Workshop on “Teaching Supply Chain Mgmt. via Games”

Hunger Chain

Mummy bird only has one worm, whom to give it to?

Flora PARK

A Supply Chain Contracts and Collaboration Simulation

Hunger Chain - A Competitive Supply Chain Simulation

Dr. Yao Zhao

Professor in Supply Chain Management

Rutgers Business School

Joint work w/ Ju Myung Song, Arim Park and Minseok Kim

Agenda

- Why Hunger Chain?
- Learning objectives
- Teaching plan
- Feedback
- Let’s play

Mummy bird only has one worm, whom to give it to?

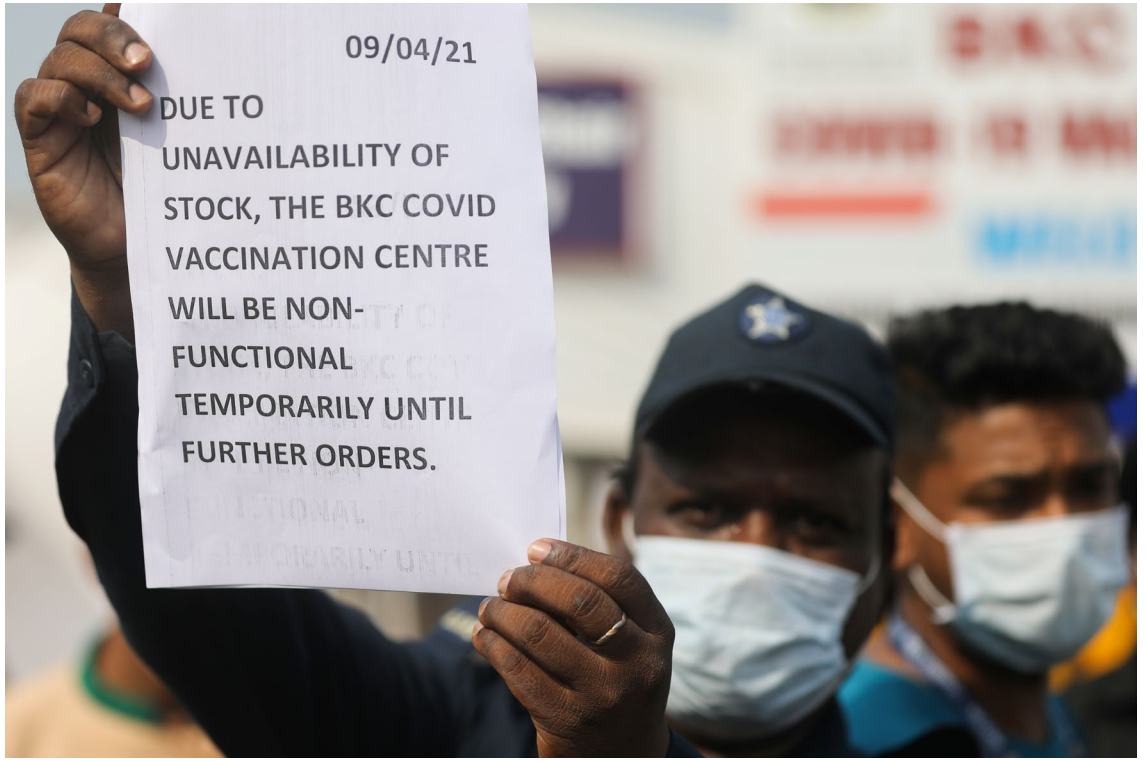
Why Hunger Chain?

Severe COVID-19 Shortage

Panic orders

Hoarding

Waste Despite Shortage



Millions of Covid-19 vaccine doses were wasted even as shortages plague other parts of the world*

*The Guardian, 2021, Oct 16.

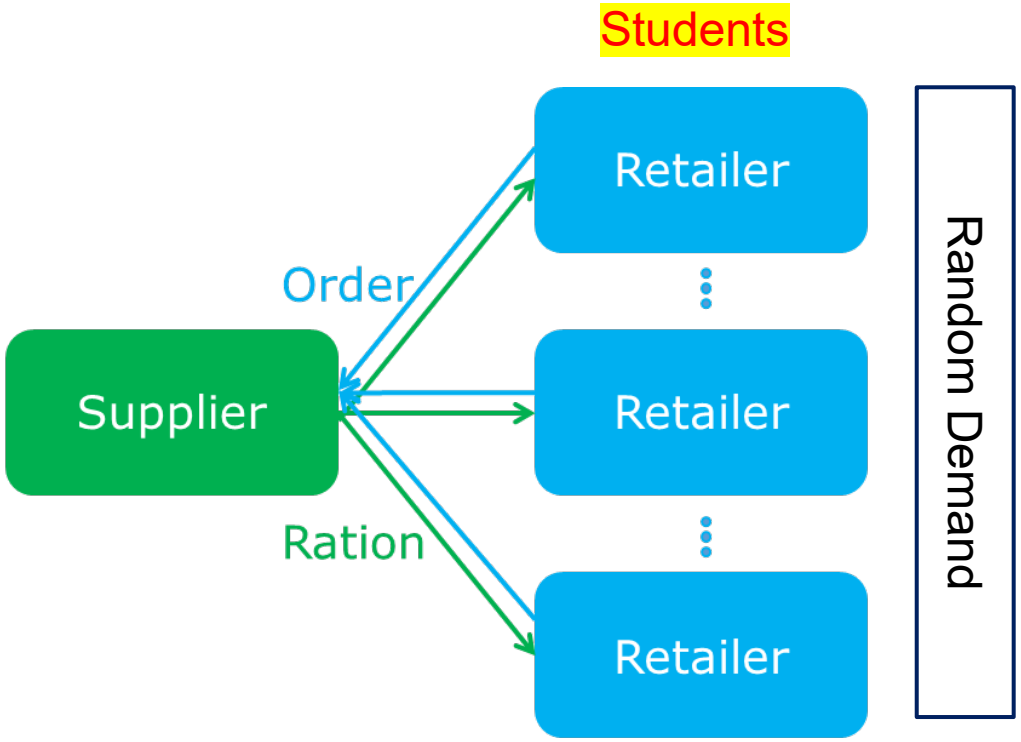
Teaching Challenges

- Hard to lecture Shortage Gaming, Competition, Prisoner’s Dilemma, but easy to play out.
- Students are easily distracted but can be engaged in games.

