Topics Deep Dive: HotSpot devices & Income of Library

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Topic 01: SPL HotSpot, any information?

In the last week's section, I looked into which item has the most copies with query below:

```
#What items has most copies
select
    count(itemNumber) as copies,
    bibNumber
from spl_2016.inraw
group by bibNumber
order by copies desc;

select
    distinct(title),
    bibNumber
from spl_2016.inraw
where
    bibNumber in (
        '3030520',
        '3489506',
        '2469502'
    );
```

In which the SPL HotSpot is the second most one.

title	bibNumber
Into the wild	2469502
SPL HotSpot connecting Seattle	3030520
Headphones	3489506

Table 01: SPL_overview

What are SPL HotSpot Devices?

About SPL HotSpot

The SPL HotSpot is easy to use and gives you a wireless connection to the internet. Just turn it on, and you are ready to connect up to 15 devices. With the SPL HotSpot, you can use your laptop or tablet to do research on the internet, shop at your favorite website, download movies and music from the Library – and more.

- SPL HotSpot is a mobile device providing wireless connection.
    - You can use it for 21 days for free. Lose: Charge 90 USD
- Since HotSpot devices serve almost the same functionality, I want to find out if there's something different among these devices (Since it's the most popular one)

General Info of SPL HotSpot Devices

Using query below to check how many different types of attributes this devices have.

```
select
    distinct itemtype,
    collcode,
    title,
    callNumber
from spl_2016.inraw
where bibNumber = '3030520';
```

> Regex and Like operations are slow, since we know the exact bibNumber of the item, we can just search in this way.

itemtype	collcode	title	callNumber
aceq	nanf	SPL HotSpot connecting Seattle	Wifi Hotspot 2063864662
aceq	naref	SPL HotSpot connecting Seattle	Wifi Hotspot Placeholder
aceqnh	naref	SPL HotSpot connecting Seattle	Wifi Hotspot Placeholder
aceqnh	caref	SPL HotSpot connecting Seattle	SPL Hotspot
aceqnh	naref	SPL HotSpot connecting Seattle	SPL Hotspot
aceq	naref	SPL HotSpot connecting Seattle	SPL Hotspot
aceqnh	nanf	SPL HotSpot connecting Seattle	SPL Hotspot
aceq	nanf	SPL HotSpot connecting Seattle	SPL Hotspot
aceqnh	seorder	SPL HotSpot connecting Seattle	
areqnh	nanf	SPL HotSpot connecting Seattle	SPL Hotspot
aceqnh	nanf	SPL HotSpot connecting Seattle	SPL Hotspot 2020
aceq	canf	SPL HotSpot connecting Seattle	SPL Hotspot
areqnh	nanf	SPL HotSpot connecting Seattle	SPL Hotspot 2020
aceq	nanf	SPL HotSpot connecting Seattle	SPL Hotspot 2020
aceq	nanf	SPL HotSpot connecting Seattle	SPL Hotspot 2022
areqnh	nanf	SPL HotSpot connecting Seattle	SPL Hotspot 2022

Table 02: SPL_Types

There are 3 different kinds of item: areqnh, aceqnh, aceq.

From open data source, we can know that they are *Reference Equipment No Hold, Equipment No Hold, and normal Equipment.* https://data.seattle.gov/w/pbt3-ytbc/2myu-6xk5?cur=tlm8xU9wwlh

ItemType: What is No Hold?

Usually place a hold is to reserve a device in advance. No hold means this item is not available for online booking. The itemtype of “No hold” devices ends in “nh”. The more “No hold” devices, the more popular the item is.

How many of Hold and No Hold?

Query below is used to get the number of “hold” and “no hold” devices number by year.

