Chicago public library: database creation

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Course project, second deliverable

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Database & table creation

We expanded our Relational Schema from the first deliverable to create a database named `chi_pub` created & the following tables in it. The full source code for this is located in the attached source archive in the file `src/schema.sql` .

```
create database if not exists chi_pub;

use chi_pub;
```

Author

```
create table if not exists author (
    aid int primary key,
    first_name varchar(510),
    last_name varchar(510) not null,
    about text
);
```

Genre

```
create table if not exists genre (
    gid int primary key,
    name varchar(127)
);
```

Subject

```
create table if not exists subject (
    sid int primary key,
    name varchar(255)
);
```

Language

```
create table if not exists language (
    lid int primary key,
    name varchar(255)
);
```

Book

```
create table if not exists book (
    bid int primary key,
    isbn char(13) not null,
    title varchar(255) not null,
    genre_id int,
    fiction bit(1), -- single bit bool repr, 0 is false, 1 is true
    edition varchar(127),
    pub_date date,
    foreign key (genre_id)
        references genre(gid)
        on delete set null
);
```

Author to Book

```
create table if not exists author_book (
    author_id int not null,
    book_id int not null,
    primary key (author_id, book_id),
    foreign key (author_id)
        references author(aid)
        on delete cascade,
    foreign key (book_id)
        references book(bid)
        on delete cascade
);
```

Subject to Book

```
create table if not exists subject_book (
    book_id int,
    subject_id int,
    primary key (subject_id, book_id),
    foreign key (book_id)
        references book(bid)
        on delete cascade,
    foreign key (subject_id)
        references subject(sid)
        on delete cascade
);
```

Language to Book

```
create table if not exists language_book (
    book_id int,
    language_id int,
    primary key (language_id, book_id),
    foreign key (book_id)
        references book(bid)
        on delete cascade,
    foreign key (language_id)
        references language(lid)
        on delete cascade
);
```

Cardholder

```
create table if not exists cardholder (
    chid int primary key,
    card_num int not null,
    first_name varchar(510),
    last_name varchar(510) not null,
    password varchar(127),
    addr_num smallint not null,
    addr_street varchar(255) not null,
```

```
    addr_apt varchar(31),
    addr_city varchar(127) not null,
    addr_state varchar(127) not null,
    addr_zip smallint not null,
    email varchar(255) not null
);
```

Cardholder to phone number

```
create table if not exists cardholder_phone (
    cardholder_id int not null,
    phone_number char(10) not null,
    primary key (cardholder_id, phone_number),
    foreign key (cardholder_id)
        references cardholder(chid)
        on delete cascade
);
```

Book to Cardholder

```
create table if not exists book_cardholder (
    timestamp timestamp not null,
    book_id int not null,
    cardholder_id int not null,
    status enum('pending', 'fulfilled', 'cancelled') not null,
    primary key (timestamp, book_id, cardholder_id),
    foreign key (book_id)
        references book(bid)
        on delete cascade,
    foreign key (cardholder_id)
        references cardholder(chid)
        on delete cascade
);
```

Branch

```
create table if not exists branch (
    brid int primary key,
    name varchar(255) not null,
    addr_num smallint not null,
    addr_street varchar(255) not null,
    addr_apt varchar(31),
    addr_city varchar(127) not null,
    addr_state varchar(127) not null,
    addr_zip smallint not null
);
```

Copy

```
create table if not exists copy (
    cid int primary key,
    book_id int not null,
    branch_id int not null,
    foreign key (book_id)
        references book(bid)
        on delete cascade,
    foreign key (branch_id)
        references branch(brid)
        on delete cascade
);
```

Cardholder to Copy

```
create table if not exists cardholder_copy (
    copy_id int not null,
    cardholder_id int not null,
    checked_out timestamp not null,
    checked_in timestamp,
    primary key (copy_id, cardholder_id),
    foreign key (copy_id)
        references copy(cid)
        on delete cascade,
    foreign key (cardholder_id)
        references cardholder(chid)
```

```
        on delete cascade
);
```

Mock data loading

Using the schema shown above, we generated csv files of data for each table using the "Dummy Data for MYSQL Database" tool from Fill Database (filldb.info). Generated data is available in `src/mock-data` in the attached source archive.

