



The Stat Teaser



Stat-Ease, Incorporated

"Statistics Made Easy"™

December 1995

These Awards are for You!

DESIGN-EXPERT® SOFTWARE SURPASSES \$1 MILLION IN SALES.

Stat-Ease Corporation wishes to share these awards with our users.



The ICP Million Dollar Award is the only one based on the true test of market acceptance. It asks the question:

"Did anyone buy it?"

The answer is a resounding yes as shown at left. In October 1995, the Minnesota Software Assoc. and ICP, Inc., honored us at an awards ceremony. Stat-Ease Corp. is happy to share this award with our users. **CONGRATULATIONS!**

Last year's Million Dollar Award for our other DOE software product -- Design-Ease -- is shown to the right.



NEW 1996 workshop sites that reduce your travel costs

In addition to our previous venues of Minneapolis, Irvine, and Philadelphia, we've added **new** workshop training sites throughout the nation in 1996!

The new cities are:

Raleigh, NC (*True Hospitality!*)

Houston, TX (*Visit The Space Center*)

Cincinnati, OH (*See The Waterfront*)

Here's the complete 1996 workshop schedule. We suggest you register early.

If your problem-solving DOE skills need some honing, join us at any of these **EXPERIMENT DESIGN MADE EASY** workshops:

- ⇒ February 6-9, 1996 (**Irvine, CA**)
- ⇒ March 26-29, 1996 (**Raleigh, NC**)
- ⇒ May 21-24, 1996 (**Minneapolis, MN**)
- ⇒ July 23-26, 1996 (**Cincinnati, OH**)
- ⇒ Sept. 17-20, 1996 (**Minneapolis, MN**)
- ⇒ Nov. 5-8, 1996 (**Philadelphia, PA**)

If you're searching for breakthroughs that go beyond an introductory workshop, register for **RESPONSE SURFACE METHODS FOR PROCESS OPTIMIZATION**:

⇒ April 23-26, 1996 (**Minneapolis, MN**)

⇒ July 9-12, 1996 (**Philadelphia, PA**)

⇒ Oct. 8-11, 1996 (**Minneapolis, MN**)

Formulators and mixture processors should consider registering for our **MIXTURE DESIGN FOR OPTIMAL FORMULATIONS**:

⇒ February 20-23, 1996 (**Houston, TX**)

⇒ June 11-14, 1996 (**Minneapolis, MN**)

⇒ Oct. 22-25, 1996 (**Minneapolis, MN**)

The 1996 workshop schedule is topped off with a brand new class for those who want even more robustness in their designs. **ADVANCED DOE & ROBUST DESIGN** is being offered only once in 1996:

⇒ July 16-18, 1996 (**Minneapolis, MN**)

Want to speak with an instructor? Call us at 800-325-9807 or 612-378-9449.

"The Expert's Corner"

QUESTION: "I use [*****] to do regressions but have so many variables that the coefficients are erroneous. I know certain variables impact our process more than others, yet when I run the analysis the impact of the variable shows up as insignificant. Can your software help me?"

-- E. Mallary McHenry

Answer: "Regression of happenstance data rarely succeeds because:

1. Factors change together, so it's impossible to say which affects the response.
2. Factors are controlled within narrow ranges, so no significant change is observed.
3. Unknown factors change at same rate as measured factors -- confounding the analysis.

If you want to understand your process, make deliberate changes and observe the results. Do this via DOE. Two-level factorials, where you vary all factors high and low, make a good start. These "screening" designs identify the vital few factors and show how they interact."

Try Design-Ease software for two-level factorial designs. Free evaluation copies are available at 800-325-9807 or 612-378-9449.

-- Mark J. Anderson
Stat-Ease Corporation principal

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Using DOE to spend less time in traffic

Part One

My friends and family accuse me of letting statistics drive my life. In fact it's true, and I'm not ashamed to say it. I recently used two statistical experiments to minimize my drive to work.

DOE #1: Determine which route is the fastest.

DOE #2: Find the optimum departure time.

This newsletter article provides details on phase 1 of the study - the choice of route. I hope this prompts you to check out alternatives for your commute. By doing so, you can gain knowledge of DOE and save time every day you go to work.