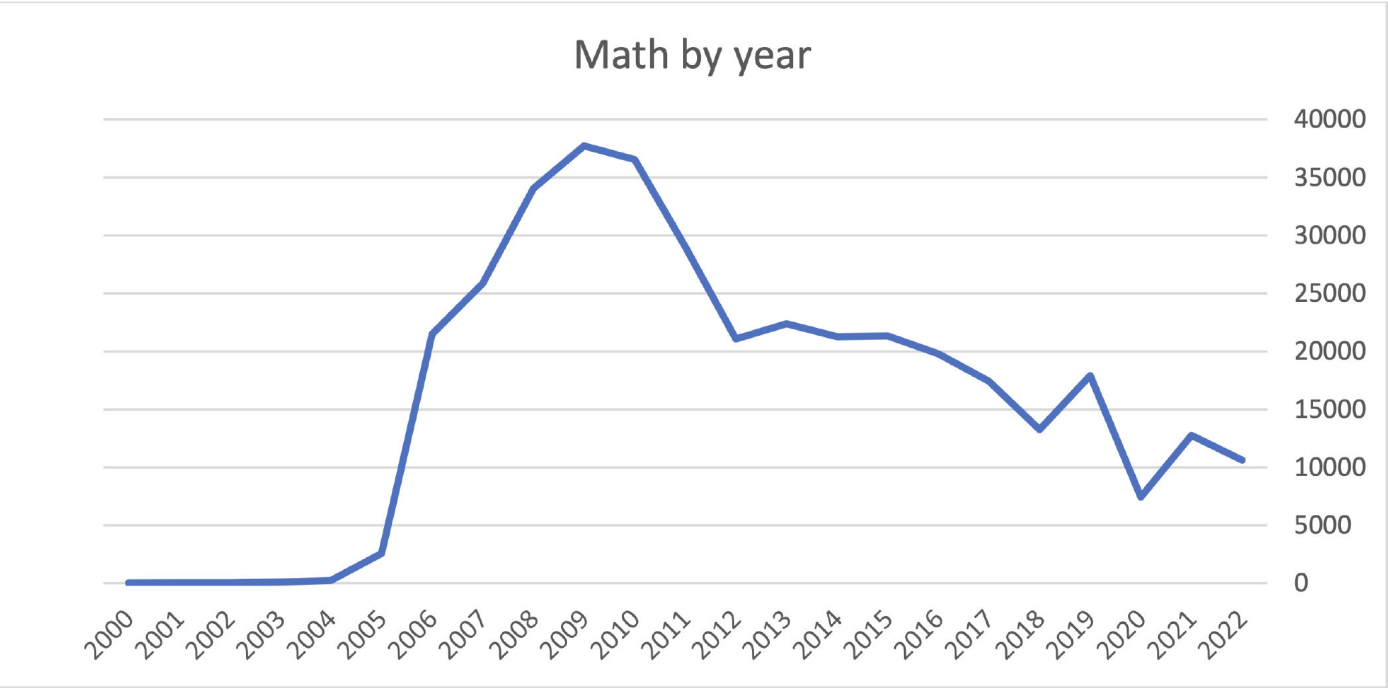
```
select
    count(itemNumber),
    substring(itemtype, 5, 2) as bigType,
    year(cout) as yr
from spl_2016.inraw
where bibNumber = '3030520'
group by bigType, yr;
```

count(itemNumber)	bigType	yr
32		1970
3		2014
1527		2015
4620		2016
3686		2017
3362		2018
4614		2019
1276		2020
5162		2021
3832		2022
2	nh	1970
2	nh	2014
283	nh	2015
1047	nh	2016
1048	nh	2017
1464	nh	2018
1515	nh	2019
1024	nh	2020
1590	nh	2021
1592	nh	2022

Table 03: Hotspot_devices_type

> Result Visualized:
>
> https://naoyuki.top/DataViz/hold/

The number of Not Hold Hotspot gradually increases, maybe due to its popularity. And 2019 there is a huge bump and 2020 there is a huge loss. The reason for 2020 is obvious, the pandemic. Compare this with Math book by year (By Nikiforov Assignment 01), I find that they follow a similar pattern, peak at 2019, down at 2020 and goes back at 2021.



- Why 2019 is the Peak?

> Possible Reason: Seattle Public Library sees positive changes after eliminating overdue fees - The Seattle Times
>
> https://www.seattletimes.com/seattle-news/seattle-public-library-sees-positive-changes-after-eliminating-overdue-fees/
>
> SPL had been considering the change since 2016. Several cities across the U.S. have reported a rise in borrowers and a decline in overdue items after adopting a no-late fee policy.

- SPL recovers so much than math books, it seems like people really needs these devices.

> https://www.spl.org/about-us/news-releases/library-loans-wi-fi-hot-spots-to-connect-communities-during-covid-19-crisis

Possible new devices model?

