



Littlefield Brewery

By BeerBoyz (ESA Team 16)

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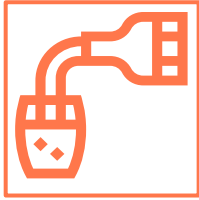
Tan Heng Kiat Noel 1004136

Haohong Xin 1005152

Video



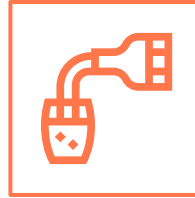
System Inputs



Customer Demand

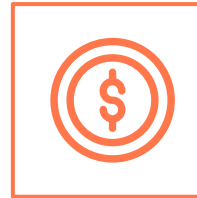
The system will randomly generate customer demand

Outputs



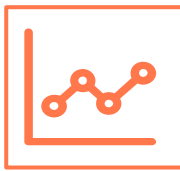
Demand Lost

Number of Customers Lost



Profit (used for leaderboard)

Overall Revenue from Beers -
Operating and Material Costs
+ interest accrued



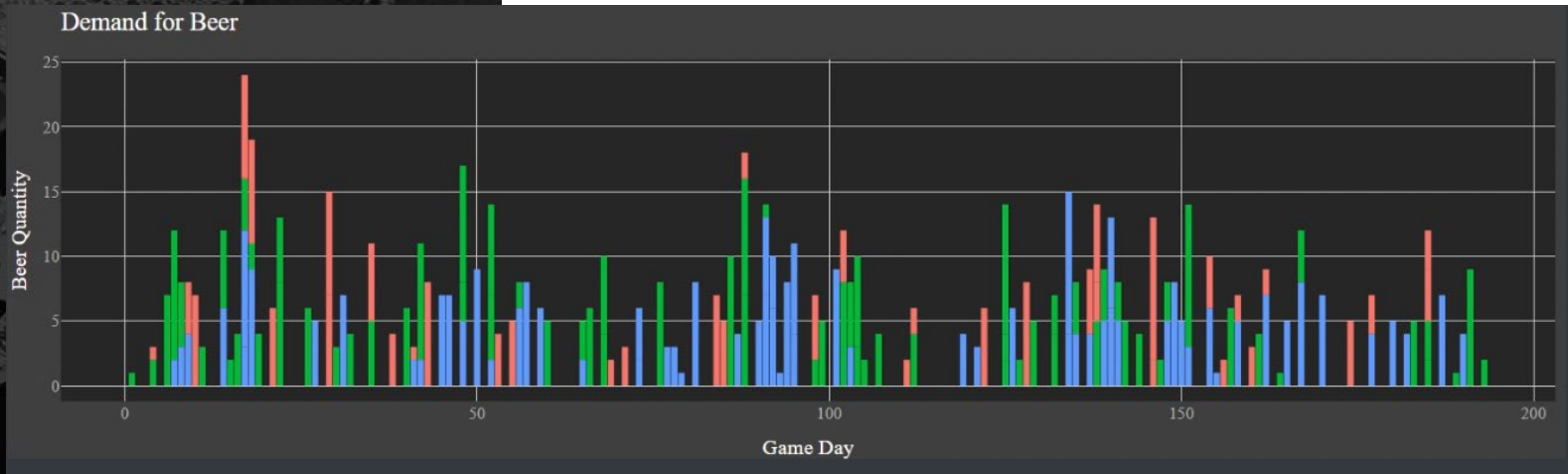
Demand Generation

Customer j demand for Beer i
modelled as Normal Distribution

$$X_{ij} \sim N(D_{ij}, \sigma_{ij}^2)$$

Notation

- D_{ij} : Customer j 's average demand for Beer i
- σ_{ij} : Customer j 's standard deviation in demand for Beer i
- X_{ij} : Random Variable representing customer j 's demand for beer i



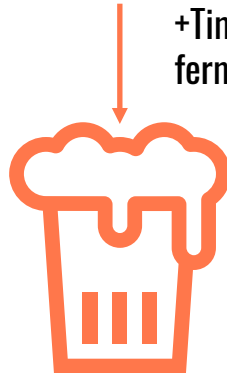
Recap... How does a Brewery work?