Learning Objectives

Shortage Gaming (Panic Order, Hoarding), Competition, Rationing

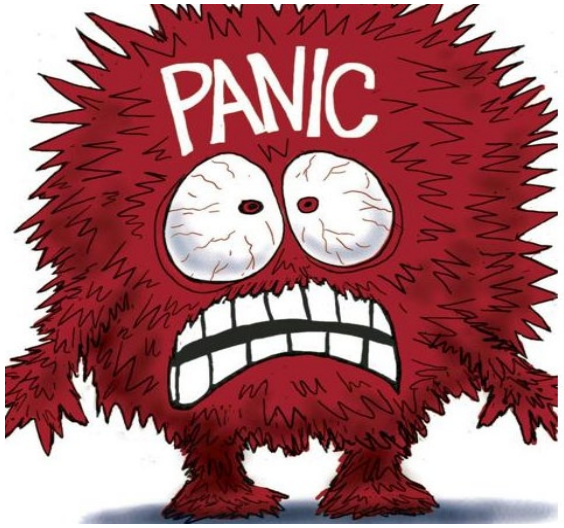
Mummy bird only has one worm, whom to give it to?



Supply is limited, how to allocate efficiently and fairly?

Supply Chain Under Shortage might suffer…

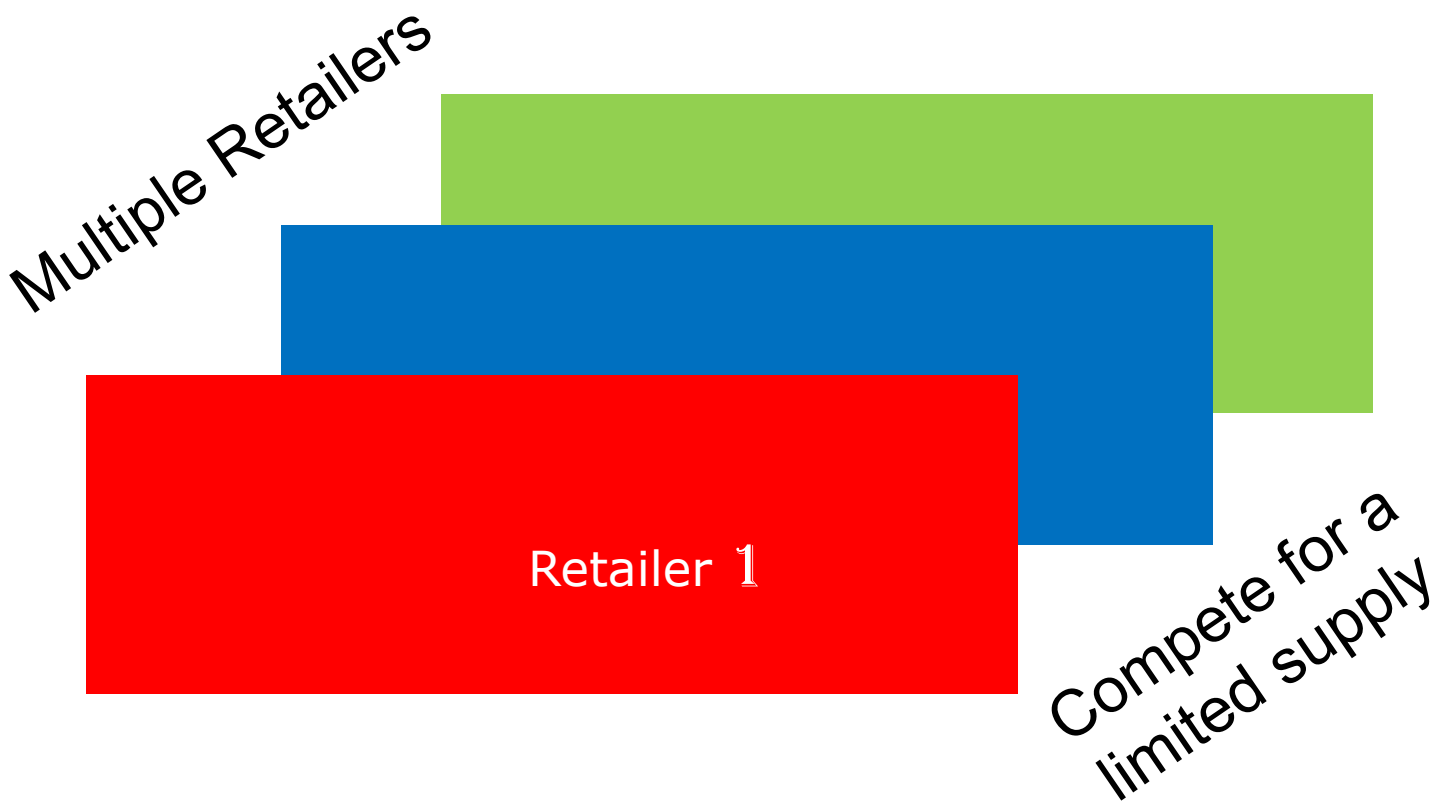
Panic Orders



Hoarding

Wrong Allocation

A Competitive Environment

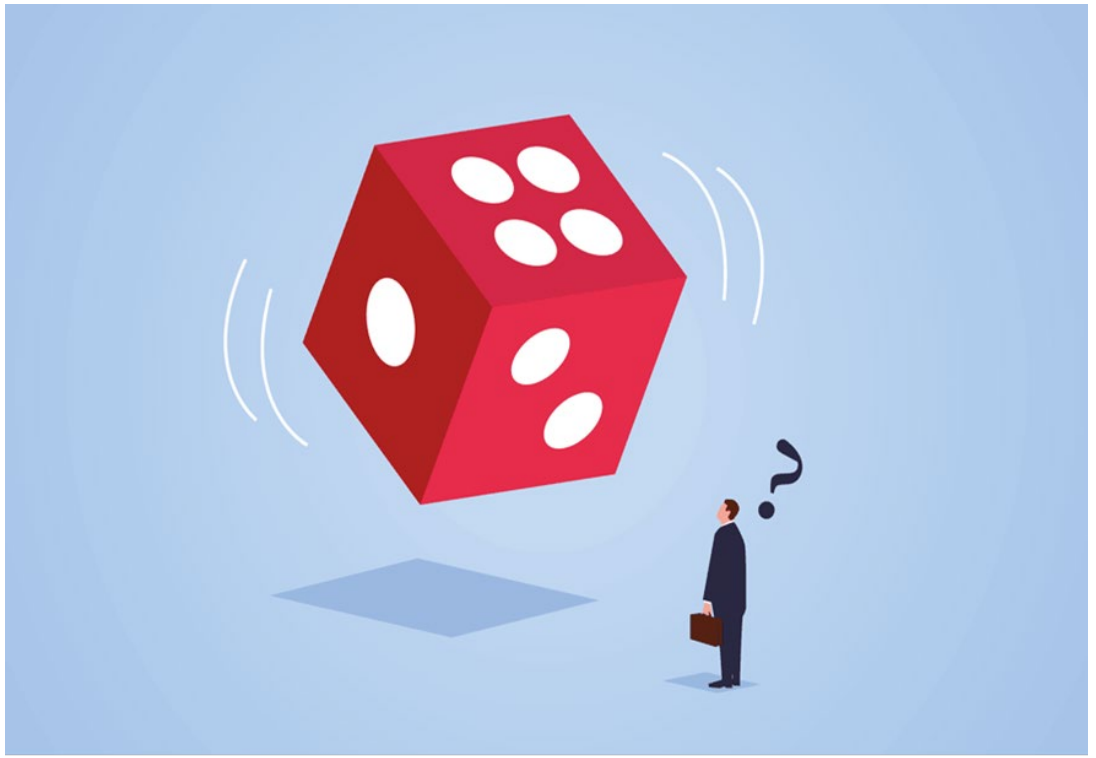


Hunger chain is interactive & competitive in the sense that one team's action affects others' payoff.

Teaching Plan

Teaching Plan (45 mins ~ 3 Hours)

The Shortage Game



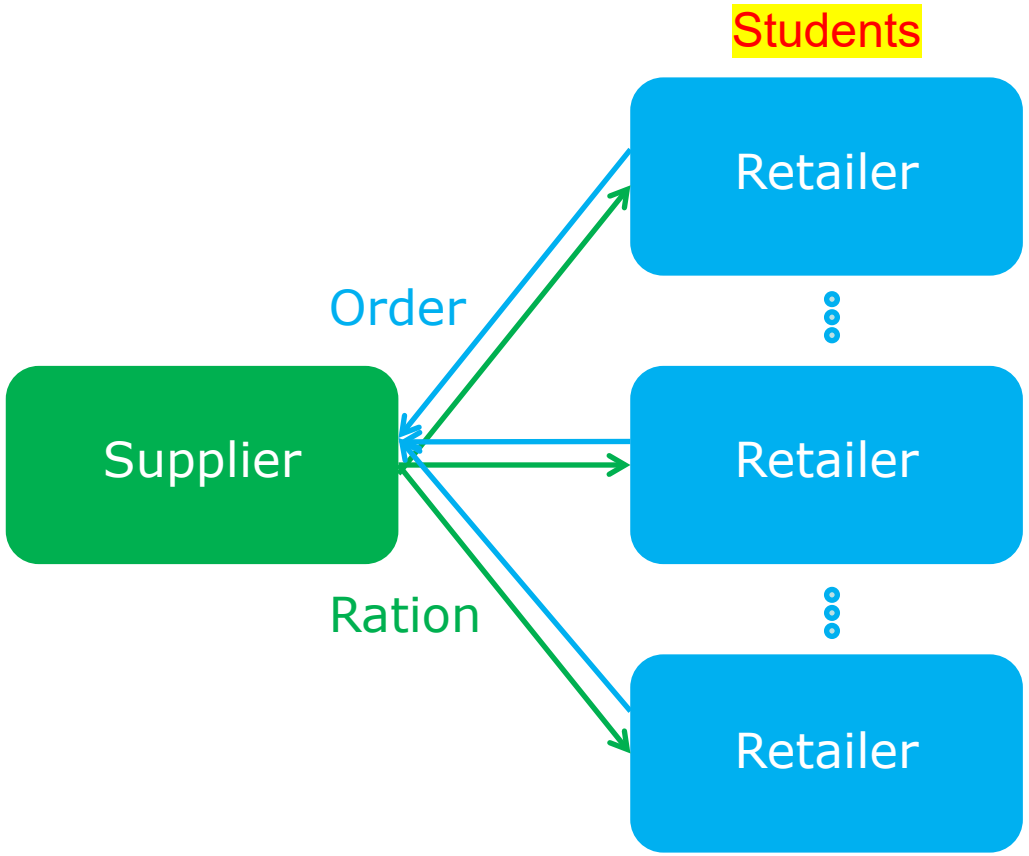
The Newsvendor Game

Sample Teaching Plan

1. The newsvendor game
   - Students trial and error w/o knowing the newsvendor model
   - Learn the magic number – newsvendor solution
   - Relate to game experience
2. The shortage game
   - Panic orders, hoarding, Prisoners' Dilemma, supply chain melt down
   - Relate to real life practices
   - Supply rationing: the fair sharing rule ("turn-and-earn"*)

*Lu and Lariviere (2011)

The Hunger Chain



- Retailers (students) place orders; supplier (robot) decides allocation
- **Proportional Allocation Rule**

If total order > total supply

$$\textbf{Ration} = \frac{\textit{The retailer's order}}{\textit{Sum of all retailers' orders}} \times \textit{Supply}$$

Rounds 1 ~ 3,
Without Revealing
Competitive Information

- Students can only see their performance for each period.

Competition : Your profit depends on others' actions.

Must consider your competitors' strategies.

