***type*** of **record** the hold was for.
- How do we resolve record types that are not bib (`b`) to the bib record they're linked to?
- **`CASE`** clause or expression, can be used to produce different results depending on a **conditional expression**

# Let's build a query: CASE

```
CASE
WHEN r.record_type_code = 'i' THEN (
        SELECT
        l.bib_record_id
        FROM
        sierra_view.bib_record_item_record_link as l
        WHERE
        l.item_record_id = h.record_id
        LIMIT 1
)
WHEN r.record_type_code = 'j' THEN (
        SELECT
        l.bib_record_id
        FROM
        sierra_view.bib_record_volume_record_link as l
        WHERE
        l.volume_record_id = h.record_id
        LIMIT 1
)
WHEN r.record_type_code = 'b' THEN (
        h.record_id
)
ELSE NULL
END AS bib_record_id,
```

- This section of the **partial** SQL statement demonstrates resolving item (`**i**`) and volume (`**j**`) to the `**bib_record_id**` that they are linked to.
- Full **`TEMP TABLE`** creation: Figure 19.1: https://iug2019-sql.github.io/figs/figure_2.19.1.html

# Let's build a query: `WITH` clause

- Now that we have our **`TEMP TABLE`**, **`temp_hold_data`** we can do some more with it
- We can also simplify things by using **`WITH`** clause to create a **Common Table Expression** (**CTE**)
  - **CTE** can be thought of as defining temporary tables that exist just for one query
  - This is just one ***optional*** method that can be used to simplify logic of a complex SQL statement

# Let's build a query: `WITH` clause (cont.)

```
WITH distinct_titles AS (
        SELECT
        t.bib_record_id,
        string_agg(t.pickup_location_code::TEXT, ',') AS pickup_locations,
        COUNT(*) as count_holds_title
        FROM
        temp_hold_data as t
        GROUP BY
        t.bib_record_id
)

SELECT
d.*
FROM
distinct_titles AS d
ORDER BY
d.count_holds_title DESC
;
```

Figure 20:
https://iug2019-sql.github.io/figs/figure_2.20.html

# Let's build a query: `WITH` clause (cont.)

| | bib_record_id<br>bigint | pickup_locations<br>text | count_holds_title<br>bigint |
|---|---|---|---|
| 1 | 420910219176 | ba,ha,re,dt,sh,an,cr,ha,an,md,ha,wt,pl,1,ch,sm,1,wh,ge,lv, | 3062 |
| 2 | 420910212190 | ch,ba,cv,an,gr,grw,fo,an,av,ha,gr,1,dp,mo,mw,nr,ch,dt,ha,g | 3037 |
| 3 | 420910217875 | sb,cv,1,re,sm,ha,wy,sm,av,gr,hp,ge,dt,sm,sb,ge,dt,ma,oa,sh | 2914 |
| 4 | 420910219177 | co,lv,1,dp,ba,dt,an,ha,wh,ma,mw,fo,gh,ha,mo,sb,sh,gr,rew,c | 2817 |
| 5 | 420910214745 | gr,dp,oa,lv,ba,dt,ns,hp,ma,ge,sm,lv,ww,1,sb,sm,sm,hp,mn,dp | 2816 |
| 6 | 420910221212 | av,oa,nr,sh,fo,sm,mn,mn,ge,ha,sb,md,1,co,sb,mn,sm,ep,grw,m | 2793 |
| 7 | 420910219178 | sm,cv,ge,gh,mn,ha,ba,ba,ma,sm,ba,lv,an,ma,oa,ma,1,mo,cv,1, | 2763 |
| 8 | 420910207644 | dt,gh,ns,lv,pl,ge,co,sh,gr,1,mm,hp,dt,dt,sm,an,wy,mn,re,ma | 2740 |
| 9 | 420910216470 | lv,nr,re,sb,an,mt,wh,sm,an,1,ba,mm,an,wh,wy,nw,ge,md,dp,ha | 2692 |
| 10 | 420910221213 | ba,1,wt,cv,oa,hp,1,1,ba,rew,re,fo,ba,mm,mo,wy,mn,md,sm,ww, | 2651 |
| 11 | 420910219175 | mo,av,ha,wy,mn,1,sb,ch,cr,ch,ns,sm,sm,ch,pl,sh,ha,ma,sb,wh | 2646 |
| 12 | 420910221214 | gr,mw,cl,an,cv,ge,dt,sm,wh,md,sm,ge,ha,bh,ns,sm,fo,mt,pl,w | 2630 |
| 13 | 420910216469 | ww,lv,ge,sm,1,nw,sh,1,md,os,wy,lv,an,nr,ns,wt,ha,1,mo,sm,l | 2622 |
| 14 | 420910216471 | mw,gr,sm,ma,ba,oa,ch,hp,ha,hp,ma,nr,wt,sm,fo,oa,nw,ch,oa,l | 2597 |
| 15 | 420910222250 | an,1,ha,ch,gr,gr,wh,ma,mo,grw,dp,1,ma,lv,dp,sh,an,sb,sh,wy | 2550 |
| 16 | 420910212189 | ge,1,ma,1,wh,nw,sm,mn,sh,sm,lv,mm,wy,ge,rew,gr,wy,oa,hp,mc | 2548 |
| 17 | 420910214744 | ch,wh,mn,oa,dt,nw,ww,mm,lv,nr,sm,pl,1,cv,ch,mo,sh,mn,an,ha | 2493 |

