

# IE332 Project Assignment Phase #3

We certify that the submitted work does not violate any academic misconduct rules, and that it is solely our own work. By listing our names and student IDs we acknowledge that any misconduct will result in appropriate consequences. Moreover, we have **read and understood the assignment instructions**.

*“As a Boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue.”*

Group 4: Find My Warehouse

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Date: 5 December 2018

## Links and Account Information

### Group Account Login

- Group 4 Login: g1090425
- Group 4 Password: S7LyWCRb

### Database Login

- Group 4 Login: g1090425
- Group 4 Password: group4332

### Example User Account Login 1:

- User Login: PBruce@organization.org
- Password: \$CyV!&xep

### Example User Account Login 2:

- User Login: RRosario@email.com
- Password: zJhN%LCmQTbAera

### URLs:

- Main Page - [http://web.ics.purdue.edu/~g1090425/mypage/main\\_page.php](http://web.ics.purdue.edu/~g1090425/mypage/main_page.php)
- Filtering Inputs Page - [http://web.ics.purdue.edu/~g1090425/mypage/filtering\\_inputs.php](http://web.ics.purdue.edu/~g1090425/mypage/filtering_inputs.php)
- Scheduling Algorithm Page - [http://web.ics.purdue.edu/~g1090425/mypage/scheduling\\_algorithm.php](http://web.ics.purdue.edu/~g1090425/mypage/scheduling_algorithm.php)
- About Us Page - [http://web.ics.purdue.edu/~g1090425/mypage/about\\_team\\_page.php](http://web.ics.purdue.edu/~g1090425/mypage/about_team_page.php)
- Contact Us Page - [http://web.ics.purdue.edu/~g1090425/mypage/contact\\_us.php](http://web.ics.purdue.edu/~g1090425/mypage/contact_us.php)
- Analytics Page - <http://web.ics.purdue.edu/~g1090425/mypage/analytics.php>
- Login Page - [http://web.ics.purdue.edu/~g1090425/mypage/log\\_in.php](http://web.ics.purdue.edu/~g1090425/mypage/log_in.php)
- Sign Up Page - [http://web.ics.purdue.edu/~g1090425/mypage/create\\_account.php](http://web.ics.purdue.edu/~g1090425/mypage/create_account.php)
- Warehouse Details Page - [http://web.ics.purdue.edu/~g1090425/mypage/warehouse\\_details.php](http://web.ics.purdue.edu/~g1090425/mypage/warehouse_details.php)
- Login Request Page - [http://web.ics.purdue.edu/~g1090425/mypage/log\\_in\\_request.php](http://web.ics.purdue.edu/~g1090425/mypage/log_in_request.php)
- Request a Lease Page - <http://web.ics.purdue.edu/~g1090425/mypage/contracts.php>
- Owner Portal Page - [http://web.ics.purdue.edu/~g1090425/mypage/owner\\_portal.php](http://web.ics.purdue.edu/~g1090425/mypage/owner_portal.php)
- User Directory Page - [http://web.ics.purdue.edu/~g1090425/mypage/user\\_directory.php](http://web.ics.purdue.edu/~g1090425/mypage/user_directory.php)
- New Warehouse Page - [http://web.ics.purdue.edu/~g1090425/mypage/new\\_warehouse\\_form.php](http://web.ics.purdue.edu/~g1090425/mypage/new_warehouse_form.php)
- Ratings Page - <http://web.ics.purdue.edu/~g1090425/mypage/ratings.php>
- Payment Page - [http://web.ics.purdue.edu/~g1090425/mypage/payment\\_page.php](http://web.ics.purdue.edu/~g1090425/mypage/payment_page.php)

