Fractional Factorial Topics

- Create the fractional factorial: Basically use defining relations that we saw for confounded block designs, but keep only one of the blocks. You can expedite the process using the concept of an embedded factorial (Example 18.2). An embedded factorial for a 2^{k-q} fractional factorial is a factorial in $k-q$ factors in which all factor-level combinations appear in the design. There will always be some set of $k-q$ factors for which this is possible, you can tell by picking letters where none of their combinations appear as aliases of I. The fractional factorial should be constructed in conjunction with listing aliases.

- List the alias structure: Find all generalized interactions of the defining contrasts and create the defining relation. For example in Example 18.1 the defining contrasts are ABC and $-CDE$, giving the set of defining relations as $I = ABC = -CDE = -ABDE$. The resolution of a fractional factorial design is equal to the minimum number of letters in the set of defining relations. Once the defining relations are known we can use multiplication mod 2 to find the aliases of any effects. We usually find the aliases of at least all main effects and two-way interactions.

- Analyze the results: Find an embedded factorial design. If there is replication, then analyze the embedded factorial design and interpret the results keeping the alias structure in mind. If there is no replication, create a normal (or half-normal) plot of contrasts to pick the most important looking effects. You can reanalyze the design by projecting unto a smaller set of important-looking effects. Remember that these results are optimistic since we are selecting which terms to analyze.

- Further topics: The text discusses ideas such as confounding a fractional factorial into blocks and de-aliasing the design. One method for de-aliasing is called folding over the design.