The following is the Supply Chain Game Description so that you can better understand the game and make decisions:

The supply chain includes four agents: factory, distributor, wholesaler, and retailer.

The two types of flows in this supply chain include product and information.

Shipment, i.e., product flow, is made downstream, i.e., from the factory to the distributor, then to the wholesaler, and finally to the retailer.

Order information is transmitted upstream in this supply chain, i.e., from the retailer to the wholesaler, to the distributor, and finally to the factory.

Here, order quantity is essentially the demand for the agent who receives it.

The shipment delay and order delay among retailer, wholesaler, distributor, and manufacturer (factory) are two weeks.

This indicates that when retailer places an order, the wholesaler will receive the order two weeks later. When the wholesaler sents out the shipments, the retailer will receive the shipments two weeks later.

The shipment delay and order delay between the manufacturer (factory) and the material supplier is one week.

This indicates that when factory places an order, the material supplier will recieve the order one week later. When the material supplier sents out the shipments, the factory will receive the shipments one week later.

There is no delay for the retailer to ship out its inventory to meet the customer demand.

The supply chain operates continuously for a number of weeks. At the beginning of week 1, there are already orders from the previous two weeks flowing upstream in the supply chain. Meanwhile, there are two weeks of shipments flowing downstream in the supply chain.

Thus, before week 1, the total order placed for the retailer, wholesaler, and distributor is 16 units (arriving in the following 4 weeks) while the total order received is 0.

For the factory (manufacturer), the total order placed is 8 units (arriving in the following 2 weeks) and the total order received is 0.

The following are the key relationships for each supply chain agent:
- Total demand = current demand + previous week's backorder
- Available inventory to ship in a week = incoming shipment + on-hand inventory
- If Available to ship > total demand, then ending inventory = available inventory to ship − total demand
- If Available to ship < total demand, then ending backorder = total demand − available inventory to ship
- Weekly cost = ending backorder * backorder cost + ending inventory * inventory holding cost
- Backorder cost is 1.0 per unit per week
- Inventory holding cost is 0.5 per unit per week
- Total cost = sum of all weekly costs

Please note that the demand for each agent remains until it is satisfied, and backorders persist until they are fulfilled.

The objective for each supply chain agent is to make decisions on how many units to order each week to minimize total costs.

In addition to the information provided above, please consider the following before making your weekly ordering decision.

1. Some of your past orders may not yet have arrived. Consider estimating your inventory position, which is the sum of end-period inventory and on-order quantity (any previous orders that have not yet arrived).

2. Your order will arrive in a future period. Consider estimating an order-up-to level that would be sufficient to satisfy your forecast of demands till the end of that future period.

3. Your order should bring your inventory position up to your order-up-to level.

Calculation guidance:

1. Understand Key Variables:
- Beginning Inventory: Inventory at the start of the week.
- Previous Week's Backorder: Unfulfilled demand from previous weeks.
- Incoming Shipment: Shipments expected to arrive this week.
- Demand: Customer demand for this week.
- Order Placed: Orders you placed in previous weeks that have not yet arrived.
- Outgoing Shipment: Shipments you send out to fulfill demand.

2. Calculate Total Demand:
- Total Demand = Current Demand + Previous Week's Backorder

3. Calculate Available Inventory to Ship:
- Available Inventory to Ship = Incoming Shipment + On-hand Inventory

4. Determine Ending Inventory or Backorder:
- If Available Inventory to Ship > Total Demand:
    - Ending Inventory = Available Inventory to Ship - Total Demand
    - Ending Backorder = 0
- If Available Inventory to Ship < Total Demand:
    - Ending Backorder = Total Demand - Available Inventory to Ship
    - Ending Inventory = 0

5. Estimate On-Order Quantity:
- If you do not know the total orders placed and received, but you have already figured out the on-order quantity of last week (after the arrival of incoming shipments), the order placed last week, and the incoming shipment of this week, then:
- On-order Quantity = On-order quantity of last week + Order placed last week - Incoming shipment of this week
- If the variables total orders placed and total orders received are known, then:

- On-order Quantity = Total orders placed - Total orders received

6. Calculate End-Period Inventory Position:
- End-Period Inventory Position = (Incoming Shipment + On-hand Inventory) - Total Demand + On-order Quantity

7. Forecast Future Demand Using Simple Moving Average (SMA):
You should use the past demand for forecasting.
- SMA = (Sum of Demand over current period and Past n-1 Periods) / n, do not exclude weeks that has demand = 0! Demand = 0 should also be included in the sum of demand.
- Choose a forecast period (T), it is the number of weeks you need to wait from you place an orer to the arrival of the shipments.

8. Calculate Total Forecasted Demand:
- Total Forecasted Demand = SMA $\times$ (T+1)

9. Set the Order-Up-To Level:
- Order-Up-To Level = Total Forecasted Demand + Safety Stock
- Safety Stock is an additional quantity to cover uncertainties in demand and supply.

10. Determine the Order Quantity:
- Order Quantity = Order-Up-To Level - Current Inventory Position
- Ensure that the order quantity is non-negative. If the calculation results in a negative number, set the order quantity to zero.

11. Double Check
Please note that the previous answer is for reference only and may not be entirely correct. Your final answer should strike a balance and avoid potential future backorders. This will help keep inventory levels stable, handle similar demand in the coming weeks, and minimize holding costs. Please review the order quantity you intend to place according to this criterion.

Additional Information:

Order and Shipment Delay:
- Order Information Delay: When you place an order at week X, the order information will take 2 weeks to reach your supplier. Therefore, the order information will reach your supplier at week X + 2.
- Shipment Delay: After the supplier receives the order information, it takes another 2 weeks for the shipment to be delivered to you. Consequently, you will receive the orders at week X + 4.
- If you place an order at week X:
- The order information will reach your supplier at week X + 2.
- You will receive the orders at week X + 4.

On-Order Quantity:
- If the variables on-order quantity of last week (after the arrival of the incoming shipment), order placed last week, and incoming shipment of this week are known, then:
    - On-order quantity = On-order quantity of last week + Order placed last week - Incoming shipment of this week.
- If the variables total orders placed and total orders received are known, then:
    - On-order quantity = total order placed - total order received.

End-Period Inventory Position:
- The formula for the End-period Inventory Position is as follows:
- End-period Inventory Position = (Incoming Shipment + On-hand Inventory) - Total Demand + On-order Quantity

Order-Up-To Level:
- Order-Up-To Level is a target inventory level that a supply chain agent aims to reach after placing an order, determined based on the forecasted demand over a specific future period.
- Simple Moving Average (SMA) can be used for forecasting future demand by averaging the demand over a specified number of past periods.
- Steps to calculate the Order-Up-To Level:
    1. Forecast Future Demand Using SMA:
$$ \text{SMA} = \frac{\sum_{i=1}^{n} \text{Demand in Period } i}{n} $$
    2. Determine the forecast period (T).
    3. Calculate Total Forecasted Demand:
$$ \text{Total Forecasted Demand} = \text{SMA} \times (T+1) $$
    4. Calculate Current Inventory Position:
$$ \text{Current Inventory Position} = (\text{Incoming Shipment} + \text{On-hand Inventory}) - \text{Total Demand} + \text{On-order Quantity}] $$
    5. Set the Order-Up-To Level:
$$ \text{Order-Up-To Level} = \text{Total Forecasted Demand} + \text{Safety Stock} $$
    6. Determine the Order Quantity:
$$ \text{Order Quantity} = \text{Order-Up-To Level} - \text{Current Inventory Position} $$

By following these guidelines, you can effectively manage your inventory, order placement, and forecast demands to minimize costs in the supply chain game.