- User's Warehouse Page - [http://web.ics.purdue.edu/~g1090425/mypage/your\\_warehouses.php](http://web.ics.purdue.edu/~g1090425/mypage/your_warehouses.php)
- Pending Contracts Page - [http://web.ics.purdue.edu/~g1090425/mypage/pending\\_contracts.php](http://web.ics.purdue.edu/~g1090425/mypage/pending_contracts.php)
- Update Profile Page - [http://web.ics.purdue.edu/~g1090425/mypage/update\\_profile.php](http://web.ics.purdue.edu/~g1090425/mypage/update_profile.php)
- Delete Account Page - [http://web.ics.purdue.edu/~g1090425/mypage/delete\\_account\\_form.php](http://web.ics.purdue.edu/~g1090425/mypage/delete_account_form.php)

## Possible Bonus Points

- Use of Latex for final report
- Machine learning used to develop the Check Price feature
- Pie chart on Analytics page of website made in Shiny

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# 1 Introduction

Approximately 30% of all warehouse space goes unused in the U.S. [1] This is a serious economical issue, and our company has found a solution. At Find My Warehouse, our mission is to provide a platform that allows customers to easily and efficiently find storage space, while allowing warehouse owners to profit off underutilized warehouses. As a response to the growing trend of peer-to-peer resource sharing and underutilized warehouse space in the U.S. Find My Warehouse has developed a web-based system to facilitate warehouse sharing. Our solution includes a search system that ranks available warehouses based on user-specified parameters and a user-friendly portal that allows both owners and lessees to view their active contracts and add or search for new warehouses.

## 2 Solution Quality

### 2.i Assumptions

- **A nationwide presence** from the start of our company would benefit a broader market of users faster than a niche market, creating a larger return. For this reason, we decided to open our application to all warehouses nationwide, rather than focusing in on select cities.
- **Peer-to-peer economies** are most effective when modeled to be more reliant on user input and less reliant on corporate input. Thus, our solution is rooted in user's freedom from corporate parameters, whether they are an owner or lessee. For example, we do not require owners to list a minimum amount of space or require a minimum contract length. [2]
- **Most important factors for the user** are zipcode, start date of lease, and end date of lease. We decided on these primary filters because a customer will only create a contract if the warehouse is in an area that they desire with the corresponding availability. After these initial filters, the user is redirected to a filtered list of warehouses with the opportunity to refine their results even more.

### 2.ii Why Our Solution is Effective

We believe our solution is excellent and sets itself apart from similar applications because of emphasis on the following areas:

#### *Accessibility for More Users*

- **Partial rental system** allows lessees to rent a portion of the total space available in a warehouse without a minimum space or time obligation.
- **No membership cost** or additional fees to users.
- **Broad location coverage** as existing warehouses being leased through our system are well-distributed amongst the 9 major regions of the United States, with the exception of the East South Central and New England regions which are smaller regions by area. (Figure 1)

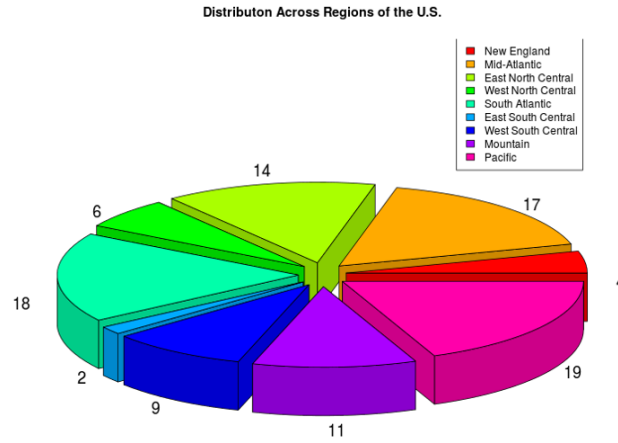


Figure 1: Distribution Across Regions of the U.S.

#### *Connecting Warehouse Owners to Lessees*

- **Comprehensive user portal** collects all contract information and links to user actions in one place.
- **Detailed rating system** gives insights to user qualities and warehouse conditions so users can make informed decisions before accepting contracts.

#### *Streamlining the Rental Process*

- **Pending contracts page** facilitates ease of contract acceptance.
- **Double verification of pending contracts** allows the owner to change the price from a warehouse's initial listing before a user accepts to reflect changes in market conditions.
- **Universal contract terms** provided to minimize legal fees.