# Let's build a query: STRING_AGG()

```
string_agg(t.pickup_location_code::TEXT, ',') AS pickup_locations,
```

- From previous query, the PostgreSQL **`STRING_AGG()`** function allows us to create a list (delimited by the `,` character) of the `pickup_location_code` values for each title
- **`STRING_AGG()`** takes a **`TEXT`** data type as the first argument, and a **`TEXT`** data type as the delimiter
- https://www.postgresql.org/docs/current/functions-aggregate.html

# Data Types & Casting

https://www.postgresql.org/docs/current/datatype.html

- Some important and common PostgreSQL data types to understand
  - **`INTEGER`**: signed, four-byte integer (`1`, `-1`, `42`, etc)
  - **`NUMERIC`**: real number or **`NUMERIC(p,s)`** with p digits with s number after the decimal point
  - **`TEXT`**: character string with unlimited length
  - **`CHAR`**: single character, or `CHAR(n)` fixed-length of `n` characters with *space padded*
  - **`VARCHAR(n)`**: variable-length character string of `n` characters with *no space padded*
  - **`BOOLEAN`**: true or false values (can use special `IS TRUE` or `IS FALSE` clause to test)

# Data Types & Casting (cont.)

https://www.postgresql.org/docs/current/datatype-datetime.html

- Date / Time Types:
  - **`DATE`**: ISO 8601 (`YYYY-MM-DD`):
    `2019-03-17`
  - **`TIMESTAMP`**: ISO 8601 date with time (24-hour clock):
    `2019-03-17 11:41:13.979849`
    Time zone is optional
    **`TIMESTAMP WITH TIME ZONE`**:
    `2019-03-17 11:41:13.979849-04`

# Data Types & Casting (cont.)

https://www.postgresql.org/docs/current/datatype-datetime.html

- Date / Time Types (cont.):
  - **INTERVAL**: defines periods of time
    - Traditional Postgres format:
      `1 year 2 months 3 days 4 hours 5 minutes 6 seconds`
    - Useful in defining ranges of time limit in **WHERE** clause

```
SELECT
*
FROM
sierra_view.circ_trans AS c
WHERE
c.transaction_gmt <= NOW() - '1 hour'::INTERVAL
AND c.transaction_gmt > NOW() - '2 hours'::INTERVAL
ORDER BY
c.transaction_gmt
```

Figure 23

# Data Types & Casting (cont.)

- Casting one data type to another is necessary to perform some operations: `::` or **CAST(*expression* AS *type*)**
  (`CAST` example here: https://iug2019-sql.github.io/figs/figure_2.23.1.html)
  - From the previous query example:

```
c.transaction_gmt <= NOW() - '1 hour'::INTERVAL
```

- The string value `1 hour` is being converted to the **INTERVAL** data type, so that it may be included in an operation (subtraction) involving another date format
  - **TIMESTAMP** data type is returned from the function, **NOW()**