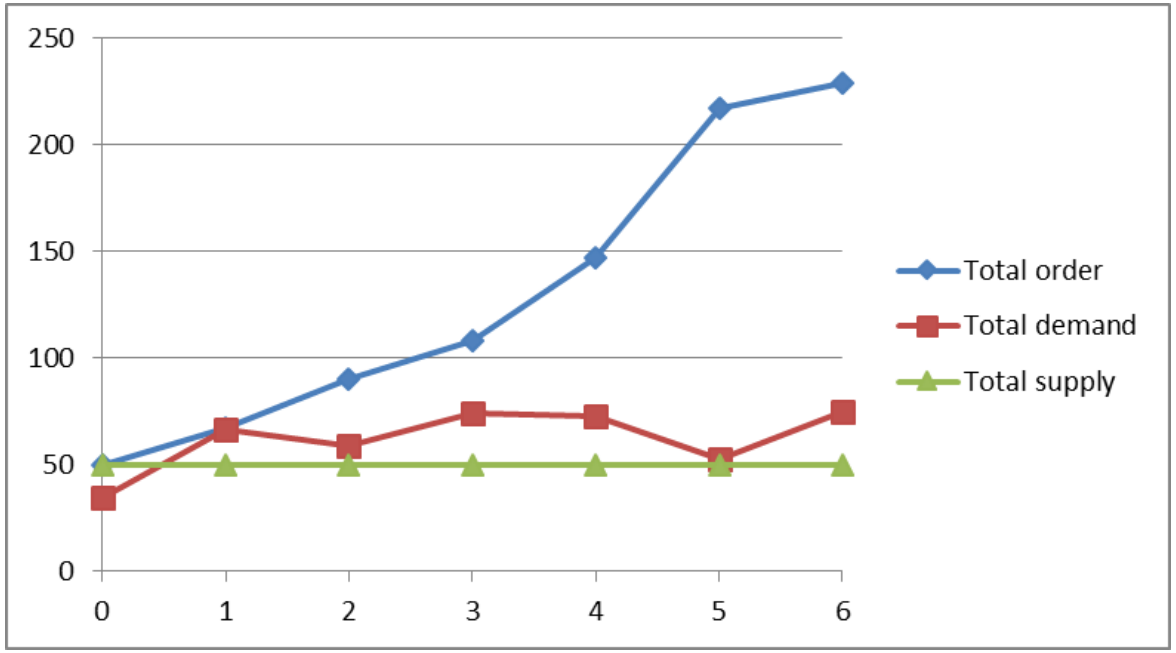
Rounds 4 ~ 6,

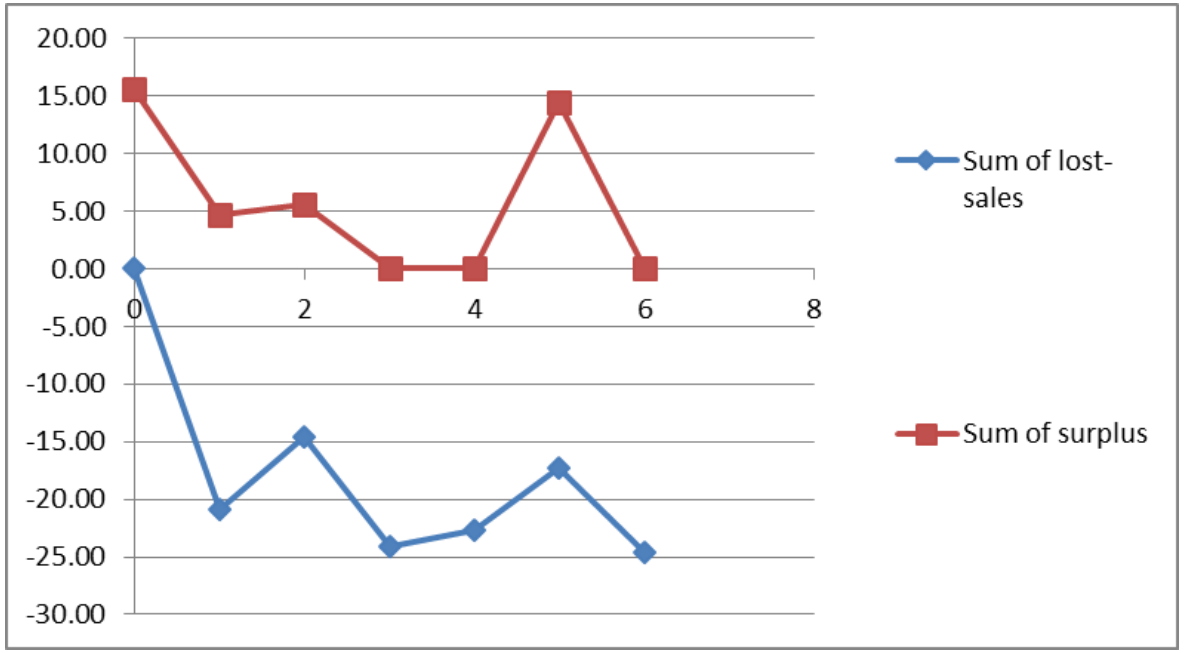
Revealing Competitive Information

Show Complete Game Info

Period	Total Demand	Total Order	Total Supply	Total Lost Sales	Total Surplus Inventory
0	34.36	40.00	40.00	0.00	5.64
1	57.97	132.00	40.00	20.57	2.60
2	74.06	200.00	40.00	34.06	0.00
3	62.67	485.00	40.00	22.95	0.29
4	57.10	1650.00	40.00	17.31	0.21
5	61.46	5750.00	40.00	24.41	2.94
6	67.86	225000.00	40.00	57.23	29.38

Sample Game Trajectory





Facing stable demand, total order increases significantly over time!

Panic orders

Both lost-sales and surplus inventory in the same time!

Hoarding

Is Order Inflation Inevitable?

Retailer 1 \ Retailer 2	Inflate order	Tell truth
Tell truth	1: Lose badly 2: Win more	1: Win 2: Win
Inflate order	1: Lose less 2: Lose less	1: Win more 2: Lose badly

The Prisoners' Dilemma

- **Real life examples?**

How to handle shortage?

Suggest a Solution at the End…

- **Fair sharing*:** uses past sales to allocate supply
  - Ex: Allocates limited supply among customers by their %s of the last 13-week of shipments
  - If Store contributed to 10% of the total sales in the previous 13-week period, then allocate 10% of the supply to Store.

Pros:

- No Order = No Game
- Promotes sales, clear incentives.
- Guarantees product delivery to high-demand markets.