#### *Forecasting Successful Decisions*

- **A check price feature**, when adding a new warehouse, uses a classification model based on past warehouse data to predict the popularity of a warehouse and give an expert prediction on warehouse popularity with the current listing price. This feature was developed with machine learning.

### 3 Important Factors of User Portal

The user portal contains features that allow users to interact with information about their contracts, including:

- **A table of active contracts** (Figure 3) to view their respective information, including dates of the contract and rental price.
- **Lessee or Owner ID button** directs to contact information for the other user involved in the contract.
- **Warehouse ID button** directs the user to relevant information about warehouses they are connected with, including location and ratings.
- **Complete contract ratings here button** allows users to rate other users involved in the contract on their professionalism and to rate warehouses they have rented on their physical condition.
- **Directory button** allows a user to search for another user.
- **Pending contracts button** shows users when the other party involved in their contract has requested a new or updated contract. Once both parties hit accept, changes can no longer be made.
- **Lease a new warehouse button** directs the user to the warehouse directory where they can search for a new warehouse and request a lease with our Advanced Warehouse Search Feature. (Figure 2) A scheduling algorithm allows warehouse utilization to be maximized, as users can share warehouses. The search results are optimized using a simple, yet effective ranking algorithm which is detailed in Appendix B.
- **Add a new warehouse button** allows warehouse owners to add new facilities to our system and includes a price forecasting button to predict warehouse popularity based on listed price.
- **Fedex tracking** for users to track shipments to and from warehouses.
- **Administrative tabs** allow a user to update personal information or delete their account.

Zip Code:  
47906

Start Date:  
12/05/2018

End Date:  
03/20/2019

Types of Storage:

- ☒ Pallet Racking
- ☐ Shelving
- ☐ Mobile Shelving
- ☐ Multi-Tier Racking
- ☐ Mezzanine Flooring

Lower Price Bound (/SF/Mo):  
0.40

Higher Price Bound (/SF/Mo):  
2.50

Entire Warehouse:  
☐ Entire Warehouse

Lower Space Bound (SF):  
200

Higher Space Bound (SF):  
500

Year Built:  
2018

Lower Bound Owner Rating:  
3

Lower Bound Warehouse Rating:  
3

Submit

Figure 2: Warehouse Search Feature



Welcome, DJ Pauly B!

Access Our Directory

Add New Warehouse

Lease New Warehouse

Check out your warehouses

See if you have any pending contracts

Update personal information

Delete your account

Log Out

Contracts where you are a lessee:

Contract ID	Owner ID	Warehouse ID	Start Date	End Date	Space Rented	Rental Price	Ratings	Amount Paid
0000000002	0000000209	0000002302	2020-02-12	2020-09-03	6460	1.06	<a href="#">Complete Contract Ratings Here</a>	46563.69 <a href="#">Click here to pay.</a>

Contract ID	Owner ID	Warehouse ID	Start Date	End Date	Space Rented	Rental Price	Ratings	Amount Paid
0000001050	0000000244	0000002310	2018-12-19	2019-03-22	20000	0.46	<a href="#">Complete Contract Ratings Here</a>	28520.00 <a href="#">Click here to pay.</a>

Contracts where you are an owner:

Contract ID	Lessee ID	Warehouse ID	Start Date	End Date	Space Rented	Rental Price	Ratings
0000001058	0000000326	0000002874	2018-12-28	2019-04-12	1000	0.69	<a href="#">Complete Contract Ratings Here</a>

Contract ID	Lessee ID	Warehouse ID	Start Date	End Date	Space Rented	Rental Price	Ratings
0000001061	0000001000	0000002874	2021-02-11	2021-08-12	1000	0.79	<a href="#">Complete Contract Ratings Here</a>

Enter FedEx Tracking Number:

Track!

Figure 3: User Portal

## 4 Analytics

The analytics dashboard provides the users an overview of the company’s performance with data analytics. This plot shows that the number of contracts or transactions has an upward trend throughout the years indicating profitability. This proves the investment and industry potential of our service.