# Working With Date Types

- **`NOW()`** will return current timestamp
- Use **`::`** to convert data types
- **`TO_CHAR()`** can be used for date and timestamp formatting
- Remember that ISO 8601 (**`YYYY-MM-DD`**) can be useful for sorting!

```
SELECT
now(),
now()::DATE,
DATE(now()),
to_char(now(), 'MM-DD-YYYY'),
to_char(now(), 'MON-DD-YYYY'),
to_char(now(), 'Day Month DD, YYYY')
```

| now<br>timestamp with time zone | now<br>date | date<br>date | to_char<br>text | to_char<br>text | to_char<br>text |
|---|---|---|---|---|---|
| 2019-03-15 15:29:38.7211-04 | 2019-03-15 | 2019-03-15 | 03-15-2019 | MAR-15-2019 | Friday March 15, 2019 |

- Template Patterns for Date/Time Formatting can be found here: https://www.postgresql.org/docs/current/functions-formatting.html

# Let's build a query: INDEX

- Returning to our example, we were working with a **TEMP TABLE**: https://iug2019-sql.github.io/figs/figure_2.20.html
- What if our query is slow?
- Queries can be made to run significantly more quickly when an **INDEX** is used!
- Adding the **CREATE INDEX** statement to the query:

```
CREATE INDEX temp_hold_data_bib_record_id ON temp_hold_data(bib_record_id);
ANALYZE temp_hold_data;
```

https://iug2019-sql.github.io/figs/figure_2.26.html

# Let's build a query: `INDEX`

- Creating good indexes can be useful when building a **`TEMP TABLE`** that will be used in **multiple** or **complex queries** involving a **`JOIN`** or **`GROUP BY`** operation.
  - Keep in mind that a index scan is better than a sequential scan when doing an operation on columns.
  - Further reading about using indexes:
    - http://www.postgresqltutorial.com/postgresql-indexes/postgresql-index-types/
    - https://use-the-index-luke.com

# Let's build a query (cont.)

- Here's the query script up to this point: https://iug2019-sql.github.io/figs/figure_2.28.html
- We want to bring in some counts of available items.
  - To keep things simple, we're going to limit to:
    - Holds that are bib level
    - Holds placed by patrons with ptype_code = 0

# Let's build a query (cont.)

```
SELECT
COUNT(*)
FROM
sierra_view.bib_record_item_record_link AS l
JOIN
sierra_view.item_record AS i
ON
  i.record_id = l.item_record_id
LEFT OUTER JOIN
sierra_view.checkout as c
ON
  c.item_record_id = l.item_record_id
WHERE
l.bib_record_id = d.bib_record_id
-- item has a status code of something that we'd want to see
AND i.item_status_code IN (
        '-', '!', 'b', 'p', '(', '@', ')', '_', '=', '+'
)
AND COALESCE(
        --if this age is >= 60 days, it'll return FALSE,
        -- and not count as an "available item"
        age(c.due_gmt) < '60 days'::INTERVAL,
        -- if there is no due_gmt value (NULL) return TRUE
        TRUE
)
```

- Statement will count available items meeting certain criteria:
  - `item_status_code`
  - `due_gmt`

Figure 29:
https://iug2019-sql.github.io/figs/figure_2.29.html

# Let's build a query: COALESCE()

```
AND COALESCE(
        --if this age is >= 60 days, it'll return FALSE,
        -- and not count as an "available item"
        age(c.due_gmt) < '60 days'::INTERVAL,
        -- if there is no due_gmt value (NULL) return TRUE
        TRUE
)
```

Figure 30

- **`COALESCE()`**: Returns the ***first argument*** that is not **`NULL`**
- In the example above, '**`c.due_gmt`**` could have a value of **`NULL`**` (remember `LEFT OUTER JOIN`?)
- If age of due date is greater or equal to 60 days, we get a value of **`FALSE`**
- Otherwise, we get a value of **`TRUE`** and can consider the item to be "active"