Take the Raw Materials



Water + Malt + Hops + Yeast

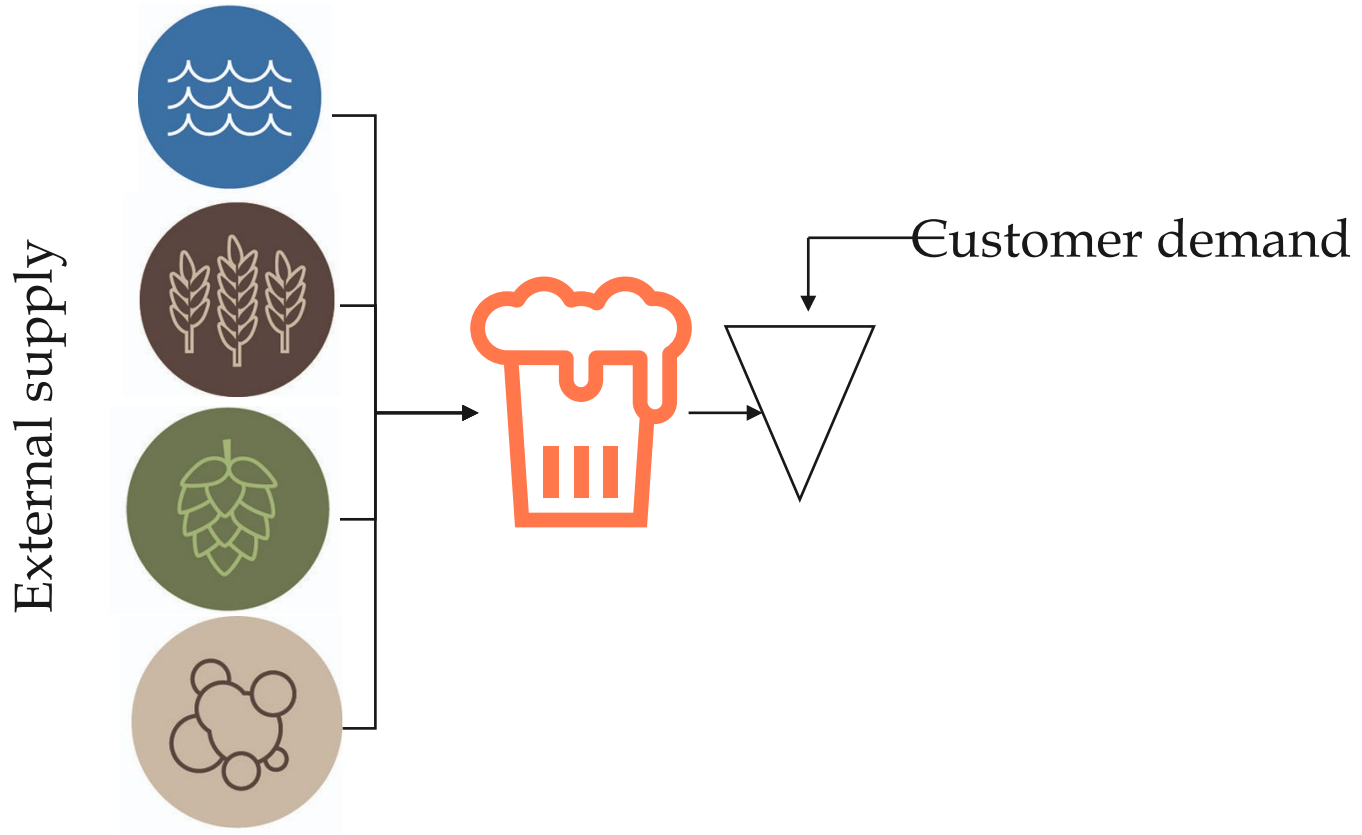
+Time in a
fermentation tank



A Fresh Glass of Beer! 😊



Material Requirement Planning (MRP)





