Computer use at the public library

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Monte Carlo simulation
IS 597 PR Fall 2020

Project purpose & background

- The COVID-19 pandemic cast a bright spotlight on digital inequality
- Goal: Explore public library computer utilization
- My background: Digital inclusion practitioner
- Co-enrolled in: Evaluation & assessment of library services

Open data

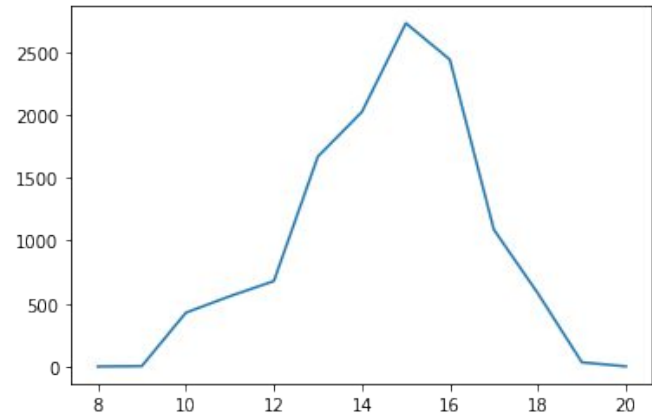# Analysis of open data: Seattle Public Library

The City of Seattle provides circulation records for all materials, including laptops, checked out from all locations of the Seattle Public Library.

What is the distribution of laptop usage by hour?
- ~70% of checkouts were between 1-5 p.m.

How many patrons use laptops per day?
- In 2019, the mean was 36 checkouts/day.

Laptop checkouts by hour, 2016-2020

Analysis of open data: Chicago Public Library

The City of Chicago provides the number of desktop computer sessions per month, per library location, as well as the number of computers available at each location.

How many computer sessions are there per month?
- Over last 4 years, big branches logged 16,000-28,000 sessions/month.
- Overall, computer use has decreased year over year.

* Seattle Public Library measures laptop use; Chicago Public Library measures desktop use. Library science studies show that patrons prefer different devices for different purposes (Summey and Gutiérrez, 2012 and Feldmann, Wess, and Moothard, 2008). For this simulation, they are treated the same.

Harold Washington Library Center

To focus my study, I looked at the Harold Washington Library Center (HWLC), the central library within the Chicago Public Library system, located in downtown Chicago.

There are currently 153 desktops available to use at HWLC.

At right: HWLC monthly desktop use by year
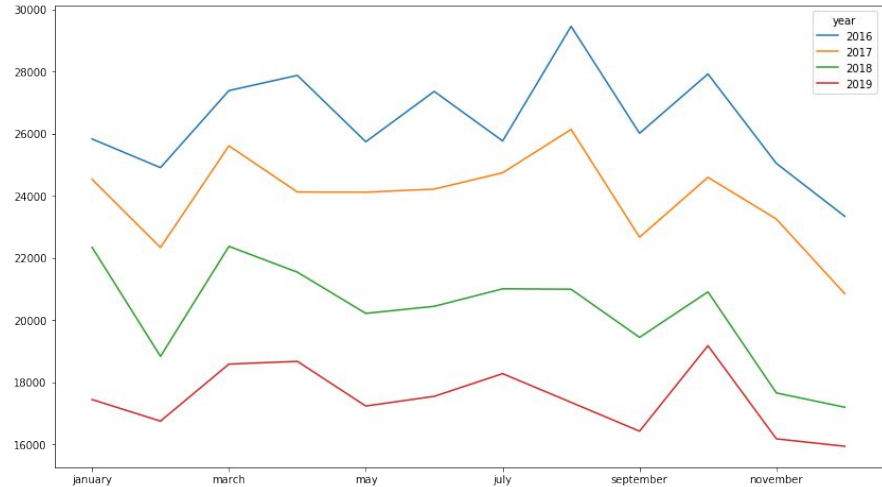
Hypothesis

The fewer public computers a library offers, the lower the service cost--and quality. The more public computers a library offers, the more sessions patrons will log and the higher the cost of the service, but eventually, the number of computers would exceed demand, decreasing utilization rates. Somewhere along this spectrum, there is an optimal computer "fleet" size for public libraries, which balances service quality and cost.

What is the optimal number of computers?