# Let's build a query: Final Output

- "Final" bib level holds to available item query: https://iug2019-sql.github.io/figs/figure_2.31.html

| | bib_record_id bigint | bib_record_num text | count_holds_title bigint | count_items_available bigint | hold_to_item_ratio text | best_title character varying(1000) | pickup_locations text |
|---|---|---|---|---|---|---|---|
| 1 | 420907797479 | b1002471a | 1 | 0 | | Luciano Pavarotti premieres Verdi [sound recording] : [first | pr |
| 2 | 420907799032 | b1004024a | 1 | 1 | 1.00 | Otto of the Silver Hand. | dt |
| 3 | 420907799561 | b1004553a | 1 | 1 | 1.00 | Milestones [sound recording] | co |
| 4 | 420907799835 | b1004827a | 1 | 2 | .50 | Giving you the best that I got [sound recording] | pr |
| 5 | 420907800116 | b1005108a | 1 | 2 | .50 | The miracle of mindfulness : a manual on meditation | an |
| 6 | 420907801727 | b1006719a | 1 | 1 | 1.00 | B.B. King live at the Regal [sound recording] | ww |
| 7 | 420907801789 | b1006781a | 1 | 1 | 1.00 | In the age of the smart machine : the future of work and pow | oa |
| 8 | 420907802767 | b1007759a | 1 | 2 | .50 | Orthodoxy. | mo |
| 9 | 420907803146 | b1008138a | 1 | 13 | .08 | Lolita | l |
| 10 | 420907803182 | b1008174a | 1 | 3 | .33 | Dead man's folly | cl |
| 11 | 420907803201 | b1008193a | 2 | 1 | 2.00 | Notes of a native son. | ww,md |
| 12 | 420907803535 | b1008527a | 1 | 5 | .20 | Player piano | ch |

Figure 32:
https://iug2019-sql.github.io/figs/figure_2.32.png

# Let's build a query: Final Output (cont.)

- https://iug2019-sql.github.io/figs/figure_2.31.html
- Please note the following things about this final SQL statement:
  - We created a **second** **`TEMP TABLE`** called "**`temp_title_item_counts`**", to more easily make the final calculation for **`` `hold_to_item_ratio` ``** (which is the ratio between holds: **`` `count_holds_title` ``** and available items: **`` `count_items_available` ``**
  - NOTE that this is also a simplified output of the bib level holds *only*
  - *Does anyone know why we have a* ***`CASE`*** *clause checking to see if* ***`` `count_items_available` ``*** *is equal to zero?*

# Tips and Tricks

- Orders of operations and parentheses are important!

```sql
-- find holds placed up to 2 days ago, ready for pickup
SELECT
h.id,
AGE(h.placed_gmt) as hold_age,
h.status
FROM
sierra_view.hold AS h
WHERE
h.placed_gmt >= NOW() - '2 days'::INTERVAL
AND h.status = 'b' OR h.status = 'j' OR h.status = 'i'
ORDER BY
hold_age DESC
LIMIT 10
```

| | id<br>bigint | hold_age<br>interval | status<br>character(1) |
|---|---|---|---|
| 1 | 30931202 | 1 year 1 mon 4 days 10:16:33 | i |
| 2 | 37179891 | 11 mons 22 days 11:52:21 | i |
| 3 | 37229026 | 11 mons 18 days 06:05:51 | i |
| 4 | 37161396 | 10 mons 7 days 03:10:43 | i |
| 5 | 37206717 | 9 mons 27 days 06:39:22 | i |
| 6 | 36944773 | 9 mons 12 days 05:51:45 | i |
| 7 | 37262863 | 8 mons 28 days 09:41:10 | i |
| 8 | 37228182 | 8 mons 24 days 09:34:25 | i |
| 9 | 37184688 | 8 mons 6 days 12:57:22 | i |
| 10 | 37109094 | 7 mons 16 days 12:19:58 | i |

```sql
-- find holds placed up to 2 days ago, ready for pickup
SELECT
h.id,
AGE(h.placed_gmt) as hold_age,
h.status
FROM
sierra_view.hold AS h
WHERE
h.placed_gmt >= NOW() - '2 days'::INTERVAL
-- note the added '(', ')'
AND (h.status = 'b' OR h.status = 'j' OR h.status = 'i')
ORDER BY
hold_age DESC
LIMIT 10
```

| | id<br>bigint | hold_age<br>interval | status<br>character(1) |
|---|---|---|---|
| 1 | 37291801 | 1 day 16:12:34 | b |
| 2 | 37292521 | 1 day 15:59:29 | b |
| 3 | 37292557 | 1 day 15:45:01 | b |
| 4 | 37292362 | 1 day 15:44:00 | b |
| 5 | 37292181 | 1 day 15:31:42 | b |
| 6 | 37292623 | 1 day 15:31:01 | b |
| 7 | 37291032 | 1 day 15:21:56 | b |
| 8 | 37295434 | 1 day 15:09:48 | b |
| 9 | 37291922 | 1 day 14:58:39 | b |
| 10 | 37297738 | 1 day 14:53:18 | b |