(Q,r) Model

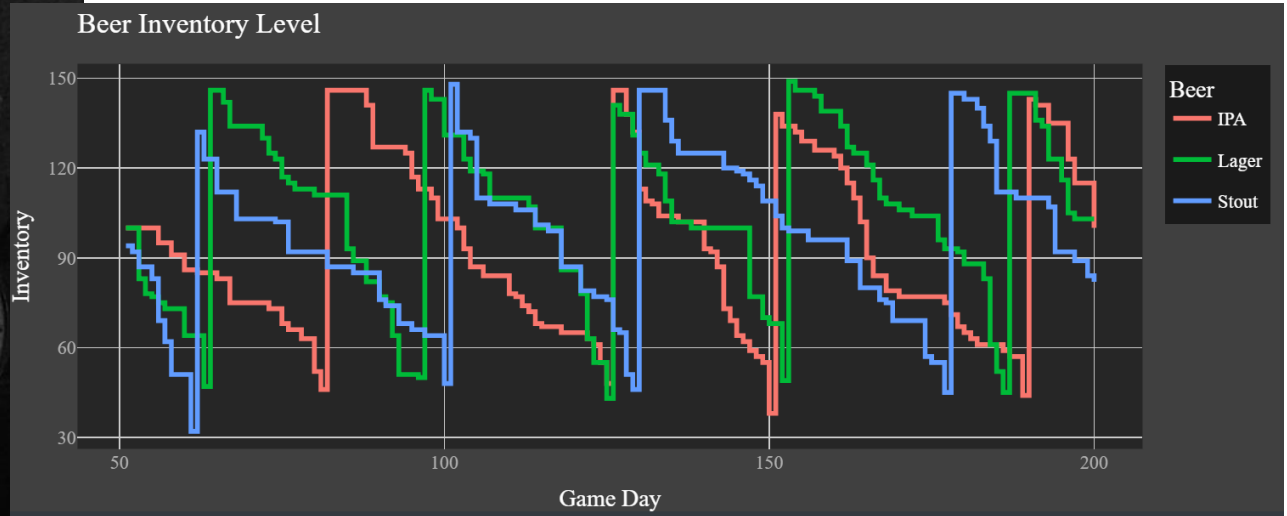
Manage

- Reorder Quantity
- Reorder Point



Achieve

- Maximize Profit
- Manage Inventory



A dark, artistic photograph of a drink preparation scene. It features a brush with white bristles, two glasses filled with a dark liquid and white foam, and a metal strainer with a circular head and a handle. The background is dark and textured, with some small white particles scattered around.

Possible Improvement for MSO Concept

We can learn from the game

- Materials Requirements Planning (MRP)
- (Q, r) Model concepts

We could also add

- Inclusion of queuing analysis as well!

