Business Analytics

BSMS2002

TA sessions
Utkarsh Sahu (21f1001107@ds.study.iitm.ac.in)

https://github.com/utkarsh4tech/BSMS2002

Tag us on discourse

1. Prof. Dr. Malolan Sundararaman - @Milo
2. Prof. Swaminathan - @ram158
3. TA Utkarsh Sahu - @SahuUtkarsh03

$y = mx + c$

You have implemented a simple linear regression on a constant elasticity model $D(P) = C * P^{-\varepsilon}$ after performing a log-log transformation. The regression results indicate that the intercept is equal to 75 and the slope is equal to 30.

$\log D = \log C + (-\varepsilon) \log P$

$-\varepsilon = 30$

$\varepsilon = -30$

1) What is value of demand when price(P) is 1? C
2) What is value of elasticity?
3) Why do we use Log-Log Transformation?

$\log C$ = Intercept = 75 $\Rightarrow$ $e^{75} = C$

The demand for Diyas at a shop is as given in below figure. If the demand is expected to follow a constant elasticity curve, then answer the given subquestions

$D = C \cdot P^{-\epsilon}$ → $-(0.3)$

$P_1/P_2 = \left(\frac{P_1}{P_2}\right)^{-\epsilon}$

1) What is the elasticity of the D-R curve?
2) What is the demand at a price of Rs. 35?
3) Demand is ___ in nature?

$D = C \cdot P^{-0.3}$

$48 = C \cdot (15)^{-0.3}$

D_1 P_1

D_2 P_2

$D_1 = 48$, $P_1 = 15$

$P_2 = 44$, $P_2 = 20$

$\epsilon = \frac{\log(D_1/D_2)}{\log(P_2/P_1)}$

$D = \_\_ \cdot P^{-\epsilon}$

→ Log - Log

⇒ C, E

Revenue

$R = p * D$

$* (D_0 - mp)$

$= D_0 p - m p^2$

Profit

$\pi = p * D - c * D$

$D_0 p - m p^2 - c D_0 + m p c$

You have estimated the demand to follow the following relationship: D(p) = 100 - p. Now, you intend to maximize the revenue R(p) = D(p)* p. You find the first derivative of R(p) with respect to p, equate it to 0 and find p*. What is the value of p* ?

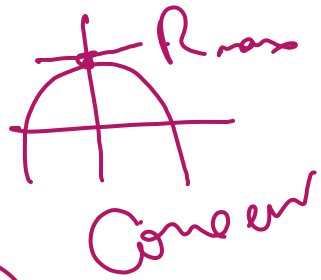
$$R(p) = D_0 p - m p^2$$

$$p^* \rightarrow \boxed{\frac{D_0}{2m}}$$

$$\frac{100}{2(1)} = 50$$

You then find the second derivative of $R(p)$ with respect to p. What do you conclude?

a. The revenue function is convex
b. The revenue function is concave



Now the same relationship of demand and price is used to maximise profit. What will be the value of p* if the marginal cost per unit is Rs. 2.

$D = 100 - p$

$D * p - c * p = \pi$

$p^* = \frac{D_0 - mC}{2m} = \frac{100 - 1 \cdot 2}{2 \cdot 1}$

$\Rightarrow 98/2 = 49$

Write Dual for the following problem

Objective: Maximize ($10Y_1 + 20Y_2 + 5Y_3 + 7Y_4 + 12Y_5 + 11Y_6$)

Constraint-1: $Y_1+Y_2+Y_3+Y_4+Y_5+Y_6 <= 200$

Constraint-2: $2Y_1+3Y_3 <= 50$

Constraint-3: $4Y_2+5Y_4+3Y_6 <= 70$

Constraint-4: $Y_1+ Y_3 <= 20$

Constraint-5: $Y_2+Y_4+Y_6 <= 70$

Constraint-6: $Y_1, Y_2, Y_3, Y_4, Y_5, Y_6$ are all non-negative

You are given the following linear program (primal):

$$\text{Maximize } Z = aX_1 + bX_2$$

$$\text{subject to}$$

$$X_1 + X_2 \leq c$$

$$dX_1 + eX_2 \leq f$$

$$X_1, X_2 \geq 0$$

where $a, b, c, d, e, f > 0$. The dual variable corresponding to the first constraint is Y_1 and the dual variable corresponding to the second constraint is Y_2. After solving the primal and finding X_1^* and X_2^*, we find that that $X_1^* + X_2^* = c$ and $dX_1^* + eX_2^* < f$. What is the value of Y_2^*

A parts supplier must assign supply from 5 warehouses (W1, W2, W3, W4 and W5) to 3 customers (C1, C2 and C3), such that the total demand of 300 units for the three customers is satisfied. The warehouse capacities are 85, 55, 75, 65 and 40, for W1, W2, W3, W4 and W5 respectively. A warehouse can supply any number of customers. The cost to supply a customer from a given warehouse is provided in Table-1.Given this information, answer the subquestions.

Customer	Cost to supply a warehouse (Rs./ unit)				
	W1	W2	W3	W4	W5
C1	100	80	75	88	133
C2	50	85	120	112	94
C3	120	75	90	93	143

1) How many decision variables are present in the standard primal formulation of the given problem?

2) How many constraints are present in the standard primal formulation of the given problem? (Note: Exclude the count of non-negativity constraints when you input your answer)

3) If W1 supplies 75 units, W2 supplies 55 units, W3 supplies 75 units, W4 supplies 60 units and W5 supplies 35 units, then how many decision variables in the dual will have a non-zero value?