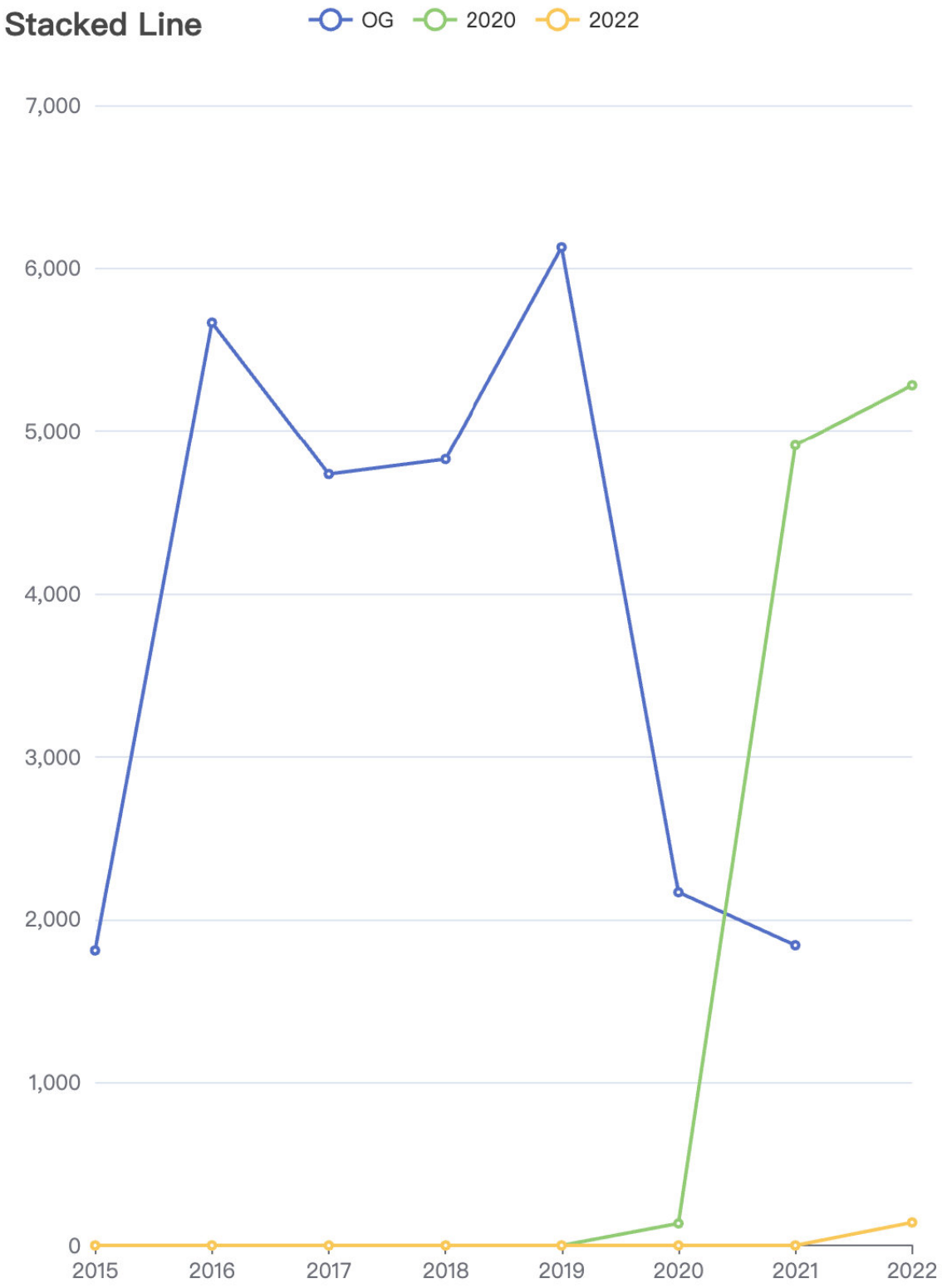
In callNumber part, some are labeled as 2020 and 2022. Assume callNumber indicates model information. I use below query to get the number of devices by their models.

```
select
    count(itemNumber),
    callNumber,
    year(cout) as yr
from spl_2016.inraw
where
    bibNumber = '3030520'
group by callNumber, yr;
```

count(itemNumber)	callNumber	yr
2		2015
23	SPL Hotspot	1970
1	SPL Hotspot	2014
1808	SPL Hotspot	2015
5667	SPL Hotspot	2016
4734	SPL Hotspot	2017
4826	SPL Hotspot	2018
6129	SPL Hotspot	2019
2165	SPL Hotspot	2020
1840	SPL Hotspot	2021
10	SPL Hotspot 2020	1970
135	SPL Hotspot 2020	2020
4912	SPL Hotspot 2020	2021
5283	SPL Hotspot 2020	2022
1	SPL Hotspot 2022	1970
141	SPL Hotspot 2022	2022
2	Wifi Hotspot 2063864662	2014
2	Wifi Hotspot Placeholder	2014

