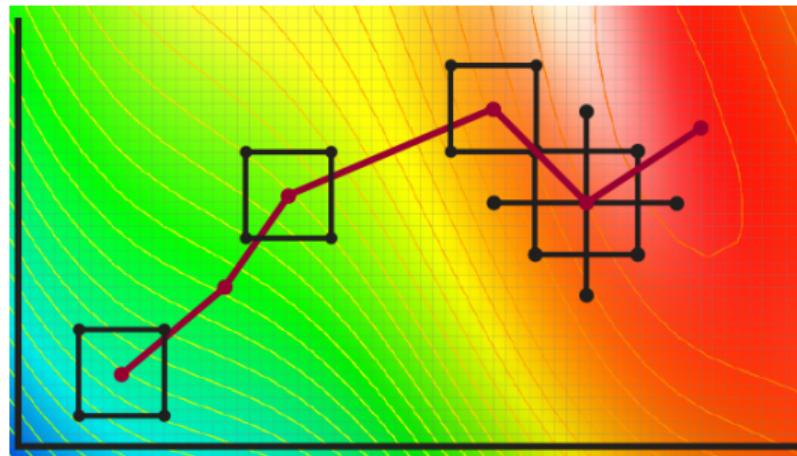


Experimentation for Improvement



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Design and Analysis of Experiments

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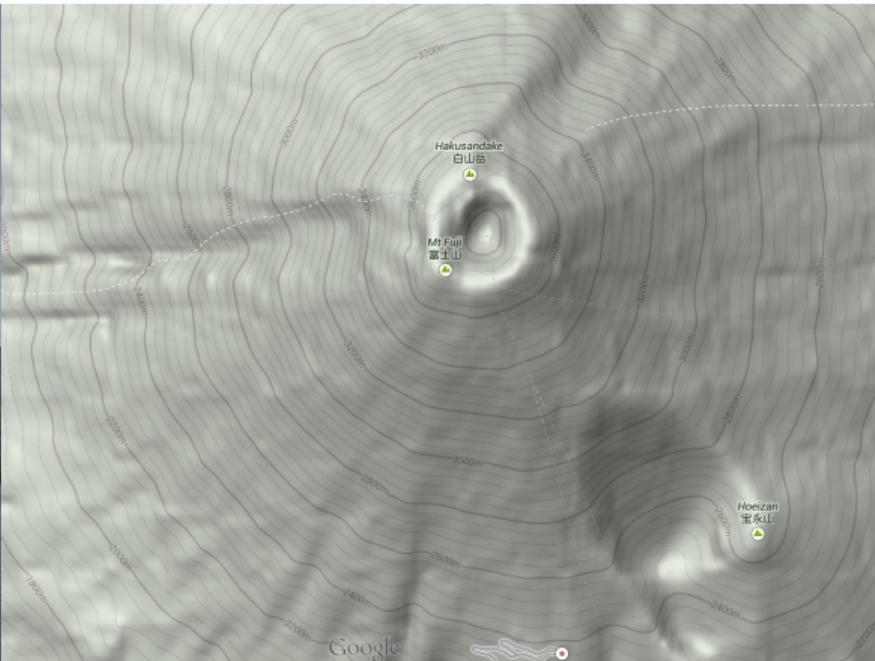
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Interpreting what contour plots are



[Wikipedia: [Wikipedia](#)]



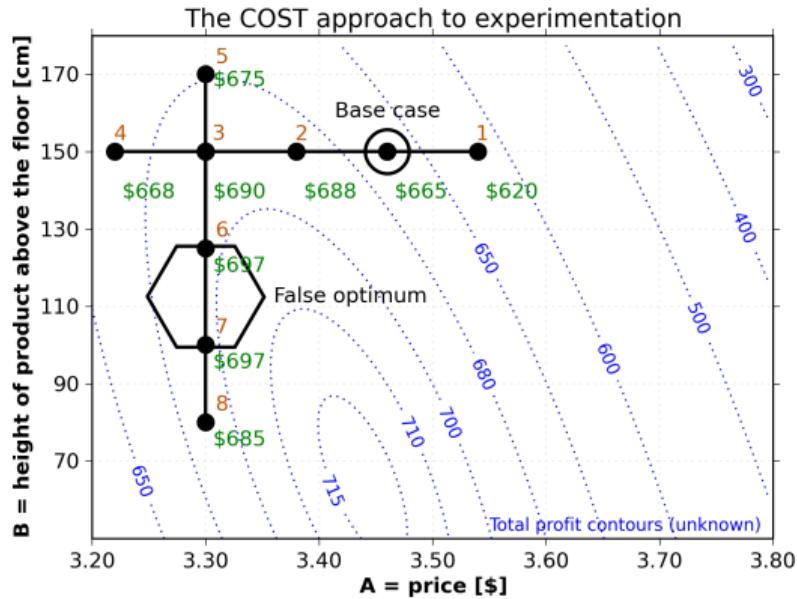
[Google Maps link]