Cons:

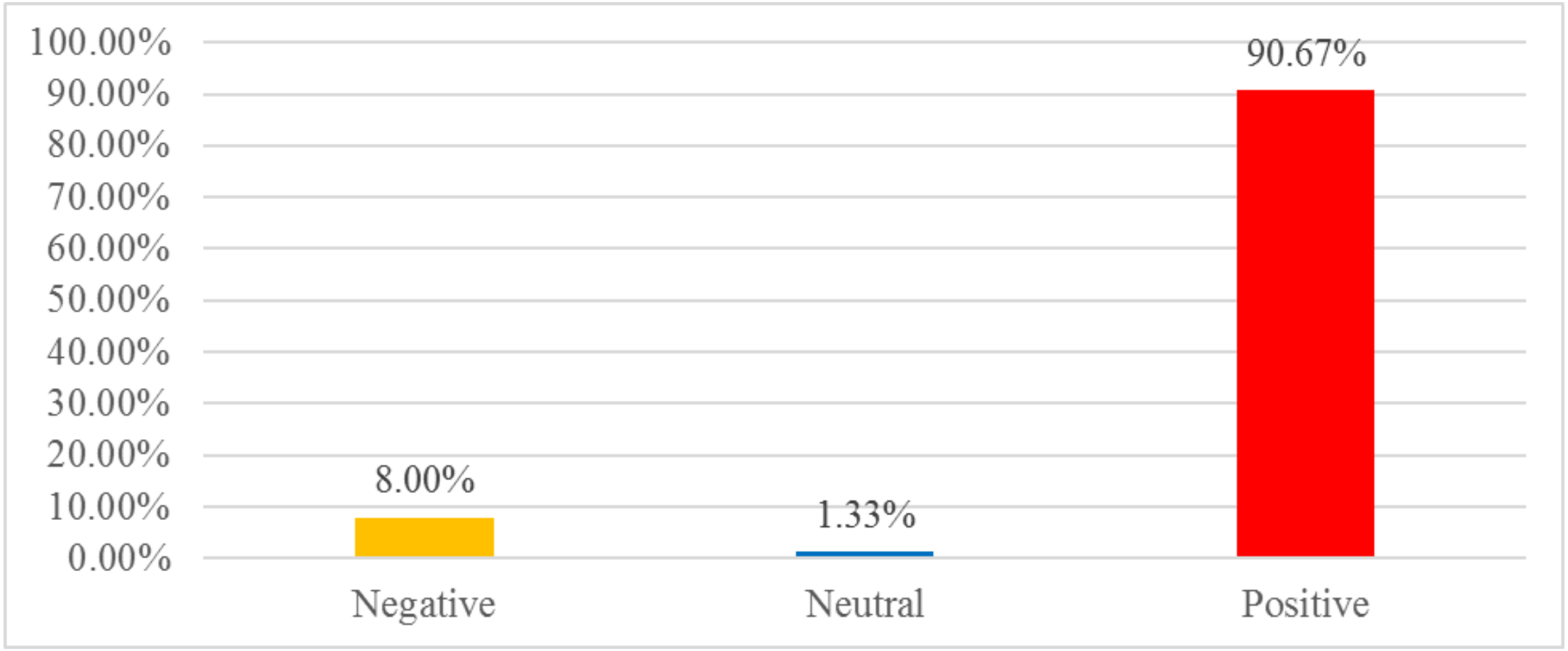
- Might lock in market shares – unfair
- Disregard retailers' forecast and marketing effort

*Lu and Lariviere (2011)

Feedback

- **Courses and audience**
  - **Courses:** Operations Management (Analysis), Supply Chain Mgmt., Procurement / Sourcing, Distribution & Logistics.
  - **Target audience:** Undergraduate, Graduate (MS, MBA), Executive / Continuing Education Students.
- **Games stats:** 80+ instructors, ~2000 student teams, 600+ games
- **Awards**: 2021 Decision Sciences Journal of Innovative Education (DSJIE) Best Teaching Brief awards, Finalist – 2019 DSI Instructional Innovation Award.

Sentiment Analysis of Student Feedback



Decision Science Journal of Innovative Education Paper:
https://yzhao12345.github.io/assets/doc/Song_Park_Zhao_DSJIE21.pdf

Sample Student / Instructor Feedback

- A student: “The Hunger Game was very **interactive** and brought critical thinking to the activity. I really enjoyed it as we got to work in groups while being inclusive enough to work together as a class. **The competition** aspect of the activity pushes each group to become more **proactive with critical thinking** which broadens everyone's perspective and **reflection of real-world competition**.”
- An instructor: “The game successfully boosted student engagement in my online class, which helps me to achieve 4.51 [out of 5] rating in my summer teaching evaluation.”

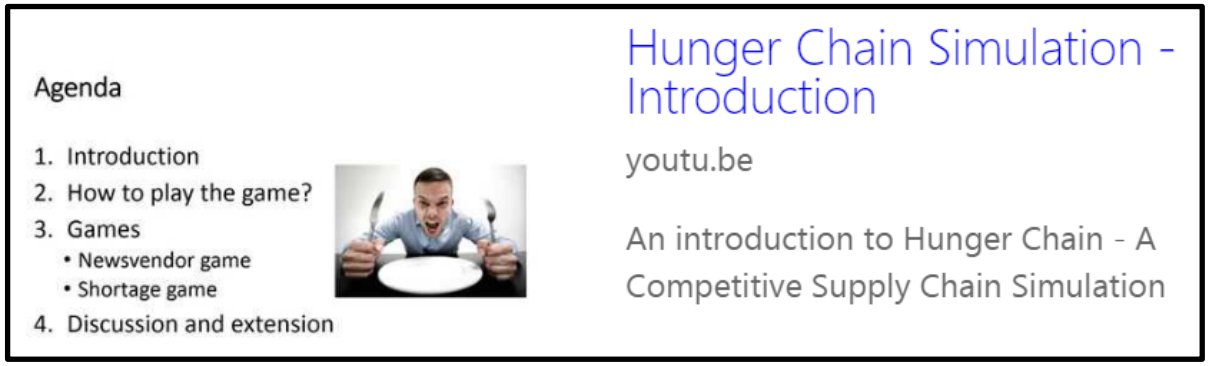
Sample Test Questions / Test Scores

Questions	Learning Objective	Experimental Group (Played the simulation, n =13)		Control Group (Did not play the simulation, n =16)		Mann-Whitney U test *p*-values
		Mean	SD	Mean	SD	
Q1: Why could shortage of supply lead to panic orders or hoarding?	Understand the causes of the panic orders & hoarding under supply shortages.	**7.96**	1.11	6.25	1.22	0.026
Q2: How the retailer's outcome depend on the actions of others?	Hands-on experience of supply chain competition.	**8.03**	1.03	5.80	0.70	0.003
Q3. Which allocation rule that you learned allocates more efficiently and/or fairly? Why?	Understand the importance of supply rationing rules in terms of efficiency and fairness.	**8.00**	1.11	6.63	1.25	0.037

