Activity: the last elbow, by marginal analysis

Chapter 7, Single-Period Stochastic Inventory

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Work in pairs. 20 minutes.

Names: _____

The item. The utility storeroom stocks a 200 A load-break elbow for the old 15 kV underground cable. The capital project that changes the transformer specification also replaces that cable, so after the project an elbow fits nothing. Until then, failures on the old cable call for elbows, and the storeroom makes one last buy now.

- An elbow bought now costs **\$120**.
- An elbow needed after the stock runs out is bought from a surplus broker for **\$180**, in time for the repair.
- Elbows left when the project ends go to a surplus dealer for **\$25** each.

The engineer's sketch of the elbows needed over the project window:

Elbows needed x	20	30	40	50	60
$P\{X = x\}$	0.10	0.30	0.20	0.25	0.15

Buy in steps of ten, as the sketch is drawn.

Part A. Predict

Compute the mean of the sketch. Will the best buy be above or below it?

Part B. Ten elbows at a time

1. Compute the overage cost c_o, the underage cost c_u, and $P\{X \le x\}$ for each x.
2. Having decided on Q, the next ten elbows save c_u each when demand reaches $Q + 10$, and lose c_o each when demand stops at or below Q. Fill one row per step, and stop where the net turns negative.

From	To	$P\{X \ge$ to$\}$	Gain	$P\{X \le$ from$\}$	Loss	Net	Decision
20	30						
30	40						
40	50						
50	60						

3. Confirm the answer with the critical ratio.

Part C. The check: cost all five

The cost of buying Q when x are needed is $120Q - 25(Q - x)^+ + 180(x - Q)^+$. Compute the expected cost of each candidate (split the five between you), and confirm that the cost has one low point, where Part B stopped.

Q	20	30	40	50	60
Expected cost					

Part D. A buyback offer

The elbow's manufacturer offers to buy back unused elbows for **$85** each when the project ends, in place of the surplus dealer's $25. Recompute c_o, the critical ratio and the best buy. What does the offer save the storeroom in expected cost?

Part E, if you have time. Where the order moves

1. Above what buyback price does the best buy first rise from 30 to 40? From 40 to 50?
2. At the best buy without the offer, what is the probability that the storeroom runs short? The project engineer calls that too risky. Answer in one or two sentences.

Exit ticket (tear off and hand in)

Name: _____

1. Why is the best buy below the mean for the elbow, when it was above the mean for the mower deck belt?

2. True or false, and why: the step from 30 to 40 lost only $20, so buying 40 instead of 30 is a serious mistake.