Concept Combination



**Materials
Requirements
Planning**

**Automation
& (Q, r)
models**



**Fun &
Complex Game!**





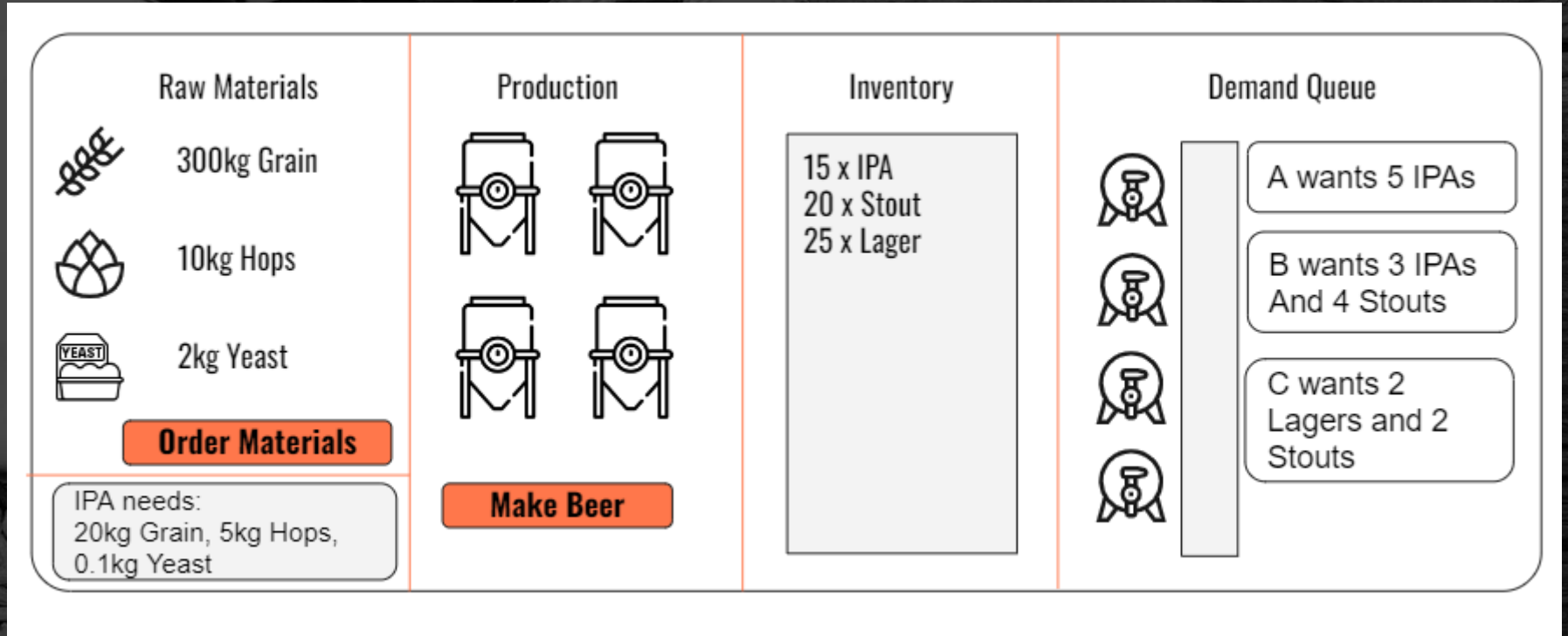
■ *MSO Problem Statement* ■

*“How might we **optimize** our **efficiency** of making the beer while **minimizing** our cost and **maximizing** customer satisfaction?”*



Frontend UI

Frontend UI: Initial Prototype



Week 8 & 9- Further Organisation

The Brewery Game

Reset Game

Advance: Next Day

Money

\$ 1e+05

Day

1

Lost Sales

0 Customers Lost

name	lostQty
IPA	0.00
Lager	0.00
Stout	0.00

Raw Materials

name	qty
Malt	550.00
Hops	100.00
Yeast	5.00

Beer Inventory

name	qty
IPA	100
Lager	100
Stout	100

Material Orders

Purchase

Material	Quantity	Days	Supplier
----------	----------	------	----------

Brewery Tanks


Brew

Tank	Beer	DaysInTank
1	Empty	NA
2	Empty	NA
3	Empty	NA
4	Empty	NA


Customer Demand


Customer	Beer	Quantity	Day	actualDay
Tapout	Lager	1.00	0.00	0.01


Week 10- Using Bs4Dash

The Brewery Game



Save Water, Drink Beer!


 User Info

 Main Page

 Analysis Page

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 Logout

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Reset Game

Cash Balance: \$ 1e+05

Days: 1

Advance: Next Day

Raw Materials

name	qty
Malt	1500
Hops	100
Yeast	5

Beer Inventory

name	qty
IPA	100
Lager	100
Stout	100

Lost Sales

0 Customers Lost

name	lostQty
IPA	0.00
Lager	0.00
Stout	0.00

Material Orders

Purchase

Material	Quantity	Days	Supplier
----------	----------	------	----------

Brewery Tanks


Brew

Tank	Beer	DaysInTank
1	Empty	NA
2	Empty	NA
3	Empty	NA
4	Empty	NA

Customer Demand

Customer	Beer	Quantity	Day
Locality	IPA	2.00	0.00
Freebird	Lager	3.00	0.00
almost famous	Stout	8.00	0.00

Dark Mode 😊

 The Brewery Game

Save Water, Drink Beer!