Why we need response surface methods



[Flickr: slgc]

Some questions on how we will use response surface methods



- ▶ Observing the surface is costly
each touch on the surface = experiment
we want to do as few experiments as possible
- ▶ How do we get to the top quickly and efficiently?
- ▶ How will we know we are actually at the top?

What does the response surface consist of?

The response surface is a plot of the outcome variable:

- ▶ total sales (to maximize)
- ▶ total number of unburned popcorn (to maximize)
- ▶ height of plants (to maximize)

If you are stuck, use “profit”

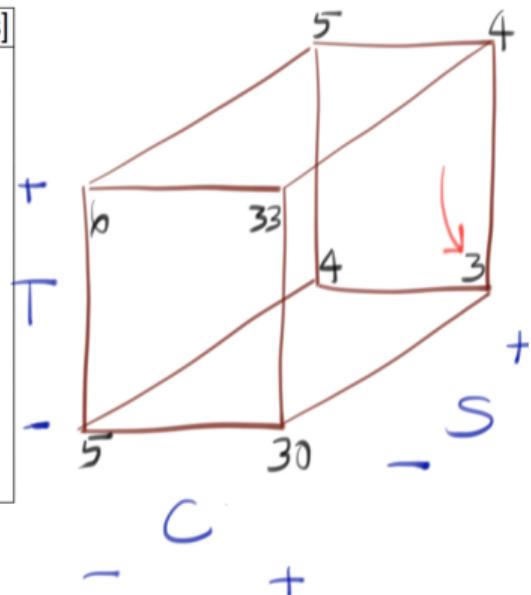
$$\text{Profit} = (\text{total income}) - (\text{total expenses})$$

What do we do if we want to **minimize**?

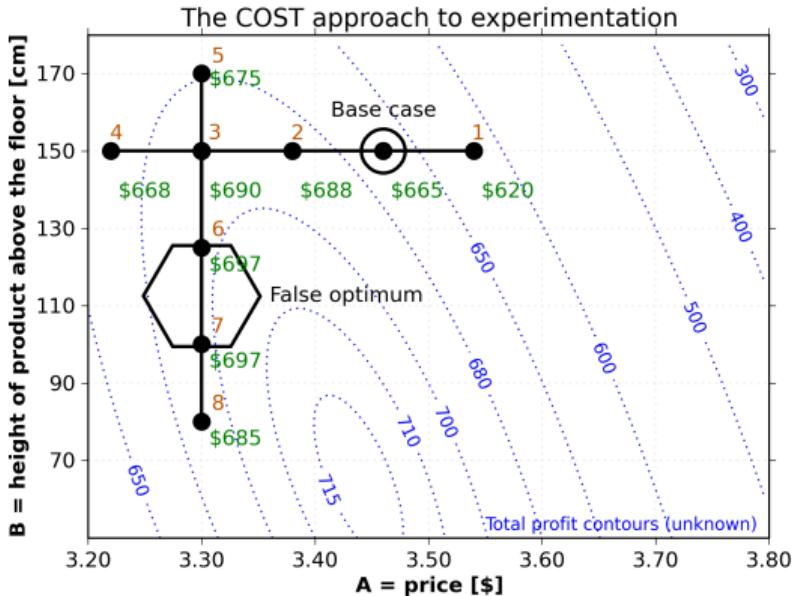
We still maximize, but just turn our response surface upside-down

maximization = - (minimization)

Standard order	C	T	S	Outcome [lbs]
1	-	-	-	5
2	+	-	-	30
3	-	+	-	6
4	+	+	-	33
5	-	-	+	4
6	+	-	+	3
7	-	+	+	5
8	+	+	+	4



Some questions to leave you with for the next video



- ▶ Which direction should we climb up that mountain?
- ▶ How do we get to the top quickly and efficiently?
- ▶ What size of steps should we take?
- ▶ What if that surface is nonlinear?
- ▶ When do we stop? “How do we confirm we are at the top?”

Hint: some of the answers were given in the prior video (popcorn optimization)