This data was then loaded into the database using the following bash script:

```
#!/usr/bin/env bash

db=chi_pub
glob=mock-data/*.csv

cd "$(dirname "$0")"

echo "Setting up database & tables..."
# start in sys database since a database has to
# be selected to execute a sql source
mysql -ppass sys < schema.sql
# verify database created
mysql -ppass -e "show databases;"
# verify tables created
mysql -ppass $db -e "show tables;"

# enable loading csv from file
mysql -ppass $db -e "set global local_infile=true;"
echo "Loading data from csv source..."
# loop over data files & load each one
for f in $glob; do
    b=${f##*/} # strip preceding path from file, giving basename (with extension)
    n=${b%.*}  # strip extension from file, giving basename only
    t=${n##*-} # strip numeric prefix, giving table name
    echo "loading data from $f into $t"
    # load data from csv
    l="load data local infile '$f' into table $t fields terminated by ',' ignore 1 lines;
    mysql --local-infile=1 -ppass $db -e $l
    # select some records to verify data loaded
```

```
    mysql -ppass $db -e "select * from $t limit 15;"
done
```

The script gave the following output on run (with some truncations & edits to make viewing in this format easier), including verification of data loading via the `SELECT` statements executed via the mysql cli in the script above.

```
Setting up database & tables...

+--------------------+
| Database           |
+--------------------+
| chi_pub            |
| information_schema |
| mysql              |
| performance_schema |
| sys                |
+--------------------+

+-------------------+
| Tables_in_chi_pub |
+-------------------+
| author            |
| author_book       |
| book              |
| book_cardholder   |
| branch            |
| cardholder        |
| cardholder_copy   |
| cardholder_phone  |
| copy              |
| genre             |
| language          |
| language_book     |
| subject           |
| subject_book      |
+-------------------+

Loading data from csv source...

loading data from mock-data/01-author.csv into author

// table too wide to fit, see output file for full version
```

loading data from mock-data/02-genre.csv into genre

gid	name
0	excepturi
1	in
3	quaerat
6	sunt
8	id
29	debitis
30	occaecati
53	quo
87	architecto
93	qui
102	molestias
198	eum
228	voluptas
483	quo
741	eveniet

loading data from mock-data/03-subject.csv into subject

sid	name
0	voluptas
1	accusantium
2	in
3	eos
4	sunt
8	ut
9	est
59	at
61	pariatur
62	ducimus
74	natus
83	illum
125	blanditiis
146	perspiciatis
183	est

loading data from mock-data/04-language.csv into language

lid	name
0	in
6	esse
35	et
48	saepe
75	et
167	qui
184	et
366	velit
3733	sed
149674	ipsam
487559	aut
2260072	consectetur
2640555	laborum
3872410	dolor
29848962	omnis

loading data from mock-data/05-book.csv into book

// table too wide to fit, see output file for full version

loading data from mock-data/06-author_book.csv into author_book

author_id	book_id
0	0
1	1
2	2
3	3
4	4
5	5
7	6
8	7
9	8
28	9
32	11
40	12
41	13

```
|        49 |      14 |
|        67 |      15 |
+-----------+---------+

loading data from mock-data/07-subject_book.csv into subject_book


+---------+------------+
| book_id | subject_id |
+---------+------------+
|       0 |          0 |
|       1 |          1 |
|       2 |          2 |
|       3 |          3 |
|       4 |          4 |
|       5 |          8 |
|       6 |          9 |
|       7 |         59 |
|       8 |         61 |
|       9 |         62 |
|      11 |         74 |
|      12 |         83 |
|      13 |        125 |
|      14 |        146 |
|      15 |        183 |
+---------+------------+

loading data from mock-data/08-language_book.csv into language_book


+---------+-------------+
| book_id | language_id |
+---------+-------------+
|       0 |           0 |
|       1 |           6 |
|       2 |          35 |
|       3 |          48 |
|       4 |          75 |
|       5 |         167 |
|       6 |         184 |
|       7 |         366 |
|       8 |        3733 |
|       9 |      149674 |
|      11 |      487559 |
|      12 |     2260072 |
|      13 |     2640555 |
```