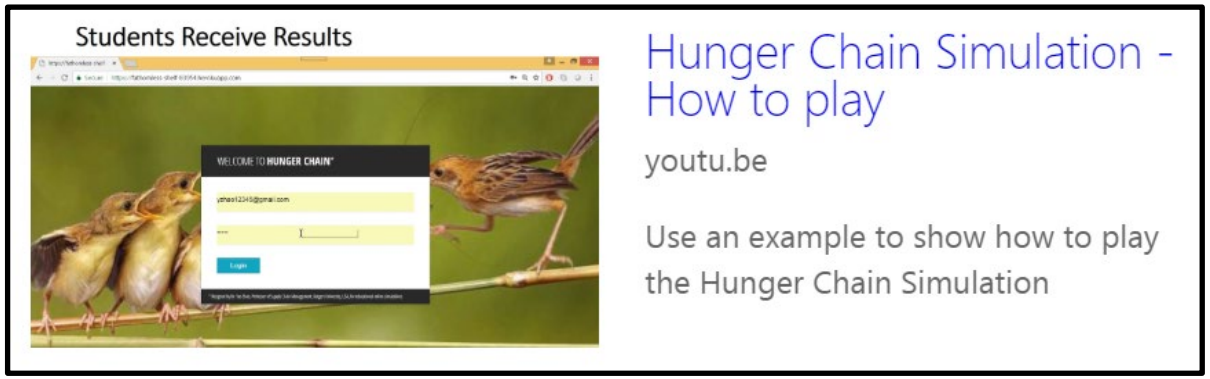
Recap

- **Easy to Setup:** Online gaming only needs a browser.
- Hard-to-lecture but easy to play out, offers practical insights through **“Hands-on Experiences”.**
- A valuable tool for teaching **important and contemporary SCM topics**: shortage gaming, supply chain competition and rationing, particularly following COVID-19 pandemic.

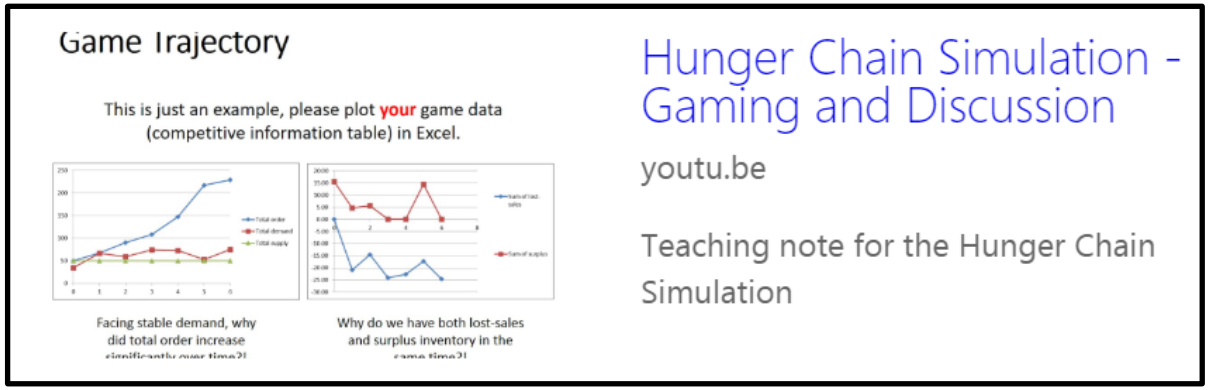
YouTube Videos for Detailed Teaching Notes