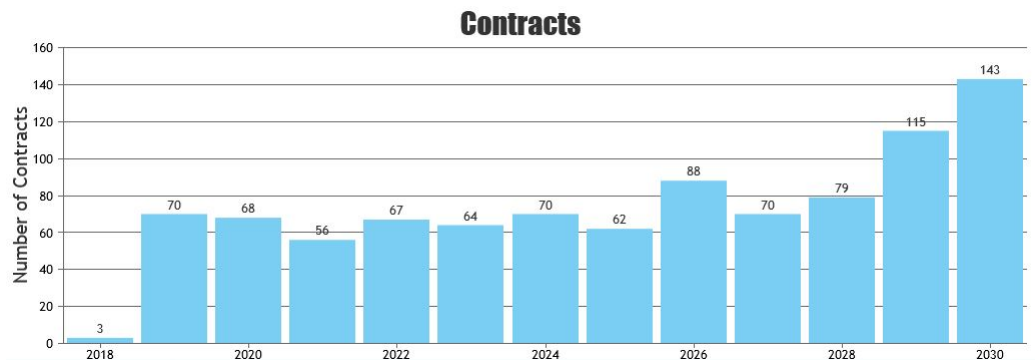


Figure 4: Contracts Over Time

The plot indicates that the business reached a peak in user interest in the early stage. Eventually, the number of new users sign-ups become stable and reach its optimized state starting around 2021. Growth in contracts over time with a more stagnant user-base suggests existing users consider our service to be effective and reliable.

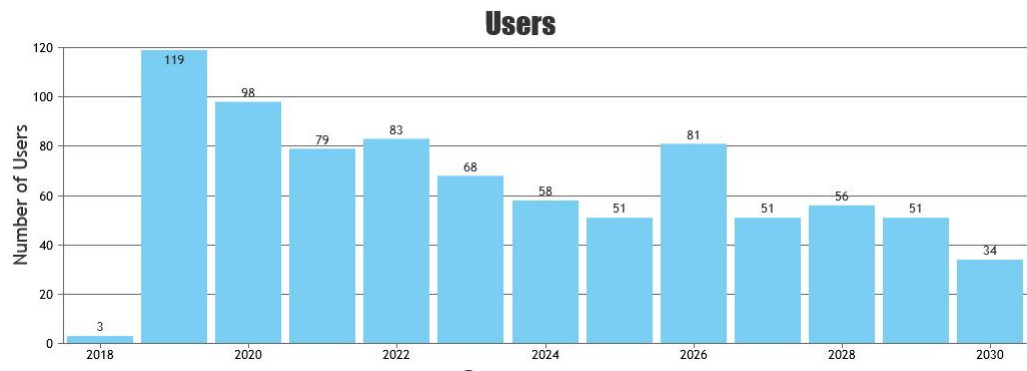


Figure 5: Users Over Time

## 5 Business Model

### 5.i Allocation on Investment

- Through our market research and tentative plan for distribution of funds, we estimate a need of \$400,000 from our investors to be allocated over two years.
- **Developmental costs (50%)** encompass compensation for our employees who will maintain the upkeep of our front end and back end.
- **Advertising costs (25%)** will include either using Facebook's or Google's platform to increase our outreach in hopes of growing our user base.
- **Office space costs (6%)** will include expanding to a functional building with amenities for our employees.
- **Server costs (5%)** are based off of utilizing 2 servers with all equipment that will host our website with ample room for expansion as our user base increases.
- **Administrative costs (14%)** will include legal expenses that we incur over the years.

### 5.ii Return on Investment

- With our current platform, we estimate a 119% return on investment over a time period of 12 years.
- We plan on decreasing the payback period by increasing our profits through two methods: ad hosting and offering a membership plan.
- We plan on selling ad space on our website that other companies can use to increase their outreach. This will reduce our payback period since we expect an increase of the number of clicks on our website which ultimately increases our ad revenue.
- We plan on implementing an optional membership plan which includes more analytical data and features for a flat rate month to month. This will be beneficial for our users who utilize our website very frequently which we expect will decrease our payback period.

