CUNY Data 609 HW 12

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p576 #2

Consider a company that allows back ordering. That is, the company notifies customers that a temporary stock-out exists and that their order will be filled shortly. What conditions might argue for such a policy?

If storage costs exceed stockout costs

What effect does such a policy have on storage costs? **It reduces them**

Should costs be assigned to stock-outs? Why? How would you make such an assignment? **YES, there is a risk that a customer may leave and/or demand a lower price if an item is stocked out**

What assumptions are implied by the model in Figure 13.7?

- **demand is constant**
- **Items are not re-odered until a stockout occurs**
- **There is no cost to a stock out**

Suppose a "loss of goodwill cost" of w dollars per unit per day is assigned to each stock-out. Compute the optimal order quantity Q^* and interpret your model.

Standard Cost equation: $sc = d + \frac{sqt^*}{2}$

Loss of goodwill: $gw = \frac{wq(t-t^*)}{2}$

cost per cycle w/goodwill loss $c = d + \frac{sqt^*}{2} + \frac{wq(t-t^*)}{2}$

average daily cost:
$c = \frac{d}{t} + \frac{\frac{sqt^*}{2}}{t} + \frac{\frac{wq(t-t^*)}{2}}{t}$

Break equation into time before stockout and time ofter stockout by replacing $\frac{t^*}{t}$ with a and $\frac{t-t^*}{t}$ with $(1-a)$

$c = \frac{d}{t} + at\frac{sq}{2} + (1-a)t\frac{wq}{2}$

quantity is really a constant times time therefore subsitute $q = rt$

$c = \frac{d}{t} + a\frac{srt}{2} + (1-a)\frac{wrt}{2}$\$

$c' = \frac{-d}{t^2} + a\frac{sr}{2} + (1-a)\frac{wr}{2} = 0$

Critical point:

$T^* = \sqrt{\frac{2d}{asr+(1-a)wr}}$.

Optimal order quantity: $Q^* = rT^*$

Therefore: $Q^* = r\sqrt{\frac{2d}{asr+(1-a)wr}}$

585 #2

find the local minimum value of the function:

$f(x,y) = 3x^2 + 6xy + 7y^2 - 2x + 4y$

$\frac{df}{dx} = 6x + 6y - 2 = 0$

$\frac{df}{dy} = 6x + 14y + 4 = 0$

Solve for Y:

$6x + 6y - 2 = 6x + 14y + 4$ $6y - 2 = 14y + 4$ $-8y = 6$ $y = -\frac{3}{4}$

Solve for X $x = \frac{26}{24}$

min/max point is at $(\frac{26}{24}, -\frac{3}{4})$

Determine if this is a min or max by taking the second derivative:

$\frac{df^2}{dx^2} = 6$ $\frac{df^2}{dy^2} = 14$

This is a min since second derivative is postive

591 #5

Using the method of Lagrange multipliers, find the hottest point (x, y, z) along the elliptical orbit: $4x^2 + y^2 + 4z^2 = 16$

Where the temperature function is: $T(x, y, z) = 8x^2 + 4yz - 16z + 600$

$L(x, y, z, \lambda) = 8x^2 + 4yz - 16z + 600 - \lambda(4x^2 + y^2 + 4z^2 - 16)$

$\frac{dl}{dx} = 16x - 8x\lambda = 0$ $\lambda = 2$ $\frac{dl}{dz} = 4y - 16 - 4\lambda = 0$ $y = 6$

$\frac{dl}{dy} = 4z - 2y\lambda = 0$ $4z = 2y\lambda$ $z = 6$

$\frac{dl}{d\lambda} = 4x^2 + y^2 + 4z - 16 = 0$ $4x^2 + 36 + 24 - 16 = 0$ $4x^2 = -44$ $x = \sqrt{-11}$

The min or max temp is at $(\sqrt{-11}, 6, 6)$

Determine if this is the hotest or coldest point by second derivative test

$\frac{dl^2}{dy^2} = -2\lambda = -12$

$(\sqrt{-11}, 6, 6)$ is the hotest point since second derivative is negative.