

Practice Problems on Inventory Management – Newsvendor: Solutions

1. Every catalog fetches a profit of \$35.00 and costs \$5.00 to produce. Therefore, Cost of under stocking $C_u = \$35$. Cost of overstocking $C_o = \$5$.

Critical ratio = $C_u / (C_u + C_o) = 35 / (35 + 5) = 0.875$. $z = 1.15$.

Each run needs to satisfy the demand during half a year, with mean $16,000 / 2 = 8,000$ and standard deviation $= 4000 * \sqrt{0.5} = 2828.43$.

Total quantity, $Q = 8,000 + 1.15 * 2828.43 = 11252.69$, round up. Johnson should print 11253 catalogs for each run.

Remark: Fixed cost is sunk, so should not be taken into account.

2. $C_u =$ Lost revenue from lost sale = $\$120 - \$18 = \$102$.

$C_o =$ Loss from an unsold crate = $\$18 + \$2 = \$20$.

Critical ratio = $C_u / (C_u + C_o) = 102 / (102 + 20) = 0.836$.

The probability density of demand and the cumulative probability is listed below.

Demand	3	4	5	6	7	8	9	10	11	12	13	14	15
Frequency	1	3	2	5	1	6	7	6	8	5	4	1	3
Prob.	0.019	0.058	0.038	0.096	0.019	0.115	0.135	0.115	0.154	0.096	0.077	0.019	0.058
Cumulative Prob. $P(d \leq x)$	0.019	0.077	0.115	0.211	0.23	0.345	0.48	0.595	0.749	0.845	0.922	0.941	1

The optimal order quantity is 12.

3. $D =$ Amount of trash (in tons) put out per day; Normally distributed: $\mu = 35$ tons, $\sigma = 9$ tons

$Q =$ Amount of trash (in tons) that can be collected per day

Number of crews needed = $Q/5$ (since each crew can collect 5 tons per day)

Overstocking:

- Happens if less trash than crews can collect ($D < Q$)
- Cost of overstocking is the cost of idle crews, $C_o = \$625/\text{crew} = \$125/\text{ton}$

Understocking:

- Happens if more trash than crews can collect ($D > Q$)
- You'll have to hire an outside contractor, so the cost of understocking is the extra cost due to the contractor, $C_u = \$650/\text{ton} - \$125/\text{ton} = \$525/\text{ton}$

$SL^* =$ Critical ratio = $C_u / (C_u + C_o) = 0.8077$

$z = \text{NORMSINV}(0.8077) = 0.86945$

$Q^* = \mu + z\sigma = 35 + 0.86945 * 9 = 42.8$ tons

Hence, it is optimal to have $42.8/5$ crews = 8.56 crews \rightarrow 9 crews (round-up rule)