## 6 Conclusion

With the storage industry booming, there has never been a better time for Find My Warehouse. Not only does this website solve economic problems, but it creates a great opportunity for investors and warehouse owners to both profit off of the solution. We use a combination of our technological advances as well as the popularity of the sharing economy to give our customers the best storage solution possible. At Find My Warehouse, we aim to provide the best short term warehouse storage solution in the U.S.

## 7 References

1. Warehouse Exchange To Match Customers & Storage PYMNTS.com [Internet]. PYMNTS.com. 2018 [cited 3 December 2018]. Available from: <https://www.pymnts.com/matchmakers/2017/warehouse-space-matches-customers-with-unused-storage-spaces/>
2. Uenlue D. 14 vital elements of Sharing Economy Business Model [Internet]. Innovation Tactics. 2018 [cited 3 December 2018]. Available from: <https://www.innovationtactics.com/sharing-economy-business-model/>
3. Commercial Property Rental Agreement [Internet]. Printablecontracts.com. 2018 [cited November 2018]. Available from: [https://www.printablecontracts.com/Commercial\\_Property\\_Rental\\_Agreement.php](https://www.printablecontracts.com/Commercial_Property_Rental_Agreement.php)
4. LoopNet: Commercial Real Estate For Sale and Lease [Internet]. Loopnet.com. 2018 [cited October 2018]. Available from: <https://www.loopnet.com/>
5. The Conference - Free Conference Website Template 2018 - Colorlib [Internet]. Colorlib. 2018 [cited November 2018]. Available from: <https://colorlib.com/wp/template/the-conference/>