User Info

Main Page

Analysis Page

Reset Game

Cash Balance: \$ 1e+05

Days: 1

Advance: Next Day

Raw Materials

name	qty
Malt	1500
Hops	100
Yeast	5

Beer Inventory

name	qty
IPA	100
Lager	100
Stout	100

Lost Sales

0 Customers Lost

name	lostQty
IPA	0.00
Lager	0.00
Stout	0.00

Material Orders

Purchase

Material	Quantity	Days	Supplier
----------	----------	------	----------

Brewery Tanks


Brew


Tank	Beer	DaysInTank
1	Empty	NA
2	Empty	NA
3	Empty	NA
4	Empty	NA






Customer Demand

Customer	Beer	Quantity	Day
Locality	IPA	2.00	0.00
Freebird	Lager	3.00	0.00
almost famous	Stout	8.00	0.00


Week 11: Styling


The Brewery Game




Divad Nojnarg

Save Water, Drink Beer!

User Info

Main Page

Analysis Page

Reset Game

\$ 1e+05
Cash Balance

1
Day

Advance: Next Day

PURCHASE

Raw Material Inventory

Material	Quantity
Malt	1500
Hops	100
Yeast	5

BREW

Beer Inventory

Beer	Quantity
IPA	100
Lager	100
Stout	100

0
Customers Lost

Lost Sales By Beer

Beer	Quantity
IPA	0.00
Lager	0.00
Stout	0.00

Material Orders

Material	Quantity	Days	Supplier
----------	----------	------	----------


Brewery Tanks

Tank	Beer	DaysInTank
1	Empty	NA
2	Empty	NA
3	Empty	NA
4	Empty	NA


Customer Demand


Customer	Beer	Quantity	Day
Tapout	IPA	2.00	0.00
almost famous	IPA	12.00	0.00
Tapout	Lager	2.00	0.00


Week 12: Organisation of Actions


The Brewery Game

Save Water, Drink Beer!





 User Info

 Main Page


 Analysis Page

 Leaderboard


☰ Littlefield Brewery

 CS   

51
Day



\$ 1e+05
Cash Balance



Total Customer Lost
Lost By Beer

0 Customers Lost

0/3
Beer Actions Taken

Advance: Next Day

Advance N days
10

Advance: 10 Days

Inventory

AllMaterialBeer

Raw Materials

Material	Quantity
Malt	1500
Hops	100
Yeast	5

Beers

Beer	Quantity
IPA	100
Lager	100
Stout	100

Actions

Purchase MaterialBrew BeerServe CustomersAutomate

Choose a Material

Malt

Supplier	Order Cost	Unit Cost	Lead Time
Crisp	50	1	14

Choose a Supplier

Crisp

Enter a Quantity to Purchase

0





Please enter a valid value

Confirm Purchase

Progress Tracker

Material OrdersTanksTotal Demand

Auto Storage

Tank	Beer	Days In Tank
	Empty	NA
	Empty	NA
	Empty	NA
	Empty	NA



Backend

Manual Feature 1: Purchase Material

Inventory

All Material Beer

Material	Quantity
Hops	175.00
Malt	400.00
Yeast	23.00



Actions

Purchase Material

Brew Beer

Serve Customers

Automate

Choose a Material

Malt

Supplier Order Cost Unit Cost Lead Time

Crisp 50 1 14

Choose a Supplier

Crisp

Enter a Quantity to Purchase

100

Cost: 150

Confirm Purchase



Progress Tracker

Material Orders

Tanks

Total Demand

Material	Quantity	Days Left	Supplier
Malt	100	14	Crisp
Hops	50	14	Yakima Hops
Yeast	500	14	White Labs

Manual Feature 2: Brew Beer

Inventory

All Material Beer

Beer	Quantity
IPA	100
Lager	100
Stout	100

Actions

Purchase Material

Brew Beer

Serve Customers

Automate

Brew a Beer

Choose a Tank

2

Choose a Beer

Stout

Required Amounts: 550 Malt, 10 Hops, 1 Yeast.

