Instructions

You are about to participate in a session where you will earn money based on your decisions and the decisions of others. All money earned is yours to keep and will be paid to you privately at the end of the session.

Please do not communicate with the other participants. If you have a question, send a chat message. One of the experimenters is monitoring it and will answer your question. Participants who communicate with others may be asked to leave and will forfeit any earnings they have accumulated.

At the beginning of the session, you will be assigned to a team with three other participants (there are four on the team altogether). You will remain on the team with the same three participants for the duration of the session. You will not be told which of the other participants in this class are on your team, nor will they ever learn your identity.

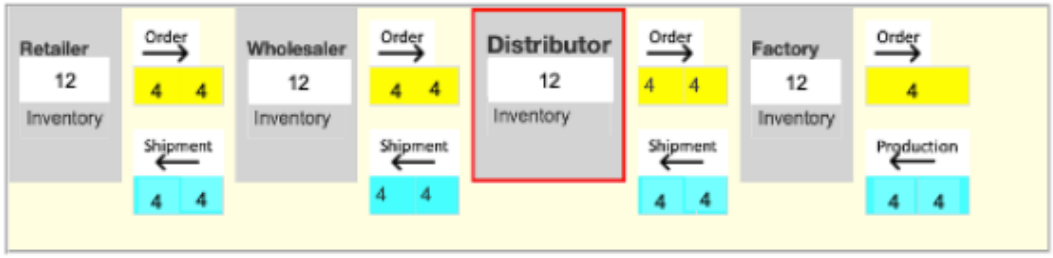
The Game

You are about to take the role of manager in a business. The business is the production and distribution of beer. As in many real companies, consumers do not purchase directly from the brewery. Instead, there is a *supply chain* which brings the beer from the factory to the consumer. There are four links in your supply chain; the Retailer, Wholesaler, Distributor, and Factory.

The four members of your team will be assigned a role as either the retailer, wholesaler, distributor or factory. Each of the four team members will have a role to play in providing beer to the customer. Each member of the team —retailer, wholesale, distributor, and factory—keeps an inventory of beer, which is used to fill the orders they receive. Each member of the team also places orders with their immediate supplier to replenish their inventory.

- The retailer (on the far left on your screen) ships kegs of beer to the customer and orders kegs of beer from the wholesaler.
- The wholesaler (to the right of the retailer on your screen) ships kegs of beer to the retailer and orders kegs of beer from the distributor.
- The distributor (to the right of the wholesaler on your screen) ships kegs of beer to the wholesaler and orders kegs of beer from the factory.
- The factory (on the far right on your screen) ships kegs of beer to the distributor and produces beer.

Initial Board State



It takes two weeks for orders you place to arrive at your supplier—thus if you place an order in the third week of the game, your upstream team member will not receive it until the fifth week of the game. Similarly, shipments of beer take two weeks to arrive—thus if you ship kegs of beer in the third week of the game, your downstream team member will not receive it until the fifth week of the game. These delays are depicted in the figure above by the two positions labeled *Orders* and *Shipments*. It takes three weeks (one week for O*rders*, two weeks for S*hipments*) for the Factory to make beer. This delay is depicted by the three positions to the right of the Factory.