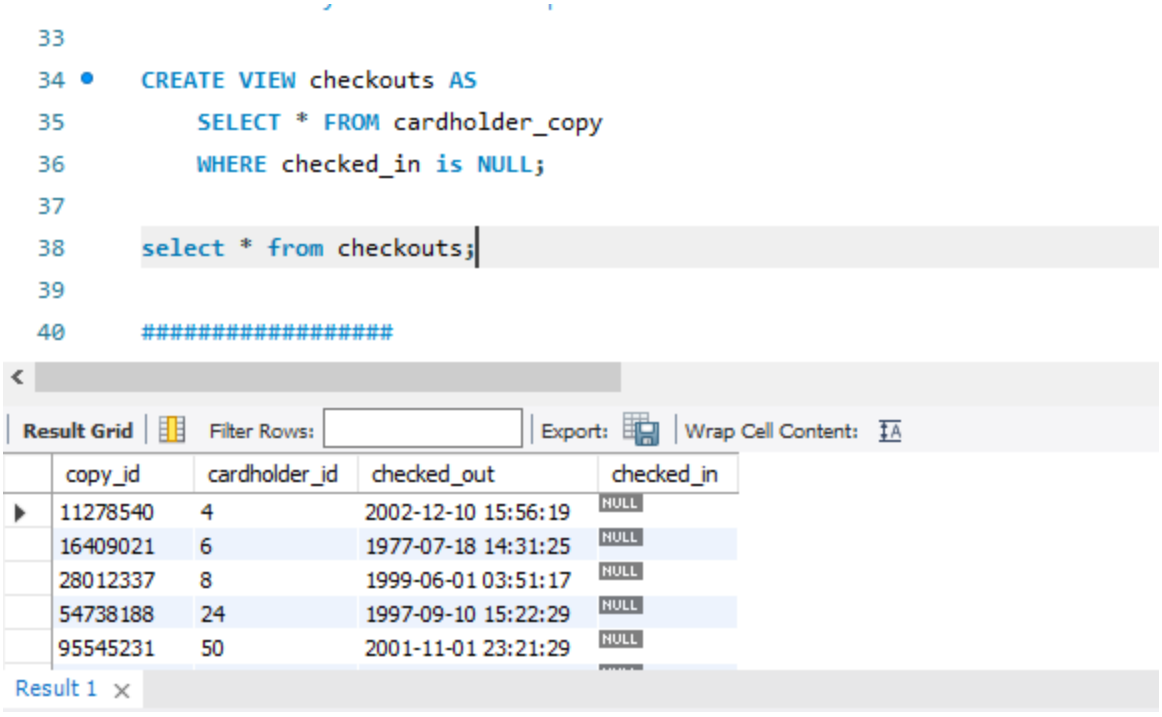
```
|      14 |     3872410 |
|      15 |    29848962 |
+---------+-------------+

loading data from mock-data/09-cardholder.csv into cardholder

// table too wide to fit, see output file for full version

loading data from mock-data/10-cardholder_phone.csv into cardholder_phone


+---------------+--------------+
| cardholder_id | phone_number |
+---------------+--------------+
|             0 | (769)507-6   |
|             0 | (952)879-0   |
|             2 | (806)781-7   |
|             2 | 488-853-96   |
|             4 | (842)371-6   |
|             4 | 643-730-28   |
|             5 | (717)353-8   |
|             5 | 296.369.23   |
|             6 | 114.581.61   |
|             6 | 210-125-40   |
|             7 | (177)109-4   |
|             7 | (839)056-4   |
|             8 | 421-473-56   |
|             8 | 533-116-99   |
|            11 | 1-469-262-   |
+---------------+--------------+

loading data from mock-data/11-book_cardholder.csv into book_cardholder


+---------------------+---------+---------------+-----------+
| timestamp           | book_id | cardholder_id | status    |
+---------------------+---------+---------------+-----------+
| 1970-02-19 09:00:58 |      38 |          4072 | pending   |
| 1970-03-06 20:09:28 |      20 |            50 | fulfilled |
| 1970-03-06 21:32:57 |       7 |            11 | cancelled |
| 1970-08-05 09:56:39 |      30 |           692 | cancelled |
| 1970-10-06 22:16:26 |      50 |         24718 | cancelled |
| 1971-11-23 06:11:12 |      23 |            56 | fulfilled |
| 1973-10-27 08:59:08 |      28 |           537 | pending   |
| 1973-12-25 06:48:38 |       5 |             7 | fulfilled |
| 1975-05-15 05:22:54 |       1 |             2 | fulfilled |
```

```
| 1976-09-19 04:19:37 |       9 |            15 | cancelled |
| 1977-06-17 23:42:31 |      13 |            25 | cancelled |
| 1979-12-29 10:51:08 |      32 |           992 | fulfilled |
| 1980-11-04 06:40:53 |       4 |             6 | fulfilled |
| 1984-02-07 20:31:44 |       8 |            12 | cancelled |
| 1984-06-21 04:44:53 |      44 |          8657 | fulfilled |
+---------------------+---------+---------------+-----------+

loading data from mock-data/12-branch.csv into branch