https://youtu.be/tHCXs51Ba-E



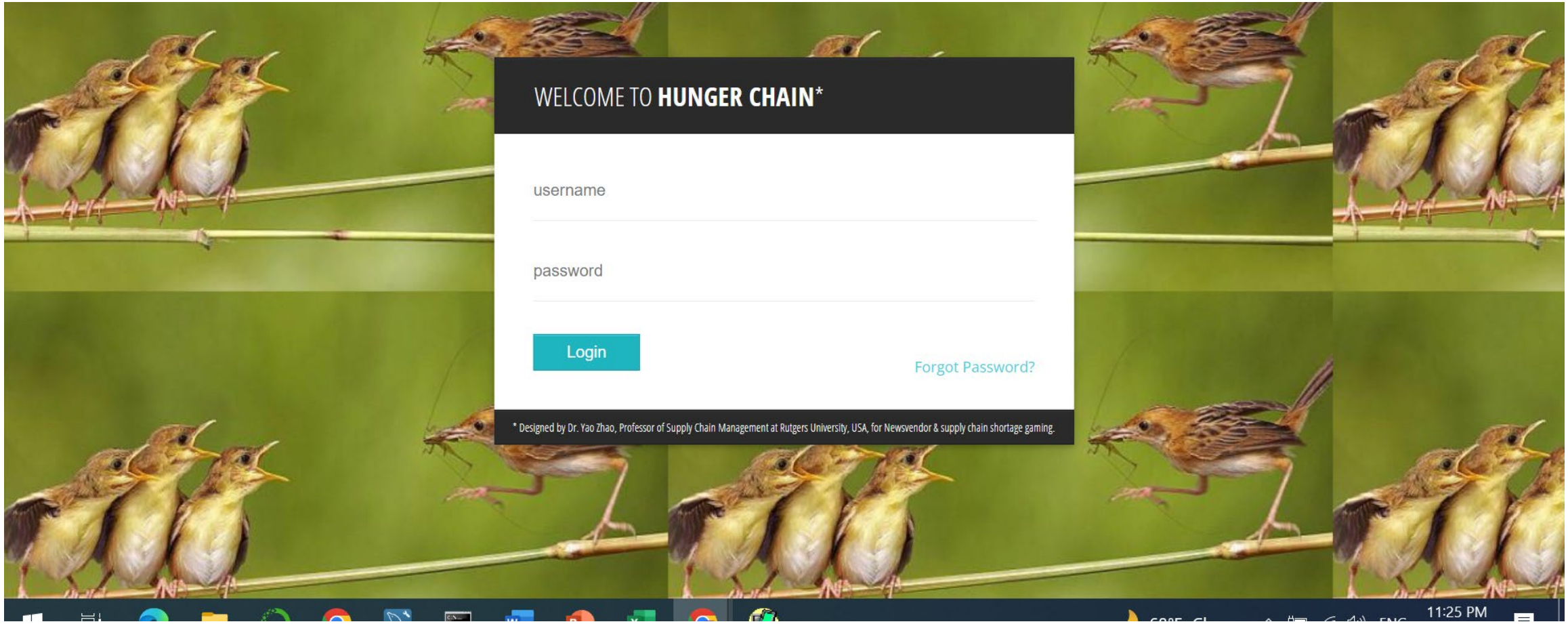
https://youtu.be/Blolth_6duk



https://youtu.be/WPqK5JwXEy8

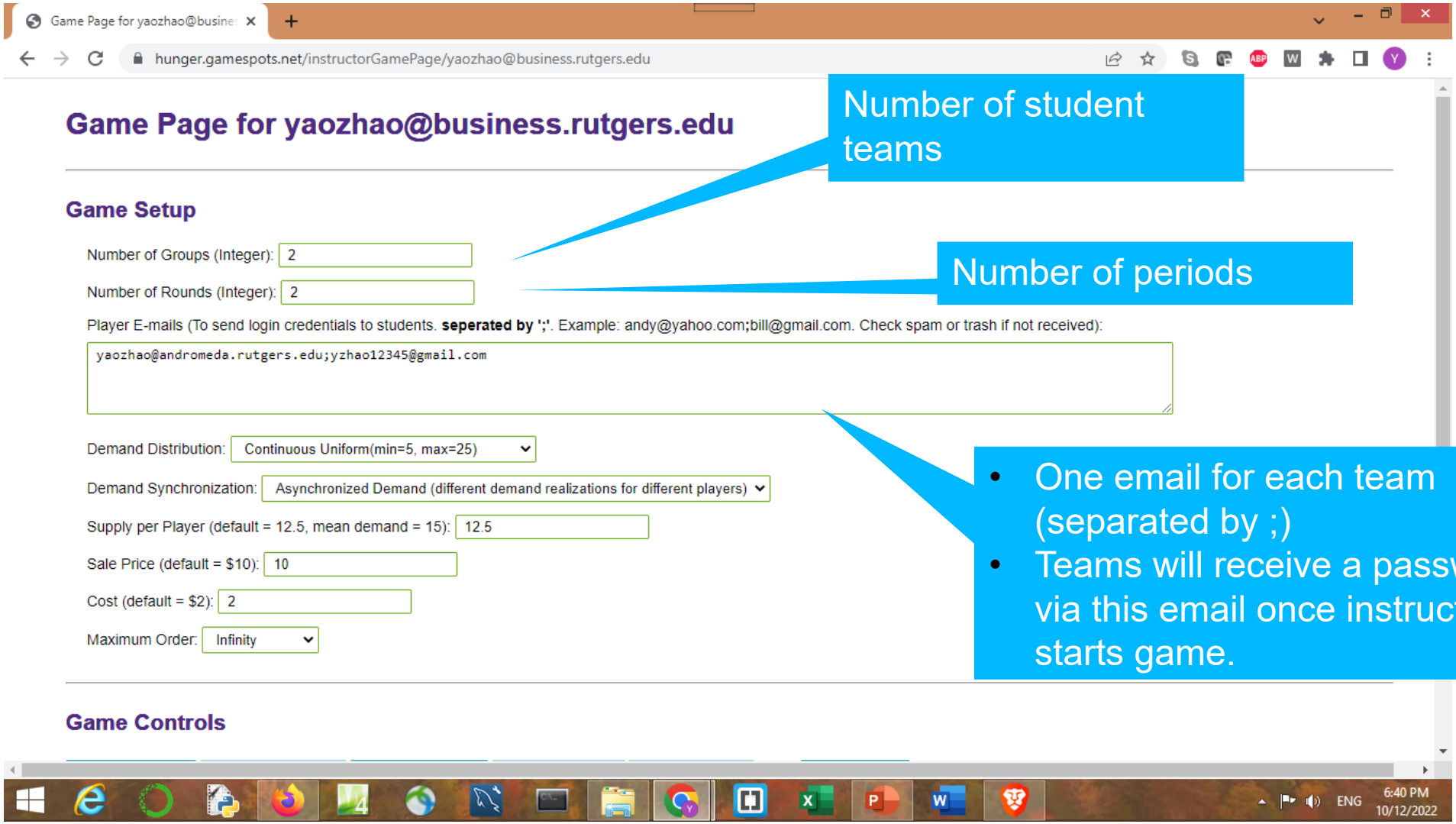

let's
PLAY

Instructor Account (Please email yaozhao@rutgers.edu)