## Appendix A: Database Design

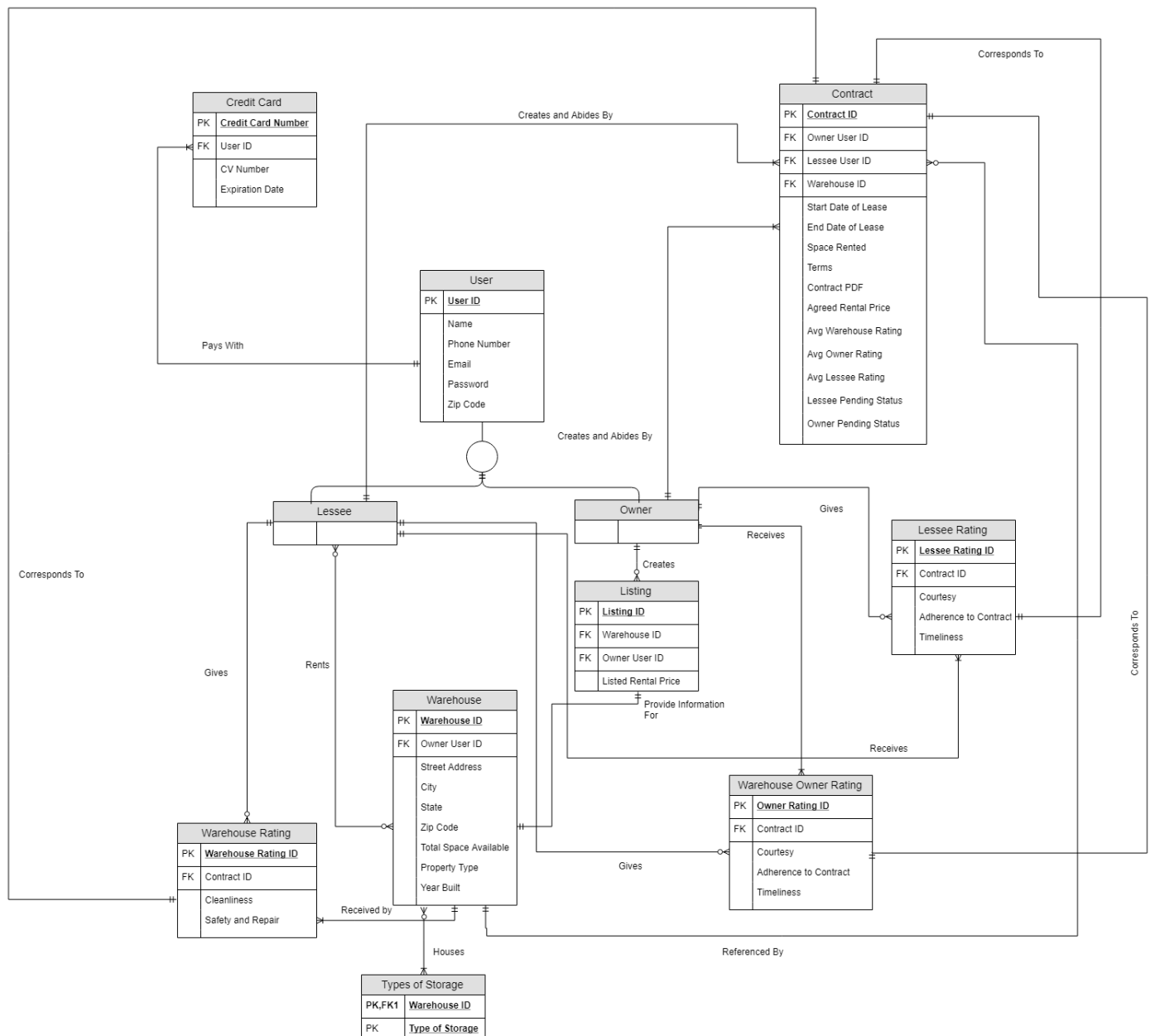


Figure 6: ER Diagram

## Appendix B: Ranking Algorithm

Ranking Value for Warehouse =

$$\begin{aligned} &4 * |\text{Listed Rental Price of Warehouse} - \text{User Specified Upper Price Bound}| + \\ &3 * |\text{Space Available for Rent in Warehouse} - \text{User Specified Lower Space Bound}| + \\ &2 * |\text{Average Rating for Warehouse} - \text{User Specified Minimum Warehouse Rating}| + \\ &2 * |\text{Average Rating for Owner} - \text{User Specified Minimum Owner Rating}| + \\ &1 * |\text{Year Built of Warehouse} - \text{User Specified Lower Year Bound}| \end{aligned}$$

The warehouses are then sorted in ascending order of ranking value, as we want to minimize the ranking values. This is so that the user gets the cheapest warehouse, the most spacious, the highest rated, and the newest warehouse. We chose the above weights for the equation because we believe that price is the most important to a lessee, followed by space available, then by rating of warehouses and owners, and finally by how old the warehouse is. We chose this specific format of the equation because multiplication, absolute value, subtraction, and addition are very elementary operations for a computer to perform. This allows the run-time of our algorithm to be very small, providing the user very quick results.

### Reference:

Ranking algorithm found in file: adv.R

Lines: 222 - 256

## Appendix C: Synthetic Data Generation

### **Pseudocode:**

Randomly generate N user inputs for each Lessee using probabilities that an input will be chosen

Randomly generate values for each user input

Send a query to receive warehouse information for warehouses matching user specifications

If contracts exist for the warehouse, check for overlapping in dates between the contract and the user specifications

If there is overlap, calculate space left in warehouse and check it meets the user specifications

If  $\text{length}(\text{Warehouses}) > 0$ , calculate ranking value based on ranking algorithm for each warehouse

Sort warehouses in ascending order of ranking value

Store first warehouse in sorted list and its attributes in a contract

### **Method:**

We modeled the terms in the contract after a sample leasing contract found online [3]. We found the warehouse addresses, potential lease terms, and potential space requirements from warehouse leasing websites, specifically LoopNet [4].

Using this information, we were able to create lower and upper bounds for our random generation of values. The scheduling algorithm deals with overlapping requirements for space. The scheduling algorithm allows users to share warehouse space in order to maximize owner profits and meet lessee time requirements.

### **Reference:**

Synthetic data generation found in file: Scheduling and Ranking.R

Lines: 230 -273