// table too wide to fit, see output file for full version

loading data from mock-data/13-copy.csv into copy


+----------+-----------+-----------+
| cid      | book_id   | branch_id |
+----------+-----------+-----------+
|  3811930 |       256 |        65 |
|  8874928 |    714417 |        11 |
| 11278540 |      5633 |        96 |
| 11758107 |  90071911 |   7253076 |
| 16409021 |         2 |        78 |
| 21227193 |  76460661 |        65 |
| 28012337 |  88021511 |     53172 |
| 28959398 |     18570 |        11 |
| 35683014 |     89495 |        11 |
| 41320555 |       343 |     28410 |
| 48676202 |     67165 |        11 |
| 54738188 | 930014220 |        78 |
| 67662260 |     10410 |     53172 |
| 70986019 |     70425 |   7253076 |
| 73256695 | 525914250 |     12617 |
+----------+-----------+-----------+

loading data from mock-data/14-cardholder_copy.csv into cardholder_copy

+----------+---------------+---------------------+---------------------+
| copy_id  | cardholder_id | checked_out         | checked_in          |
+----------+---------------+---------------------+---------------------+
|  3811930 |             0 | 2015-05-20 05:37:26 | 0000-00-00 00:00:00 |
|  8874928 |             2 | 2005-08-25 21:33:55 | 2009-12-27 05:51:45 |
| 11278540 |             4 | 2002-12-10 15:56:19 | 0000-00-00 00:00:00 |
| 11758107 |             5 | 2017-05-09 05:07:59 | 1985-01-27 12:44:21 |
| 16409021 |             6 | 1977-07-18 14:31:25 | 0000-00-00 00:00:00 |
| 21227193 |             7 | 1981-01-18 09:52:30 | 2005-09-13 08:33:49 |
```

```
| 28012337 |             8 | 1999-06-01 03:51:17 | 0000-00-00 00:00:00 |
| 28959398 |            11 | 1977-06-11 22:03:02 | 2013-05-13 04:12:53 |
| 35683014 |            12 | 1978-10-08 17:59:34 | 1999-09-08 04:31:41 |
| 41320555 |            15 | 2005-10-20 15:05:49 | 1976-11-17 13:33:41 |
| 48676202 |            20 | 1973-01-23 06:14:32 | 2003-07-10 04:37:20 |
| 54738188 |            24 | 1997-09-10 15:22:29 | 0000-00-00 00:00:00 |
| 67662260 |            25 | 2003-05-26 23:58:20 | 1990-04-18 09:46:06 |
| 70986019 |            27 | 1976-10-19 13:34:48 | 1971-02-28 07:46:20 |
| 73256695 |            28 | 1992-10-11 22:19:48 | 2017-01-25 22:39:29 |
+----------+---------------+---------------------+---------------------+
```

