

Stats 201B HW0 due Wednesday 1/15/2014 (in class)

A 34-run composite design was used to study a biological system with Herpes simplex virus type 1 (HSV-1) and five antiviral drugs: Interferon-alpha (A), Interferon-beta (B), Interferon-gamma (C), Ribavirin (D), and Acyclovir (E). This composite design has two parts: The first 16 runs form a half-fraction design with two levels (coded -1 and 1) and the last 18 runs form an orthogonal array with three levels (coded as -1 , 0 and 1). For each drug, three dosage levels were studied: the high level ($+1$) was determined by the minimum effective dosage at which the drug's antiviral effect reached plateau, the middle level (0) was 32 times diluted from the high level, and the low level (-1) corresponded to no drug used. Table 1 on next page shows the actual dosages used. Cell culture was prepared before the experiment. Virus and drugs were added simultaneously during the experiment manually. Two researchers conducted the experiment independently using the same cell culture, yielding two replicates. The run orders were randomized and two researchers used two different random orders. The observed data, readout, were the percentage of infected cells after the combination drug treatment. Table 2 shows the design and data, where replicate1 was data from researcher 1 and replicate2 was from researcher 2.

You can read the data using the following command in R.

```
dat=read.table("http://www.stat.ucla.edu/~hqxu/stat201A/data/hsv34.dat", h=T)
```

Here are some questions of practical interest. (a) Which drugs are effective for treating the HSV-1? (b) Which drug combinations are optimal? (c) Ribavirin (D) is known to be very toxic. Is it possible to find an effective drug combination without Ribavirin?

Analyze the data and draw conclusions. Your analysis should include building a regression model and performing diagnostics (identify potential outliers, influential points, etc.). You should consider possible transformations on the response and predictors (coded values or actual dosages).

Instruction: Describe your analysis procedure and state your conclusions in 2-3 pages. You may attach R commands or outputs in the end. Try your best. **This homework will NOT be graded.**

Table 1: Factors and levels of the antiviral drug experiment

Factor	Levels		
	Low (-1)	Mid (0)	High (+1)
<i>A</i> = Interferon-alpha	no drug	1.56 ng/mL	50 ng/mL
<i>B</i> = Interferon-beta	no drug	1.56 ng/mL	50 ng/mL
<i>C</i> = Interferon-gamma	no drug	1.56 ng/mL	50 ng/mL
<i>D</i> = Ribavirin	no drug	781 ng/mL	25,000 ng/mL
<i>E</i> = Acyclovir	no drug	156 ng/mL	5,000 ng/mL

Table 2: Design and data of the antiviral drug experiment

Run	Factor					Readout	
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	Replicate 1	Replicate 2
1	1	-1	-1	-1	-1	69.8	72.0
2	-1	1	-1	-1	-1	66.4	67.4
3	-1	-1	1	-1	-1	83.0	68.6
4	-1	-1	-1	1	-1	16.2	23.4
5	-1	-1	-1	-1	1	46.1	33.6
6	1	1	1	-1	-1	68.6	65.5
7	1	1	-1	1	-1	6.8	7.2
8	1	1	-1	-1	1	15.6	19.1
9	1	-1	1	1	-1	11.1	7.0
10	1	-1	1	-1	1	19.8	20.3
11	1	-1	-1	1	1	3.7	4.7
12	-1	1	1	1	-1	5.8	3.9
13	-1	1	-1	1	1	2.6	4.0
14	-1	1	1	-1	1	42.2	23.2
15	-1	-1	1	1	1	1.8	5.2
16	1	1	1	1	1	3.1	3.4
17	-1	-1	-1	-1	-1	78.6	81.9
18	0	0	0	0	0	13.3	16.7
19	1	1	1	1	1	3.4	3.8
20	-1	-1	0	0	1	21.4	25.2
21	0	0	1	1	-1	8.6	4.4
22	1	1	-1	-1	0	18.0	27.3
23	-1	0	-1	1	0	7.3	2.4
24	0	1	0	-1	1	17.9	23.7
25	1	-1	1	0	-1	52.9	54.3
26	-1	1	1	0	0	13.2	8.8
27	0	-1	-1	1	1	2.1	4.5
28	1	0	0	-1	-1	73.4	73.9
29	-1	0	1	-1	1	19.6	14.6
30	0	1	-1	0	-1	59.1	41.7
31	1	-1	0	1	0	1.4	2.6
32	-1	1	0	1	-1	7.3	4.8
33	0	-1	1	-1	0	22.3	24.0
34	1	0	-1	0	1	14.1	18.3