Brew Beer

Progress Tracker

Material Orders

Tanks

Total Demand

Auto Storage

Tank	Beer	Days In Tank
	IPA	0
	Stout	0
	Empty	NA
	Empty	NA



Progress Tracker

Material Orders

Tanks

Total Demand

Auto Storage

	IPA	14	
	Stout	14	



Inventory

All Material Beer

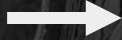
Beer	Quantity
IPA	200.00
Lager	100.00
Stout	200.00

Manual Feature 3: Serving Customer

Inventory

All Material Beer

Beer	Quantity
IPA	200.00
Lager	100.00
Stout	200.00



Actions

Purchase Material Brew Beer **Serve Customers** Automate

☐ Auto Serve

Customer	Beer	Qty	Wait Time	
Tapout	IPA	3	10	<div><div></div></div> Serve
Tapout	Lager	2	8	<div><div></div></div> Serve
Tapout	Stout	3	7	<div><div></div></div> Serve
Tapout	IPA	2	5	<div><div></div></div> Serve
Good Intentions	Lager	6	5	<div><div></div></div> Serve
Freebird	Stout	2	5	<div><div></div></div> Serve
Tapout	Stout	1	4	<div><div></div></div> Serve
Freebird	Lager	5	3	<div><div></div></div> Serve



Inventory

All Material Beer

Beer	Quantity
IPA	193.00
Lager	85.00
Stout	188.00

Additional Feature- Automation

- Reorder Quantity and Reorder Point for the Raw Materials used
- Brewing of beer to be automated once the inventory drops below the
- Rebrew Point
- Storage of beer
- Serving of customers

Actions

Purchase Material

Brew Beer

Serve Customers

Automate

☐ Automate All

☐ Auto Material Order

☐ Auto Brewing

☐ Auto Serve Customers

☐ Auto Store Beer

Material	Reorder Quantity	Reorder Point
Malt	<div>Choose a Supplier</div>	<div>Submit</div>
	<div>0</div>	<div>0</div>
Hops	<div>Choose a Supplier</div>	<div>Submit</div>
	<div>0</div>	<div>0</div>
Yeast	<div>Choose a Supplier</div>	<div>Submit</div>
	<div>0</div>	<div>0</div>

Beer	Rebrew Point	
IPA	<div>0</div>	<div>Submit</div>
Lager	<div>0</div>	<div>Submit</div>
Stout	<div>0</div>	<div>Submit</div>

Additional Feature- Automation

- Brings out the usefulness of the (Q, r) model concept
- Combines the Materials Assembly nature of brewing beer with the (Q, r) model