Views, stored procedures, & functions

Created a view to run a query on cardholder_copy that displays only copies which are checked out.



```
33
34 •  CREATE VIEW checkouts AS
35        SELECT * FROM cardholder_copy
36        WHERE checked_in is NULL;
37
38    select * from checkouts;
39
40    ##################
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

copy_id	cardholder_id	checked_out	checked_in
11278540	4	2002-12-10 15:56:19	NULL
16409021	6	1977-07-18 14:31:25	NULL
28012337	8	1999-06-01 03:51:17	NULL
54738188	24	1997-09-10 15:22:29	NULL
95545231	50	2001-11-01 23:21:29	NULL

Result 1

Created two stored procs. SelectBookByAuthorLastName polls a result set of any books in the catalog with the given varchar lastname. Check_in updates cardholder_copy.checked_in with the current system timestamp.

```
22
23 •  CALL SelectBookByAuthorLastName("Lebsack");
24
25    #Stored proc to check in a book and update its checked_ir
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

bid	isbn	title
0	308054068658	Voluptatem laudantium hic ut enim officia porro.

```
34
35 •  SELECT checked_in FROM cardholder_copy WHERE copy_id = 3811930;
36    #CALL Check_in(3811930,0);
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

checked_in
NULL

```
34
35 •  CALL Check_in(3811930,0);
36 •  SELECT checked_in FROM cardholder_copy WHERE copy_id = 3811930;
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

checked_in
2024-09-27 19:46:42

Created one function to calculate due dates by adding two weeks to a given cardholder_copy.checked_out datetime value.

```
54
55 •  SELECT cardholder_id, calculate_due_date(checked_out) AS due_dates FROM cardholder_copy WHERE checked
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

cardholder_id	due_dates
4	2002-12-24 15:56:19
6	1977-08-01 14:31:25
8	1999-06-15 03:51:17
24	1997-09-24 15:22:29
50	2001-11-15 23:21:29

Temporary tables, triggers, & indexes

Created 2 new Indexes on author.last_name and book.isbn. Assumes that these are going to be frequently accessed and having indexes here could have impact on the speed of queries. No applicable output for this one, but the sql code follows.

```
#Speed up lookup by author last name
CREATE INDEX a_lname ON author(last_name);

#Speed up lookup by ISBN
CREATE INDEX isbn ON book(isbn);
```

Created a trigger on cardholder_copy.checked_in, where, if an automated data population client attempts to insert an invalid datetime value of '0000-00-00 00:00:00' it will catch it and change that value to null before populating the DB itself No applicable output for this one, but the sql code follows.

```
DELIMITER //
CREATE TRIGGER verify_datetime
BEFORE INSERT ON chi_pub.cardholder_copy
FOR EACH ROW
IF new.checked_in < '0000-01-01 00:00:00' THEN SET new.checked_in = NULL;
END IF; //
```

Created a temporary table called copystatus, which runs a query to consolidate every single copy with its branch and current in/out status. This would: be better if it also calculated the hold status, and probably also be better as a view, but we need a temporary table for the assignment.

```
        THEN "out"
        WHEN checked_in IS NOT NULL
        THEN "in"
        END
        FROM cardholder_copy
        WHERE cid = copy_id
    )AS copy_status
    FROM copy
    WHERE cid IN (select copy_id from cardholder_copy);

select * from copystatus;
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

cid	book_id	branch_id	copy_status
3811930	256	65	out
8874928	714417	11	in
11278540	5633	96	out
11758107	90071911	7253076	in
16409021	2	78	out

copystatus 1