Activity: keeping the state

Chapter 1, Introduction to Inventory Systems

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Work in pairs. 25 minutes.

Names: _____

The item. The distributor that stocks the mower deck belt opens day 1 with **12** belts on hand, none on order and none owed. Unmet demand is backordered. An order is always for $Q = 15$ belts, and an order placed at the end of day t arrives at the start of day $t + 3$, before that day's demand. Arrivals fill backorders first.

The demands, days 1 to 10:

$$3,\ 2,\ 4,\ 1,\ 3,\ 5,\ 2,\ 4,\ 3,\ 2$$

Two rules. At the end of each day, after the demand:

- the **position rule** orders 15 if $IP \leq 6$;
- the **shelf rule** orders 15 if $I \leq 6$.

Notation. I is on hand, B backordered, IO on order, $IN = I - B$ the net inventory and $IP = I + IO - B$ the inventory position. Record each day's values at the end of the day.

Part A. Predict

Over these ten days, will the shelf rule place more orders than the position rule, fewer, or the same? Roughly how many belts will be on the shelf at the end of day 10 under each?

Part B. The position rule

Keep the ledger. Check $IP = IN + IO$ on every row.

Day	Demand	Received	I	B	IN	IO	IP	Order, due day
0			12	0	12	0	12	
1	3							
2	2							
3	4							
4	1							
5	3							
6	5							
7	2							
8	4							
9	3							
10	2							

Part C. The shelf rule

Keep the same ledger under the shelf rule.

Day	Demand	Received	I	B	IN	IO	IP	Order, due day
0			12	0	12	0	12	
1	3							
2	2							
3	4							
4	1							
5	3							
6	5							
7	2							
8	4							
9	3							
10	2							

How many orders did each rule place, and how many belts were on the shelf at the end of day 10? Which variable should trigger an order, and why not on hand?

Part D. Averages, and a check

Treat each day's end-of-day value as held for that whole day.

1. Under the position rule, compute the average on hand $\bar{I}$, the average backorders $\bar{B}$ and the average on order $\overline{IO}$ over the ten days.
2. Little's law says $\overline{IO} = \lambda L$ in the long run. Compute λ from the demands and compare. Why do the two not agree exactly here?

Part E, if you have time. One more day of lead time

Under the position rule, every order now arrives at the start of day $t + 4$. Which rows of your ledger change, and what happens to $\bar{B}$?

Exit ticket (tear off and hand in)

Name: _____

1. Can I and B both be positive at the end of a day? Why or why not?

2. In one sentence: why does the shelf rule overorder?