Figure 35

# String Functions

- PostgreSQL has many **String Functions** / **Operators** available
  - Functions allow you to modify, parse, and search within strings
  - Includes POSIX regex and simplified pattern matching
  - https://www.postgresql.org/docs/9.1/functions-string.html

# CONCAT

- Use concatenation to chain strings together
- Three methods available: **CONCAT()**, **CONCAT_WS()**, ||

```
SELECT
CONCAT(code, name),
CONCAT_WS(', ',code, name),
code || ' (' || name || ')'
FROM
sierra_view.location_myuser
WHERE
code = 'acta'
```

| concat<br>text | concat_ws<br>text | ?column?<br>text |
|---|---|---|
| actaACTON/Adult | acta, ACTON/Adult | acta (ACTON/Adult) |

# CONCAT and COALESCE

- Be careful with `NULL` values!
  - This results in a `NULL` value:

```
SELECT
NULL || 'concatinate this!' AS output
```

Figure 33

- To avoid this type of behaviour, consider using the **CONCAT()** or **COALESCE()** functions: https://iug2019-sql.github.io/figs/figure_2.34.html

```
SELECT
NULL || 'concatinate this!' AS output,
-- result: NULL

-- CONCAT will take "unlimited" variables
CONCAT(NULL, 'concatinate this!', NULL, '!') AS output2,
-- result: 'concatinate this!!'

-- COALESCE() will return ONLY the first non-null value
COALESCE(NULL, '', ' hello?') || 'concatinate this!' as output3
-- result: 'concatinate this!'
```

Figure 34

# Nesting String Functions

Using string functions to display an author in first name, last name order

```
SELECT
b.best_author AS original,
SPLIT_PART(b.best_author,' (',1) AS author_1,
SPLIT_PART(SPLIT_PART(b.best_author,' (',1),', ',2) AS author_2,
REPLACE(SPLIT_PART(SPLIT_PART(b.best_author,' (',1),', ',2),'.','') AS author_3,
REPLACE(SPLIT_PART(SPLIT_PART(b.best_author,' (',1),', ',2),'.','')
    ||' '||SPLIT_PART(b.best_author,', ',1) AS author_4
FROM
sierra_view.bib_record_property b
WHERE
best_author LIKE 'Sharma, Robin S. (Robin Shilip), 1964- author%'
```

| original<br>character varying(1000) | author_1<br>text | author_2<br>text | author_3<br>text | author_4<br>text |
|---|---|---|---|---|
| Sharma, Robin S. (Robin Shilip), 1964- author. | Sharma, Robin S. | Robin S. | Robin S | Robin S Sharma |

# Pattern Matching: LIKE

- LIKE provides a simple pattern matching option
- Two Wildcards
  - '**_**' single instance of any character
  - '**%**' any number of characters (including 0)
- Here we are finding all locations starting with 'act'

```
SELECT
code
FROM
sierra_view.location_myuser
WHERE
code LIKE 'act%'
```

| code<br>character varying(5) |
|---|
| actas |
| actap |
| actae |
| actal |
| actan |
| actnn |
| actjl |
| actjn |
| actjh |
| actjt |
| actjp |
| actjr |
| actyn |

# Pattern Matching: POSIX Regex

- POSIX regex operators: `~`, `~*`, `!~`, ` !~*`
  - Matches and Not matches
  - With and without case sensitivity
- Here we are finding all locations containing 4 lowercase letters and ending in y

```
SELECT
code
FROM
sierra_view.location_myuser
WHERE
code ~ '[a-z]{3}y$'
```

| code<br>character varying(5) |
|---|
| regy |
| pmcy |
| shry |
| medy |
| ashy |
| nory |
| wwdy |
| mayy |
| somy |
| blmy |
| camy |
| mily |
| wsny |
| neey |
| arly |

