

1. Three drugs are compared to test their relative effects on reduction of fever. Drug A is 100% aspirin. Drug B is 50% aspirin and 50% other compounds. Drug C is 25% aspirin and 75% other compounds. The drugs are randomly assigned to children ages 5-14 in the outpatient ward of a hospital complaining of the flu, with fever of 100.0F to 100.9F. Parents are telephoned 4 hours after the administration of the drug, and the reduction in fever is noted. The table below gives the data, mean reduction, and sample standard deviation for each drug.

Drug A : 2, 1.6, 2.1, .6, 1.3

Drug B: .5, 1.2, .3, .2, -.4

Drug C: 1.1, -1.0, -0.2, .2, .3

At the 0.05 significance level, test the null hypothesis that the three drugs are equally effective in reducing fever. Compute 95 percent confidence intervals for comparing all pairs of means using Tukey's method.

2. A 36 acre field is divided into a 6×6 grid of 1 acre plots, and a Latin-Square design is used to study the yields of 6 different hybrids of corn. The total yields in bushels are given below.

B	F	D	A	E	C
150	154	162	147	151	139
A	E	B	C	F	D
161	179	155	159	164	149
D	C	F	E	B	A
157	161	144	158	160	150
E	B	A	D	C	F
162	155	171	156	169	138
C	D	E	F	A	B
167	162	180	168	149	146
F	A	C	B	D	E
170	176	173	152	165	160

a. The analysis of variance table for a model that is additive in row, column, and hybrid effects is given below. Fill in all 11 of the missing entries.

source	Df	SS	MS	F
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rows				3.08
columns				4.31
hybrid				1.72
Residuals		1175		

3. A large study (sample size=200) was conducted to study the effects of three treatments for osteoporosis (loss of bone mass) in women at risk. One treatment was a large dose of calcium, the second was a large dose of vitamin D, and the third was an exercise program. The treatments were allocated in a factorial design, where the outcome measure was percent change in bone mineral density (BMD) over the study period. The objective is to find treatments or treatment combinations which help increase or maintain bone mineral density. The table below gives the mean percent change of BMD (after-before) as well as the standard deviation of change in BMD for each treatment combination.

Condition	calcium	VitD	Exercise	mean	sd	n
1	Yes	No	No	1.98	.93	25
2	Yes	Yes	No	1.96	.84	25
3	Yes	No	Yes	5.19	.92	25
4	Yes	Yes	Yes	4.72	.81	25
5	No	No	No	-0.11	1.02	25
6	No	Yes	No	0.12	.89	25
7	No	No	Yes	2.27	1.10	25
8	No	Yes	Yes	1.94	.96	25

- Compute estimates of the main effects, the two-factor interactions, and the three-factor interaction as well as their standard error estimates.
- State your conclusions about the effectiveness of these treatments for osteoporosis, and what this study implies about a possible treatment plan.

4. Suppose a large midwestern university plans to begin using the software *Mathematica* as a tool for teaching calculus. The basic aim is to divide the lecture time so that one-half of the lecture is a theoretical discussion of calculus, and the remaining half is spent on computational details and examples using *Mathematica*. All computations on homework are to be done using *Mathematica*.

Before fully implementing this approach, the university would like to take one semester to do an experiment to assess the effectiveness of teaching calculus in this manner, compared with the traditional approach. The traditional approach reserves all lecture time for a theoretical treatment of calculus, and homework solutions are obtained by hand, or with the aid of a simple calculator which cannot do symbolic integration and symbolic differentiation, two of many things that *Mathematica* can do.

Assume that several hundreds of eager students are available, as well as a pool of 10 lecturers. Also, assume that the university has plenty of available classrooms for traditional lectures as well as classrooms equipped with computers.

a. Discuss how you might construct an experiment to decide which method is more effective.

b. What are some of the possible sources of bias and variance inflation that your design strives to address?

c. What variable or variables could be used to decide the outcome (a difficult question)?

d. Briefly discuss how you would conduct the analysis.