

## Block exercise

I encourage you to refer to the supplemental material on the website to help you with the following exercise. Minitab treats Block quite differently from the first example in the notes (and the original text for this course) and we want to explore the differences in this exercise. Basically, the notes treat block as just another factor when setting up the design, and so may choose lower resolution designs than would be selected if the experiment were a fractional factorial experiment with no blocking. Minitab first selects the optimal fractional factorial design for the factors at hand, and *then* blocks the design; analysis then essentially ignores the block effect.

1. *Minitab Approach.* Four factors are examined in 8 runs with the 8 runs being subdivided into two blocks. Remember that Minitab uses  $D=ABC$  as the default design generator and  $\text{Block}=AB$  as the default block generator. First, we set up Minitab's default design by selecting 4 factors in 8 runs with 2 blocks. Look at the output in the Session window to verify the block and design generators. Enter the data below and analyze the design.

| A  | B  | C  | D  | Block | Response |
|----|----|----|----|-------|----------|
| 1  | -1 | -1 | 1  | 1     | 6.1      |
| -1 | 1  | -1 | 1  | 1     | 4.8      |
| 1  | -1 | 1  | -1 | 1     | 3.9      |
| -1 | 1  | 1  | -1 | 1     | 6.5      |
| -1 | -1 | -1 | -1 | 2     | 5.4      |
| 1  | 1  | -1 | -1 | 2     | 26.1     |
| -1 | -1 | 1  | 1  | 2     | 4.4      |
| 1  | 1  | 1  | 1  | 2     | 24.7     |

2. *Notes Design Approach.* In this section, we will replicate the notes' design approach, but no new data will be analyzed. Under Create Factorial Design, select 5 factors in 8 runs. Label Factor E as Block and create the design; the levels of Block in the worksheet are used to organize your runs. Look at the alias table; if Block (identified as E in the alias table) is crossed out from the alias table wherever it appears, what is the resolution of the design? What was the resolution of the design in Part 1? How many two-way effects are aliased with Block in Part 2? In Part 1? Which design approach do you think you prefer?