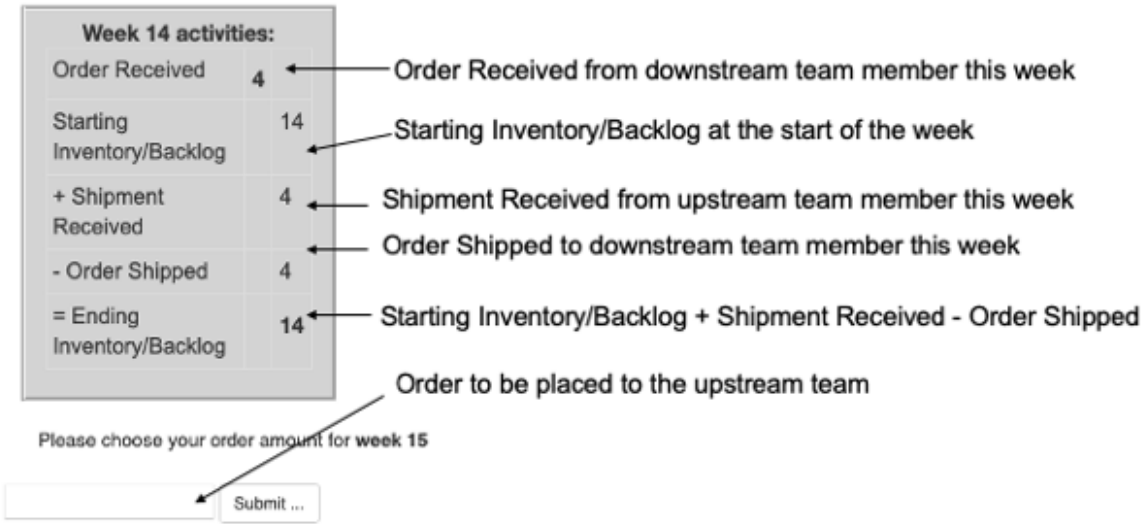
We will begin with the values of orders, inventory, and shipments shown in the figure above. Note that each member of your team has 12 kegs of beer in inventory (in their warehouse). There are also orders and shipments of four kegs each in each of the positions.

Customer Demand

The retailer receives orders from customers, simulated by the computer. In this game, *the customers will demand between 0 and 8 kegs of beer from the retailer each week*. Each number between 0 and 8 is equally likely.

Playing the Game

In addition to the picture above, you will see on your screen a table like the one below.



Every week, each player will receive an order (the *Order Received*), which was placed by their downstream team member two weeks ago. For the retailer, this will be the customers' demand. Each player will also receive a shipment from their upstream team member (*Shipment Received*), which was shipped by their upstream team member two weeks ago. For the Factory, the Shipment Received will be the amount of beer that was started three weeks ago and has now been produced.

The display describes the order of events. All players begin with their starting inventory (Starting Inventory/Backlog). They then add to this the beer they received from their upstream team member

in that week (Shipment Received). They then ship beer to their downstream team member (Order Shipped). For example, the Wholesaler receives beer from the Distributor and ships beer to the Retailer. If they have enough kegs of beer to send the entire amount ordered, they do. Any inventory remaining at the end of the week carries over and becomes the starting inventory for the following week. If they do *not* have enough kegs of beer to ship the entire amount ordered, then they ship as much as they have. In this case, they are in *backlog*—their downstream team member has ordered more beer than is available. If this happens that player ends the week with a backlog and the Ending Inventory/Backlog will be a negative number, representing the number of kegs the player still owes their customer. Any unfilled orders carry over to the next week, so the following week, Starting Inventory/Backlog will be negative. As soon as more beer arrives, it is sent to the downstream team member to fill the orders in the backlog.

Finally, each week you must decide how many kegs of beer to order from your upstream team member. You will enter the amount you choose in the box at the bottom and click Submit to confirm. Once you do, the order will be sent to your upstream team member (remember the two week delay!) for them to fill. **Note**: Your order can be zero or larger, but cannot be negative or fractional.

Costs

There are two costs that you might incur in this game.

- Inventory Costs: It costs 50¢ per week to keep a keg of beer in inventory.
- Backlog Costs: It costs $1.00 per week to be in backlog by one keg of beer.

Both costs are calculated based on the inventory or backlog you have at the end of each week.

The larger your inventory, the higher your costs, but if you run out of beer and are unable to fill all the orders you receive you will incur the larger backlog cost until you can fill the orders in the backlog. It is up to you to decide how much inventory you want to have.

Here are two examples to illustrate how the costs are calculated in each week.

Example 1:

Suppose your beginning inventory is 4, the shipment received is 4 and the order received is 2. Since the total amount on hand [4 (in inventory) + 4 (shipment received) = 8] is enough to entirely fill the order of 2, you can ship the entire order of 2. You are then left with inventory of [8 (the amount on hand) - 2 (the amount shipped)] = 6 kegs of beer. The cost for the week is 6 units of inventory * $0.50 per unit = $3.