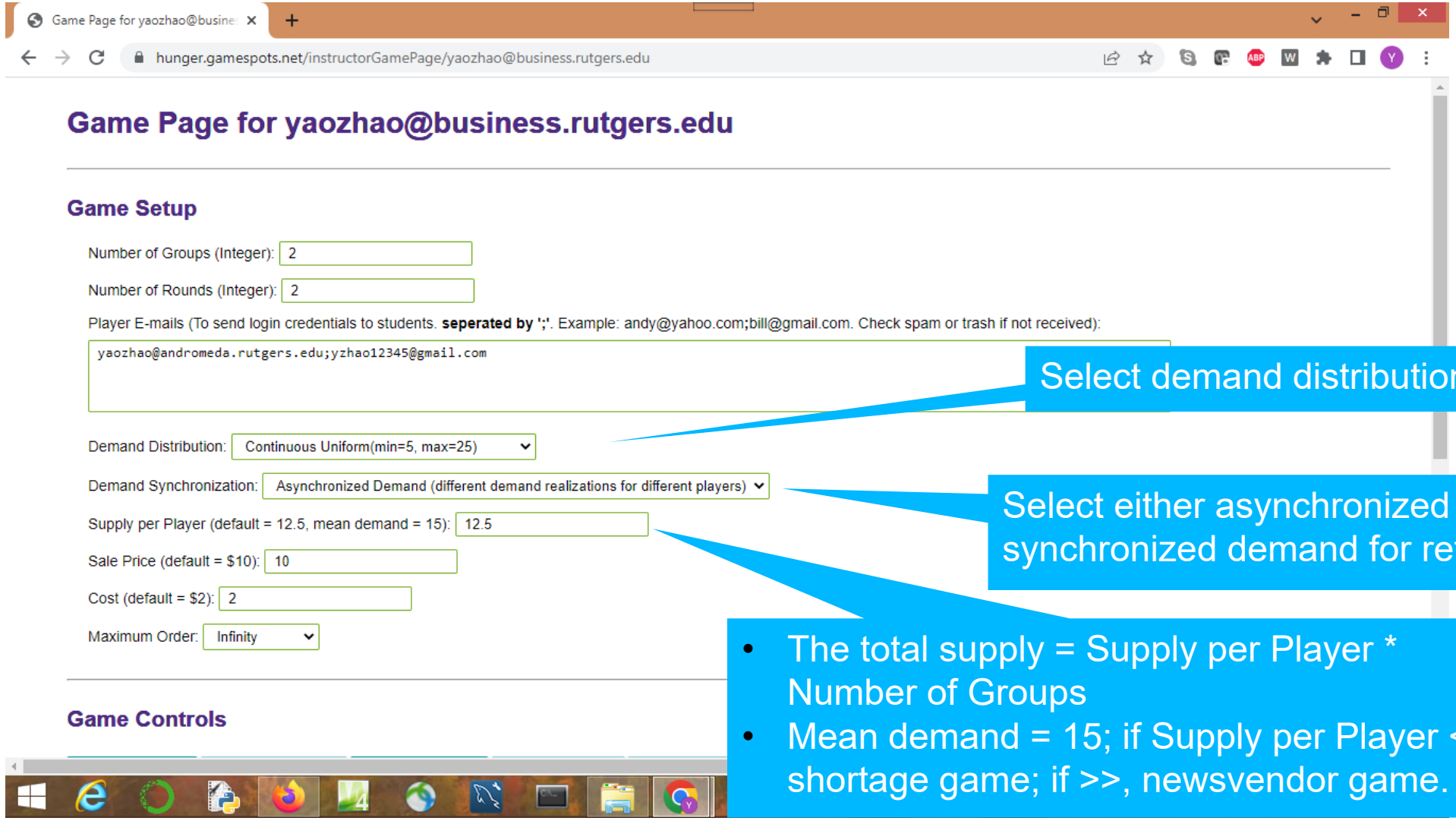


https://hunger.gamespots.net/

Instructor Game Page: Setup Student Teams



Instructor Game Page: Set Game Parameters

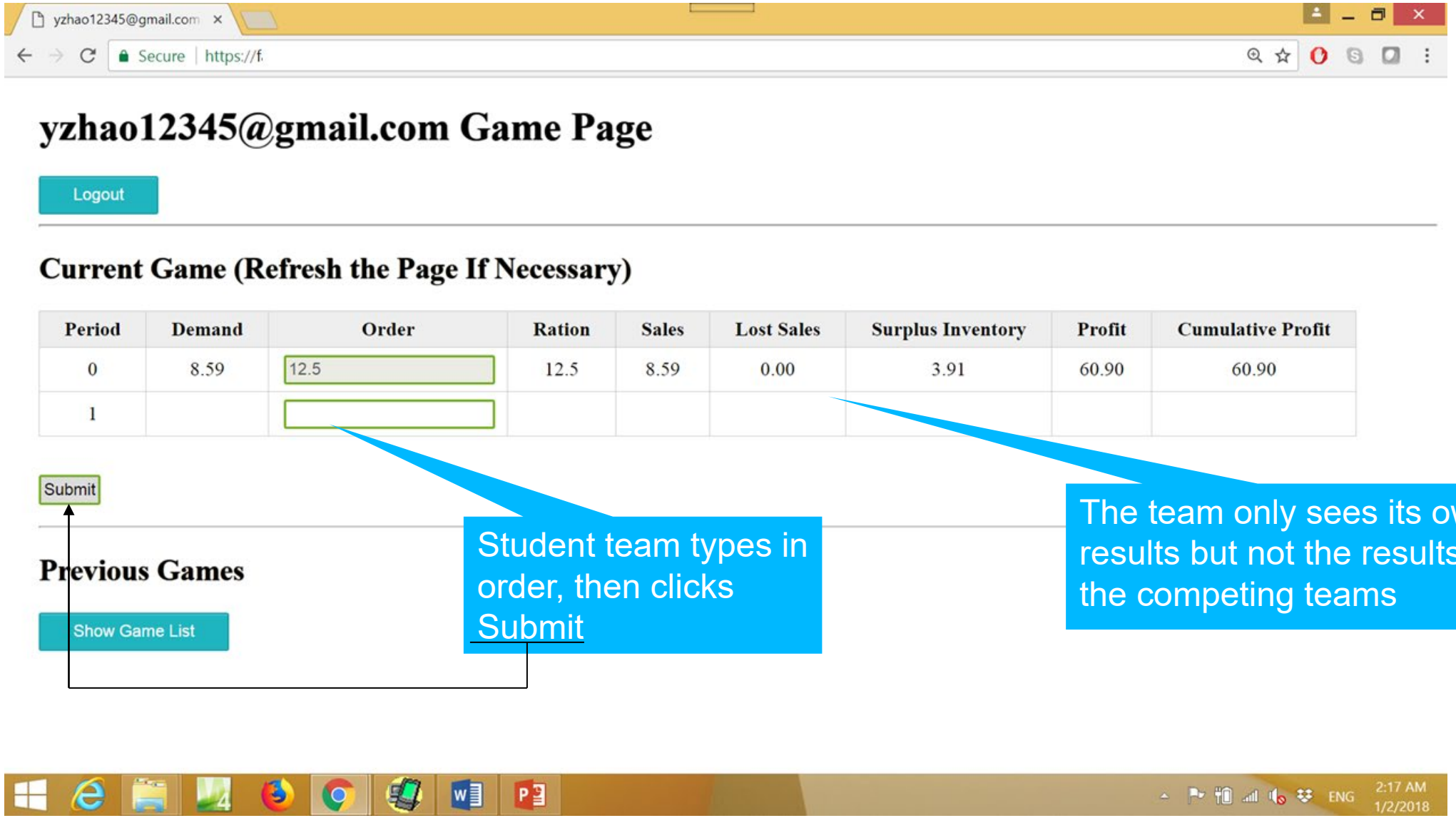


Select demand distribution.

Select either asynchronized or synchronized demand for retailers.

- The total supply = Supply per Player * Number of Groups
- Mean demand = 15; if Supply per Player < 15, shortage game; if >>, newsvendor game.

Students Game Page



For more information

yzhao12345.github.io