Actions

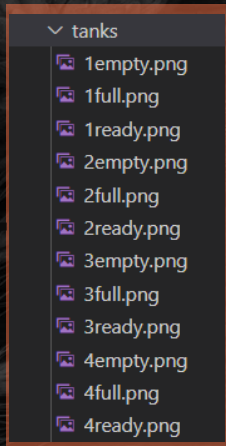
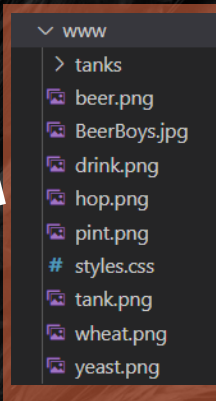
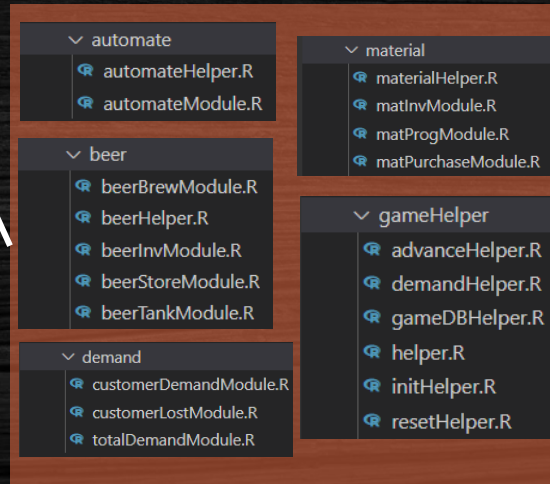
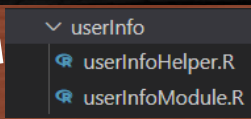
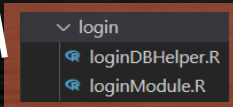
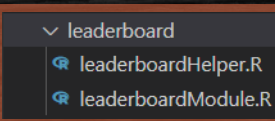
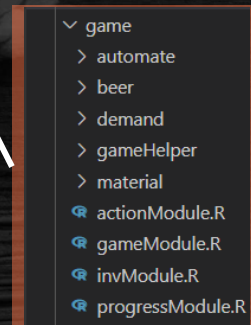
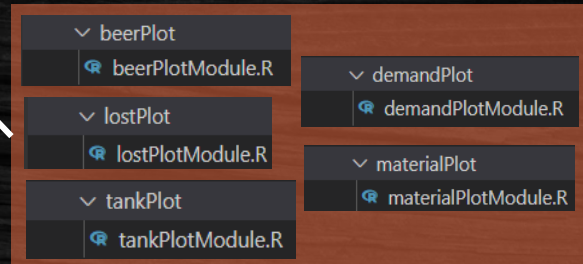
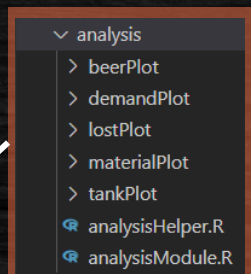
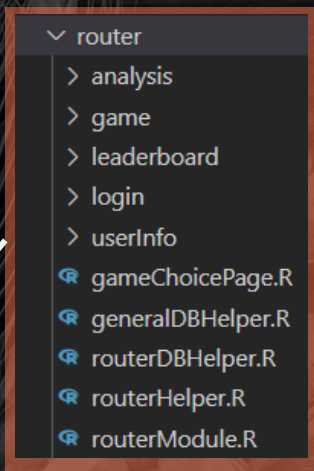
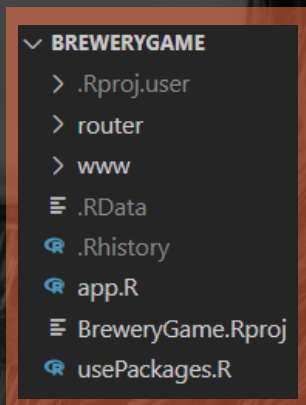
[Purchase Material](#)[Brew Beer](#)[Serve Customers](#)[Automate](#)☐ Automate All☐ Auto Material Order☐ Auto Brewing☐ Auto Serve Customers☐ Auto Store Beer

Material	Reorder Quantity	Reorder Point
Malt	<div>Choose a Supplier</div>	<div>Submit</div>
	<div>0</div>	<div>0</div>
Hops	<div>Choose a Supplier</div>	<div>Submit</div>
	<div>0</div>	<div>0</div>
Yeast	<div>Choose a Supplier</div>	<div>Submit</div>
	<div>0</div>	<div>0</div>


Beer	Rebrew Point	
IPA	<div>0</div>	<div>Submit</div>
Lager	<div>0</div>	<div>Submit</div>
Stout	<div>0</div>	<div>Submit</div>

Code Organisation


Powered by Shiny Modules





Module and Modules...


The Brewery Game

Save Water, Drink Beer!





 User Info

 Main Page


 Analysis Page

 Leaderboard


≡ Littlefield Brewery

 CS   

51
Day



\$ 1e+05
Cash Balance



Total Customer Lost
0 Customers Lost

Lost By Beer

0/3
Beer Actions Taken

Advance: Next Day

Advance N days
10

Advance: 10 Days

Inventory

AllMaterialBeer

Raw Materials

Material	Quantity
Malt	1500
Hops	100
Yeast	5

Beers

Beer	Quantity
IPA	100
Lager	100
Stout	100

Actions

Purchase MaterialBrew BeerServe CustomersAutomate

Choose a Material

Malt

Supplier	Order Cost	Unit Cost	Lead Time
Crisp	50	1	14

Choose a Supplier

Crisp

Enter a Quantity to Purchase

0





Please enter a valid value

Confirm Purchase

Progress Tracker

Material OrdersTanksTotal Demand

Auto Storage

Tank	Beer	Days In Tank
	Empty	NA
	Empty	NA
	Empty	NA
	Empty	NA

Database Design



Possibilities of Improvement

- Have different **game difficulties**
- **Play/Pause** game, **time-based** game
- Additional functions to prevent **SQL injections**: Only protected the password

Conclusion

- What we set out to do **may not occur** in the end
- **Don't be fixated** on the initial plan



Thank You