Parameter: Size of computer fleet

Cost measures:
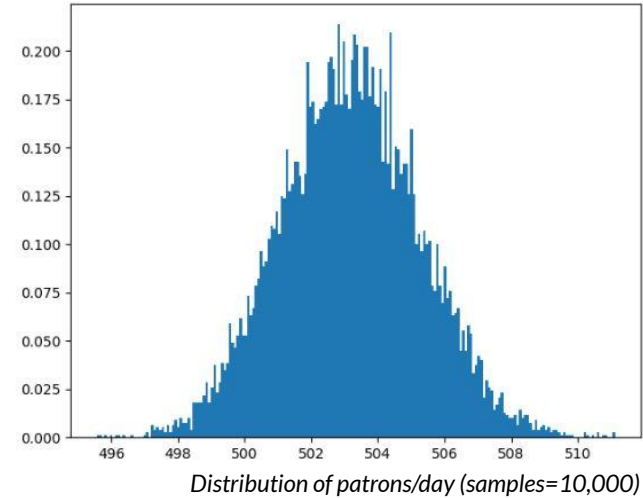- Device acquisition and maintenance
- Device utilization rates

Service quality measures:
- Number of people who waited for a computer
- How long patrons waited for a computer
- Number of people who departed the library because the wait was too long

Model design
& limitations

Probabilistic aspects of model

- **Number of computers functioning/available per day**
  - PERT distribution based on laptop failure rates
- **Number of patrons per day**
  - Beta distribution based on CPL data
- **Distribution of patrons per hour**
  - Weighted by SPL data
- **Computer reservation length: 15 or 60 minutes**
  - Options per Chicago Public Library policy
  - Weighted 30/70 based on practitioner knowledge
- **Patron willingness to wait for an open computer**
  - Randomly distributed between 15 to 90 minutes

Distribution of patrons/day (samples=10,000)

Design choices
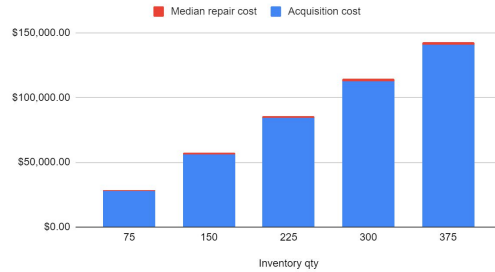
Reasoning

|		
1	Treat all days of the week and months of the year equally. In simulating prices, ignore bulk pricing.	For simplicity. Ideally, the model would account for the ebb and flow of patron traffic by day of week and by month, as well as IT asset pricing by volume.
2	Open hours at the library: Substitute 10 operating hours every day for HWLC's real (and variable) operating hours.	So that I can match my model to the by-hour distribution of utilization in the Seattle Public Library dataset.
3	Use *sessions per month* as substitute for *sessions* per day as a substitute for *patrons* per day! And, using *historical number of sessions* as a substitute for *patron demand*.	These are all proxy measures, but that's all the data we have.
4	Intentionally decrease the probable range of sessions per day relative to open data from 2019.	Based on assumption that I am modeling post-COVID computer use in 2021, and that a year-over-year decrease in sessions will continue.
5	Ignore complexity surrounding patrons making multiple reservations or arriving just before closing time.	For simplicity. While patrons do arrive near closing time, and likely use free computers for whatever time remains, the model assumes one 15 or 60-min use.

