Class 5

Optimization models

Demand function equation.
Revenue maximization.
Profit maximization.
BEPs.

Study materials:
Slides

Demand function

What shall we do with our selling Price, if:

P_1 = \$1,000, then Q_1 = 400 units, and R_1 = \$400,000

P_2 = \$1,750, then Q_2 = 250 units, and R_2 = \$437,500

To do:

(a) increase the price, or

(b) decrease the price, or

(c) keep the price at \$1,750?

SOLUTION: The price that MAX the revenue shall be:

\$2,250,

\$2,000,

\$1,750,

\$1,500,

\$1,250?

Demand function

Correct answer:
The “best” price to MAX the revenue would be: $1,500

P_{opt} = $1,500, then Q_{opt} = 300 units, and R_{MAX} = $450,000

To do:

(a) increase the price

(b) decrease the price

(c) keep the price at $1,750

This can be solved through (1) finding the demand function equation, and (2) solving a revenue maximization problem.

Demand function

Can be found using the approaches:

Sales tests:

P_1, Q_1

P_2, Q_2

Quantity (u)	Price ($)
250	1 750
350	1 250

NB: Demand function is not always linear.
P(MAX) and Q(MAX) are indicative.
Sales test not always linear.
Need to offset the effect of seasonality.

Demand Function Equation

Y = a + b*X, basic linear equation

P = a + b*Q, demand function equation

where:

a = P(MAX in the market) = 3,000

b = slope of the demand function line

= delta Y/ delta X = -5

Q(MAX) = - a/b = 600 (units)

NB: Mind the negative value of the variable coefficient of the linear equation "b".

Task: Revenue maximization

Q*(Revenue MAX) = - a/2b = 300 (u)

Substitute Q* into the Demand function equation, will find P* (= the price at Q* point)

P*= 3,000 +(-5)*300 = $1,500

R* = P* x Q* = 450,000

NB: R* is highest revenue possible at the current demand.

Profit maximization

Q^{**} (Profit MAX) = - (a – VC(u)) / 2b

P^{**} shall correspond to the value of Q^{**}

Data needed:

fixed and variable costs

FC = $100,000

VC(u) = $500

Q^{**} = 250(u), then

P^{**} = 1,750, then

R^{**} = 437,500, and

$Pr^{**} = R^{**} - FC – VC(u)Q^{**}$ = $212,500

Pr^{**} is highest operating profit possible at the current demand and total costs

Summary

	Quantity (u)	Price ($)	Revenue ($)	Op Profit ($)
Demand function	250	1,750	437,500	212,500
	350	1,250	437,500	162,500
Fixed Costs	100,000			
VC(u)	500			
b	-5			
a	3,000			
	Quantity (u)	Price ($)	Revenue ($)	Op Profit ($)
Qmax	600	0	0	-400,000
Q*(Revenue)	300	1,500	450,000	200,000
Q**(Profit)	250	1,750	437,500	212,500
Discriminant	4,250,000	SqRoot	2,062	
	Quantity (u)	Price ($)	Revenue ($)	Op Profit ($)
Q1	43.84	2,781	121,922	0
Q2	456.16	719	328,078	0
Nota bene:				
input cells				
results (u, $)				