Example 2:

Suppose your beginning inventory is 4, the shipment received is 2 and the order received is 8. Since the total amount on hand [4 (in inventory) + 2 (shipment received) = 6] is not enough to entirely fill the order of 8, the most you can ship is 6. You are then left with a backlog of [8 (the

amount ordered) - 6 (the amount shipped)] = 2 kegs of beer. The cost for the week is 2 units of backlog * $1 per unit = $2.

Your Earnings

Your objective is to make decisions that minimize the total costs incurred by your team over the entire game. We will add together the costs each team member incurs to calculate the team costs each week. We will then add together the team costs for all the weeks to calculate the team's total costs. These total costs will be used to calculate your earnings from this session.

Example 3:
If your cost was $6 every week, and if all your teammates also had costs of $6 every week, your team cost would be $24 per week. If the game lasted 100 weeks, the total cost for your team would be $2400. The lower your *team's* costs, the more money you will earn in this session, as explained below.

You earnings for this session are your $5 participation fee plus the earnings from the game. These earnings will be based on your team's performance relative to other teams. The earnings will vary between $0 and $20 per player, depending on the costs your team incurs relative to other teams. Thus your total earnings for the session will be somewhere between $5 and $25. *Every member of your team will earn the same amount.*

Your earnings from the game are calculated using the formula below.

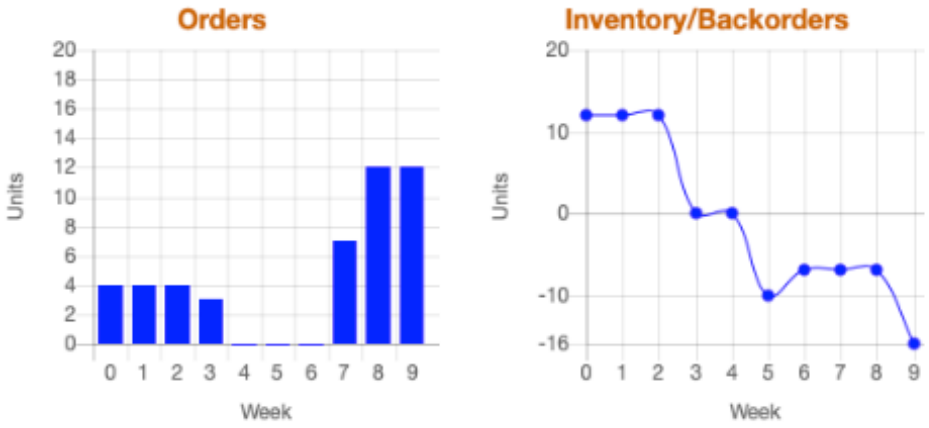
$$\text{Earnings from the game} = \$20 \times \frac{\text{Maximum cost-Your Team Cost}}{\text{Maximum Cost-Minimum Cost}}$$

We will thus compare your team's cost with the costs of the team with the highest costs and the team with the lowest cost. Here's an example of the earnings calculation.

Example 4:
If the worst-performing team incurred costs of $500, the best-performing team incurred costs of $200, and your team incurred costs of $300, then each member of your team would earn from the game $20*[(500-300)/(500-200)] = $20*[200/300] = $20*[2/3] = $13.33. In addition, you would each collect your $5 participation fee, so each member of your team would earn $18.33.

History Plots:

During the game you can view the history of what has occurred. The first chart will show you the orders you placed. The second chart will show you the inventory/backlog that you have.



Ending the Game

The number of weeks you will play has been randomly determined in advance. The game is equally likely to end in any week between week 40 and week 100. At the end of the game, the software will calculate your team's total costs and your final earnings and will display them on your screen. This amount will be transferred to you via GalaxyPay.

To continue to participate in this study please read the consent form on your screen and click "I Accept" button. You will then be asked several questions to make sure that you understand the rules of the game. If there are any questions, please let the instructor know now so the instructor can answer them.