Activity: the protection interval

Chapter 9, Periodic Review and Other Policy Forms

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Work in pairs. 20 minutes.

Names: _____

The item. The utility storeroom's recloser control, now on a calendar: the storeroom reviews it on the first of every month and orders up to a level S. Crews draw **24** a year, one at a time, as a Poisson process, and unmet demand is backordered. The supplier's lead time is **one month**. Holding a control costs **\$500** a year and a backorder **\$4,500** a year.

Notation. R is the review interval and L the lead time. $D(v)$, the demand over an interval of length v, is Poisson with mean λv, and $G_v(x)$ is its distribution function. The level is chosen from the distribution function averaged over the review interval, by the three-point rule:

$$\bar{G}(S) \approx \frac{1}{6}\left[G_L(S) + 4\,G_{L+R/2}(S) + G_{L+R}(S)\right], \qquad S^* = \min\left\{S : \bar{G}(S) \geq \frac{b}{b+h}\right\}$$

The table. Poisson distribution functions for the three means you will need.

x	mean 2	mean 3	mean 4
2	0.6767	0.4232	0.2381
3	0.8571	0.6472	0.4335
4	0.9473	0.8153	0.6288
5	0.9834	0.9161	0.7851
6	0.9955	0.9665	0.8893
7	0.9989	0.9881	0.9489

Report to four decimal places.

Part A. Predict

A planner says: "The supplier takes a month, so I set S from one month of demand, the way I would if I watched the item continuously." Is that level too high, too low, or right? Why?

Part B. The exposure

1. Compute the protection interval $\tau = R + L$, and the three mean demands λL, $\lambda(L + R/2)$ and $\lambda\tau$. Show one unit conversion.
2. Compute $\bar{G}(S)$ for $S = 3, 4, 5, 6$ by the three-point rule.

Part C. Choose the level

1. Compute the critical ratio $b/(b+h)$, and choose S^*.
2. A colleague reads the same ratio off G_τ, the mean 4 column, "since the stock must last the whole protection interval." What level does that give, and what is wrong with it?

Part D. Against continuous review

If the storeroom watched the control continuously and ordered one for one, the same ratio would be read off the demand over the lead time alone.

1. What level would continuous review set?
2. Why must the periodic level be higher? Answer with the protection interval.
3. How many orders a year does each system place? Under periodic review an order is placed at a review exactly when some demand has arrived since the last one.

Exit ticket (tear off and hand in)

Name: _____

1. In one sentence: what is the protection interval, and why is it longer than the lead time?

2. True or false, and why: the periodic level is read off the demand over the whole protection interval.