# Pattern Matching: Regex Functions

- **SUBSTRING()** extracts a specified set of characters from a string
- Can accomplish this two ways
  - Regex '^[a-z]{3}': extract 3 lowercase letters from start
  - Positionally 'FROM 1 FOR 3': extract 3 letters starting at 1st character

```
SELECT
DISTINCT SUBSTRING(code, '^[a-z]{3}'),
SUBSTRING(code FROM 1 FOR 3)
FROM
sierra_view.location_myuser
ORDER BY 1
```

| substring text | substring text |
|---|---|
| act | act |
| arl | arl |
| ash | ash |
| bed | bed |
| blm | blm |
| brk | brk |
| cam | cam |
| cmc | cmc |
| con | con |
| ddm | ddm |
| dea | dea |
| dov | dov |
| fpl | fpl |
| frk | frk |

# String Functions Cont

**Some other useful functions to know**

LOWER()
UPPER()
INITCAP()
REVERSE()
LENGTH()

LEFT()
TRIM()
REGEXP_MATCHES()
REGEXP_REPLACE()

# Tables of Note: Linking Tables

- bib_record_item_record_link
  - bib_record_order_record_link
    - course_record_bib_record_link
      - volume_record_item_record_link
        - …
- Contain foreign keys to both record types
  - Gather record counts
  - Chain data types together without having to touch record tables

# Tables of Note: Record, View, Property

- Each record type has one of each table
  - bib_view, bib_record, bib_record_property
- Record table contains majority of fixed fields
- Record_property table contains additional descriptive fields
  - Including useful values such as call_number, title and barcode
- View table combines fields from multiple tables
  - Convenience comes at the expense of efficiency

# Tables of Note: myuser

- A my_user table exists for each fixed field in the system
- Contains code and name values for their respective field
- Use to provide translations for system codes

# Unique to SierraDNA queries

```
--Identifies user accounts with the permission to access Sierra Web

SELECT DISTINCT(u.user_name)
FROM
sierra_view.iii_user_application_myuser u
LEFT JOIN
sierra_view.iii_user_desktop_option o
ON
u.iii_user_id=o.iii_user_id  AND o.desktop_option_id='899'
WHERE o.id IS NULL
ORDER By 1
```

- Desktop_option_id values are not documented
- To identify you must query the table before and after toggling an option to identify which value changes

# Unique to SierraDNA queries

```
--Provides usage count of the reading history feature

SELECT
p.home_library_code,
COUNT(p.is_reading_history_opt_in)
FROM
sierra_view.patron_record p
GROUP BY 1
ORDER BY 1
```

Other unique fields for fun queries:

- record_metadata.deletion_date_gmt
  - Count deleted records
- varfield.occ_num
  - Pick out first occurrences of varfields such as ISBN
- bool_info.sql_query
  - See sql queries underlying create list searches

# Unique to SierraDNA queries

```
--identifies order records across accounting units that lack a location code
--due to downloading incomplete data from a vendor

SELECT
  id2reckey(order_view.record_id)||'a' AS "Record_number",
  order_record_cmf.location_code AS "Location",
  order_view.accounting_unit_code_num AS "accounting unit",
  order_view.record_creation_date_gmt AS "created date"
FROM   sierra_view.order_view
  JOIN sierra_view.order_record_cmf
     ON order_view.record_id=order_record_cmf.order_record_id
WHERE
  order_record_cmf.location_code = 'none'
```

- SQL ignores accounting units
- Unlike Sierra, can conduct a single search across all records

# Further examples

- GitHub Repositories:
  - **The Public Library of Cincinnati and Hamilton County**: https://github.com/plch/sierra-sql/wiki
  - **Minuteman Library Network**: https://github.com/jmgold/SQL-Queries/wiki
  - **The University of North Carolina at Chapel Hill**: https://github.com/UNC-Libraries/III-Sierra-SQL/wiki

# Consider Attending

- Automating Booklist Curation with SQL
  - Tuesday 1:30-2:30 Deer Valley
- Cache and Release: Capturing and Using Sierra's Temporary SQL Data
  - Wednesday 3:00-4:00 Deer Valley
- SQL Users Birds of A Feather

# Find Us On Slack

All three of us can be found on the Sierra_ILS slack workspace, run by Craig Bowman

# Questions?


| | |
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