Table 04: models_over_years

> Result Visualized:
>
> https://naoyuki.top/DataViz/modelInfo



Before 2020, there is only original model. However, model 2020 sharply substitutes the original model in 2020 and 2021. The new model 2022 was just about to rise.

Topic 02: Late Return Income Change

In August 2019, there's no more overdue fees at SPL. Let's compare the income difference if we apply different policies.

- Before Aug 2019

Late fines vary by item:

- Late fines for most items are $.25 per day, for a maximum of $8 per item.
- Items borrowed via interlibrary or reference loan cost $1 per day overdue, up to a maximum of $15 per item.
- E-books and audiobooks you download expire automatically when they are due, with no late fines.

http://web.archive.org/web/20190502005120/https://www.spl.org/using-the-library/manage-your-account/payments/fees-and-lost-materials

- New Policy:

How much will I be charged if I return something late or lose an item?

We do not charge daily late fines, so there are no charges for any item you return late, once you return it. When an item is 31 days overdue we consider it lost and charge you for the replacement cost. If the item is then found and returned within one year of payment of fee, we will reimburse this fee.

- Since it's hard to know the replacement cost of all items, let's just focus on the popular ones.

Recall that the most popular items are:

	title varchar(255)	bibNumber int
1	Into the wild	2469502
2	SPL HotSpot connectir	3030520
3	Headphones	3489506

I'll focus on the first one as the replacement cost is hard to estimate.

- The replacement cost, Assume it would be 6 dollars for Into the wild, and 3 weeks of borrow duration.

Before Aug 2019:

Below function is used to calculate the fine:

```
#custom function to calculate fine #Access denied
CREATE FUNCTION CALCFINE(DATES INT) RETURNS FLOAT BEGIN
    DECLARE ret_Val INT;
    SET ret_Val = 0;
    set ret_Val = 0.25*DATES;
    if (ret_Val > 8) THEN set ret_Val = 8;
    end if;
    RETURN ret_Val;
END;
```

However, due to security reasons, doing so will get “Access Denied” in return.

Alternative way to calculate late return fee is:

```
select
    title,
    SUM(Res.Fine) as totalFine
from (
        SELECT
            title,
            DATEDIFF(cin, cout) AS DateDiff,
            least(0.25 * (DATEDIFF(cin, cout)-21), 8) AS Fine
        FROM spl_2016.inraw
        WHERE
            bibNumber = '2469502'
            and cout > '2005-01-01'
            and DATEDIFF(cin, cout) > 21
    ) as Res
group by title;
```

The result is shown as below, which is around 16806 dollars for a single book.

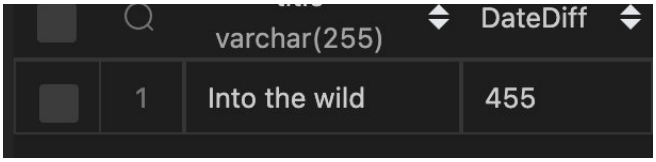
	title varchar(255)	totalFine
1	Into the wild	16806.50

After Aug, 2019

As for now, we may only consider those borrowed more than 1 year, in which the library will assume you lost the item and after 1 year even it's found, the fee is non-refundable.

Query below is used to find how many persons overdue their borrow by 1 year.

```sql
SELECT
    title,
    DATEDIFF(cin, cout) AS DateDiff
FROM spl_2016.inraw
WHERE
    bibNumber = '2469502'
    and cout > '2005-01-01'
    and DATEDIFF(cin, cout) > 21 + 365;
```



Only one person have to pay the replacement fee, which is 5.99 dollars. What a difference. Actually 210 of them will first pay 5.99 and then get the refund back, only one person can't get 5.99 bucks back.

As we might see, there is a huge difference of income for this single item (2800 times), which is astonishing. In practice, such policy lower the chances of late return and book loss, which may reduces the labor cost of handling such situations.