Initial results & recommendations

- As with many utilization simulations, the analysis of model results is ultimately subjective.
- Decisions made based on this data will be relative to external factors such as a budget cap or a given library manager's interpretation of service quality measures.
- However, this model suggests that, given a library with a volume of patron visits similar to Harold Washington Library Center, an optimal fleet size is likely not far off from their own 153!
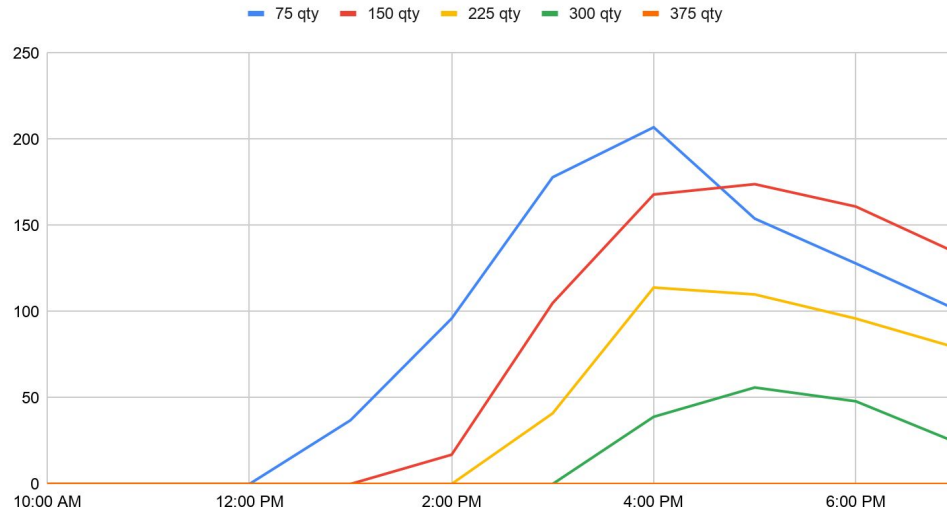
Median utilization

75 qty 150 qty 225 qty 300 qty 375 qty

Device acquisition and maintenance costs

Median repair cost Acquisition cost

Inventory qty
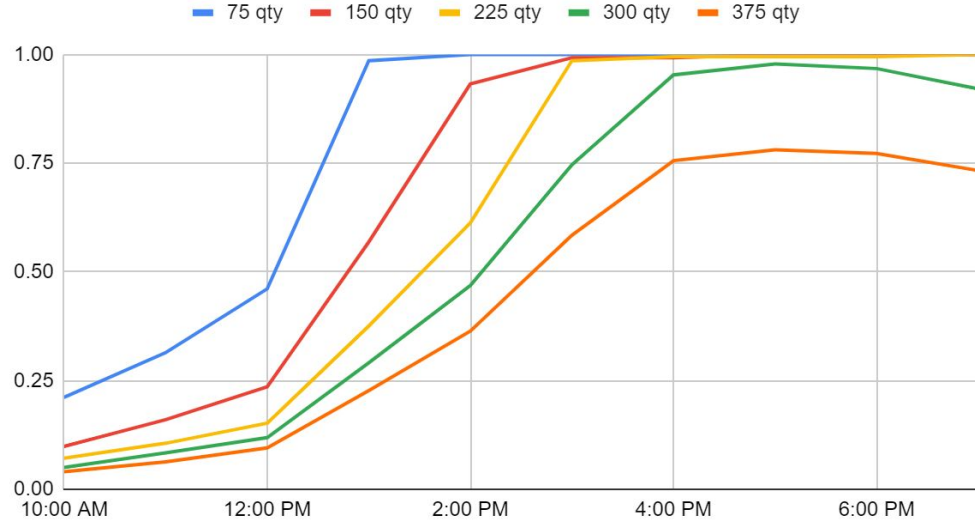
Total cost & utilization by hour, fleet size
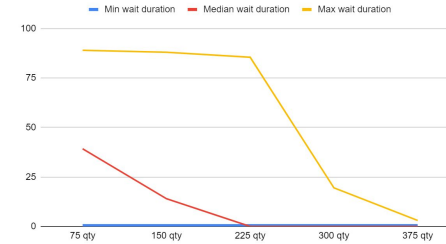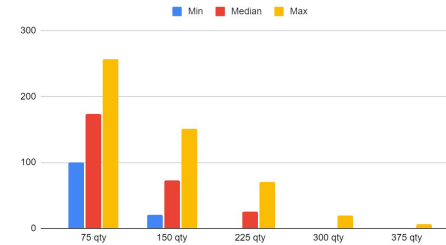
Patrons waiting, wait times & departures

Future improvements

Russian-language computer class at Rockwood Public Library in Portland, Oregon

- Reach out to Chicago Public Library for access to more detailed data, especially daily counts of patron sessions.
- Determine a more complex repair cost assessment and mean time between failures to calculate technical costs.
- Consider how other factors such as program marketing, evolving patron preference for desktops vs. laptops, or the impact of COVID-19 on patron perceptions of public computing, may affect the results.
- Investigate multi-processes/threads to decrease runtime.

Thank you

View the code: https://github.com/sararasmussn/saralr2_2020Fall_project

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