Here in Minnesota we joke that there are two seasons: *winter* and *road construction*. Whichever season, it's a real challenge driving in this state. I live in Stillwater, about twenty miles due east of Stat-Ease Corporation's office. Minnesota Highway 36 takes me straight into town, but through a gauntlet of stop lights. For several years I bypassed this stretch of road by taking a sidetrack on Interstate Highways 694 and 35E. However, the state's traffic engineers, who always seem to get one jump ahead of me, put a metering light on the ramp back onto 36. This raised the question: which route would now be the least time-consuming?

To find out, I designed a one-way DOE (one-way meaning no interactions exist between routes). I included two additional routes much farther north and south, but on freeways with no metering lights. DESIGN-EASE software produced a randomized test plan with four replications on each of the four routes for a total of 16 runs. I'd leave home precisely at 6:20 a.m. and time the drive to work. Then I fed the results into the program.

The analysis of variance (ANOVA) showed significant differences overall

(exhibiting >99.99% confidence), so I did a pairwise comparison. Here are the results from the post-ANOVA analysis produced by DESIGN-EASE. Times are in minutes:

straight-in route and suffer through the stop lights. Otherwise I zoom around the bypass and rant and rave at the engineers who trapped me with the metering light on the on-ramp

TREATMENT MEANS (ADJUSTED, IF NECESSARY)

	ESTIMATED MEAN	STANDARD ERROR
1. 694/35W (North)	31.5750	0.4141
2. 694/35E/36 (Bypass)	26.5000	0.4141
3. 36 (Straight in)	26.6500	0.4141
4. 94 (South) *	33.2667	0.4781

* One of the four runs was deleted. A traffic jam caused an extreme outlier condition.

Treatment	MEAN DIFFERENCE	DF	STANDARD ERROR	t FOR H0 COEFFICIENT=0	PROB > t
1 vs 2	5.08	1	0.586	8.666	< 0.0001
1 vs 3	4.93	1	0.586	8.410	< 0.0001
1 vs 4	-1.69	1	0.633	-2.675	0.0216
2 vs 3	-0.15	1	0.586	-0.256	0.8026
2 vs 4	-6.77	1	0.633	-10.698	< 0.0001
3 vs 4	-6.62	1	0.633	-10.461	< 0.0001

The results show that routes 1 and 4, which were long-shots, should not even be considered as reasonable alternatives (>99.99% confidence that either 1 or 2 exceed either 2 or 3). But what about the choice of driving Route 3 (straight in) or taking Route 2 (bypass)? The "Prob > |t|" for this comparison is near one (0.8026), so it's very likely that the observed difference in time occurred due to chance. I could continue to vary the two routes in a random way and eventually find the difference. I decided not to bother.

With the knowledge gained by this DOE, I am sticking to the two core routes. I base my choice on other factors, not on the basis of expecting any difference in time. For example, if weather conditions make driving difficult, a too-frequent event in winter, I take the

back to Highway 36. I only hope that their reasons for doing this are statistically and economically valid. -- Mark J Anderson

NOT SURE OF SOMETHING?

Design-Ease and Design-Expert were created to make DOE easy. But sometimes everyone gets snagged on words or numbers.

Our advice? Don't be overly concerned. Perhaps a co-worker can help you interpret results. Or maybe you'd like to attend one of our nation-wide workshops.

Or, if you are a **registered** user, you may consult us **FREE**. Call 612-378-9449 to be sure you're registered. Then anytime you have a question about DOE, call us. Our answers are part of our service to you.

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NEW!

Annotated Instructor Notes for EXPERIMENT DESIGN MADE EASY.

USE THESE TO HELP YOU:

- ✓ Review the workshop in your office or home
- ✓ Augment material in the software manual
- ✓ Conduct self-study at your pace

EACH PAPERBACK-BOUND BOOK CONTAINS:

- ✓ Bound hardcopies of **INSTRUCTOR OVERHEADS**
- ✓ **ANSWER SHEETS** ✓ Instructor **"TRANSCRIPTS"**

Cost: \$95 if you've attended the workshop;
\$195 if not (you'll receive \$100
coupon to any of our workshops)

LIMITED print run. Call 800-325-9807.

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