IE221: Operations Research – Probabilistic Methods

Module I: Inventory Models
Lecture 4, Fall 2001

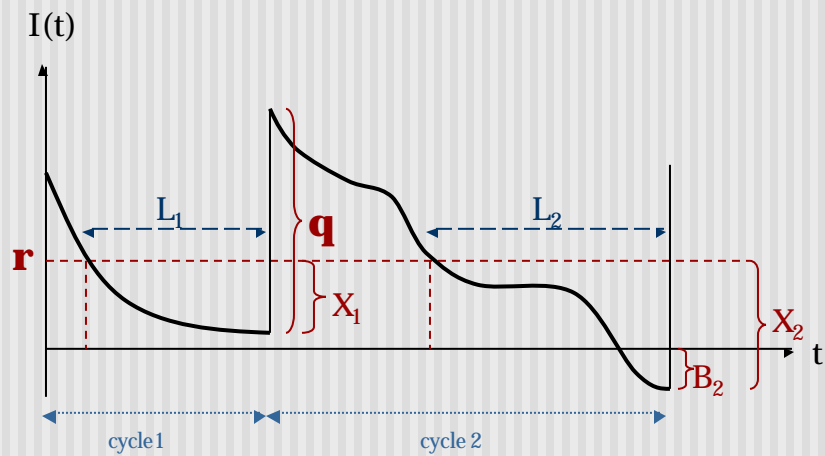### Lehigh University ◆ IMSE Department

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Lecture 4 Outline

EOQ with Uncertain Demand

- Definitions (nomenclature)
- Case 1: Back-Order
- Example
- Case 2: Lost Sales
- (r,q) and (s,S) Policies

Nomenclature

I(t)

L_1 q L_2

r

X_1 X_2

B_2 t

cycle 1   cycle 2

The Lead Demand, X

- $X = D1 + D2 + ... + D_L$
- $E[X] = E[L].E[D]$
- $Var[X] = E[L].Var[D] + E[D]^2.Var[L]$

Recall: Marginal Analysis

$TC(q,r)$

At the optimum,
$$TC(r^* + \Delta) - TC(r^*) \approx 0$$

r

r^* $r^* + \Delta$
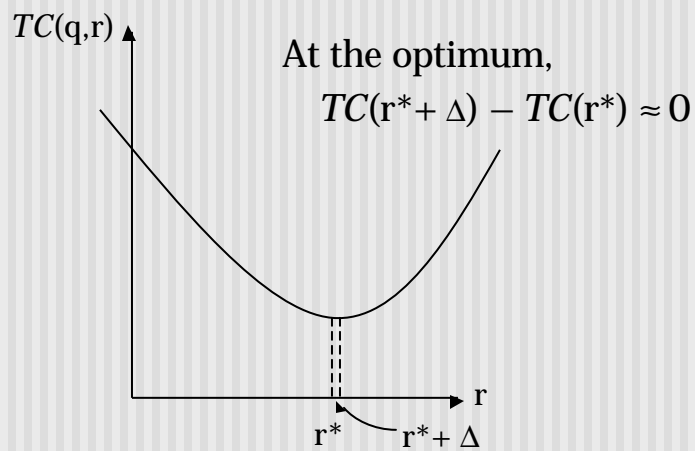
Case 1: Back-Order

Summary of results:

$$q^* \approx \sqrt{\frac{2K\overline{D}}{h}}$$

$$P(X \geq r^*) = \frac{hq^*}{c_B \overline{D}}$$
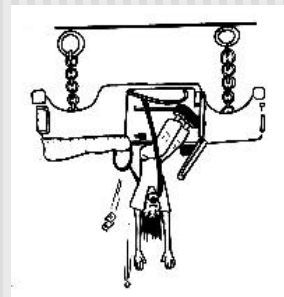
Example

Each year, Muggle Airlines needs to replace numerous seatbelts. The airline estimates that this number is normally distributed with mean 750 and standard deviation 25. The holding cost for each seatbelt is $2.50 per month. The cost of placing each order is $50 and the lead time is 1 month. Backlogging is allowed and the stockout cost (loss of goodwill etc) is assumed to be $75. What would you recommend as the reorder point?

Case 2: Lost Sales

■ Summary of results

$$q* \approx \sqrt{\frac{2K\overline{D}}{h}}$$

$$P(X \geq r*) = \frac{hq*}{hq*+c_{LS}\overline{D}}$$

Example continued ...

Suppose no passenger is willing to fly without a seatbelt, and that each stockout would result in a lost profit of $150 in addition to goodwill. How would you revise the reorder point, r*?
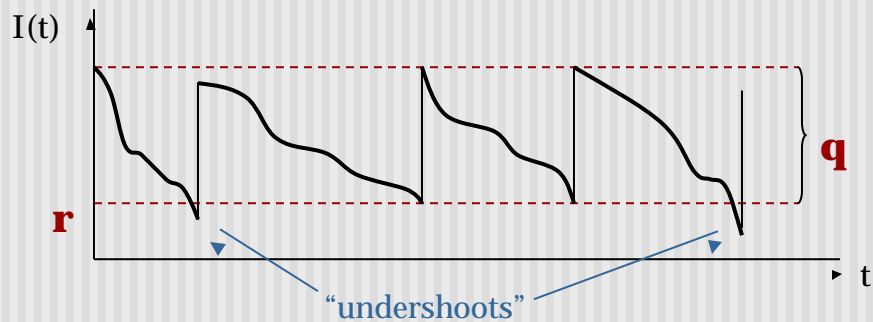
(r,q) and (s,S) policies

- ■ (r,q) also known as 2-bin policy
- ■ (s,S) policy (each demand can be for more than 1 unit)

I(t)

q

r

t

"undershoots"