The purpose of the computing in ST706 is primarily to connect the theory to data analysis. Especially in the basic design stuff (two-way models, latin squares, one way random effects) we will not try to duplicate the extensive computing, data analysis and interpretation that is a large part of ST506. We will however, look at what proc GLM in SAS does with two-way models to connect with the theory in class. When we move to more complicated mixed models and generalized linear models, I will have a bit more to say about what is out there for data analysis and how the options available relate to our theoretical development. However, even there the objective is not intensive data analysis, interpretation, model building, etc. which would be the focus of an applied second/topics course in regression.

I will mostly use SAS (which all of you have some experience with) for the computing. Note: You should all have an account on the “Statistics” PC in 1537, which has SAS on it. This is partly out of familiarity but also because of the extensive options and documentation for some of the procedures (in particular mixed, genmod and nonlin).

1 Getting table values in SAS or R

Working in SAS.

\[
F_{\alpha,d_1,d_2} = \text{finv}(1 - \alpha, d_1, d_2) \\
\alpha,d = \text{tinv}(1 - \alpha, d) \\
q_{\alpha,m,d} = \text{PROBMC}('\text{RANGE}', 1 - \alpha, d, m);
\]

For illustration, the following computes these quantities using \(\alpha = .05\), \(d = 23\), \(m = 4\) and, for the F, degrees of freedom \(d_1 = 3\) and \(d_2 = 24\).

Below the computations are done in both the data step and in IML;

```sas
data a;
tval = tinv(.95,23);
fvalue = finv(.95,3,23);
qvalue = PROBMC('RANGE', ., .95, 23, 4);
cvalue = cinv(.95,23);
proc print;
run;
proc iml;
tval = tinv(.95,23);
fvalue = finv(.95,3,23);
qvalue = PROBMC('RANGE', ., .95, 23, 4);
cvalue = cinv(.95,23);
print 't value with alpha = .05 and d = 23:' tval;
print 'F value with alpha = .05, d1 = 3 and d2 = 23:' fvalue;
print 'q value for Tukey with m = 4, alpha=.05 and d=23:' qvalue;
print 'chi-square with alpha = .05 and d = 23:' cvalue;
quit;
```

<table>
<thead>
<tr>
<th>tval</th>
<th>fvalue</th>
<th>qvalue</th>
<th>cvalue</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>3.02800</td>
<td>3.91356</td>
<td>35.1725</td>
</tr>
</tbody>
</table>
\texttt{tval} \\
\texttt{t value with alpha = .05 and d = 23: 1.713872} \\
\texttt{fvalue} \\
\texttt{F value with alpha = .05, d1 = 3 and d2 = 23: 3.027998} \\
\texttt{qvalue} \\
\texttt{q value for Tukey with m = 4, alpha=.05 and d=23 3.913569} \\
\texttt{cvalue} \\
\texttt{chi-square with alpha = .05 and d = 23: 35.172462}

\textit{Working in R.}

\texttt{F_{\alpha,d_1,d_2} = qf(1 - \alpha, d_1, d_2)} \\
\texttt{t_{\alpha,d} = qt(1 - \alpha, d)} \\
\texttt{q_{\alpha,m,d} = qtukey(1 - \alpha, m, d)} \\
\texttt{\chi^2_{\alpha,d} = qchisq(1 - \alpha, d)}

\texttt{> tvalue <- qt(.95,23)} \\
\texttt{> fvalue <- qf (.95,3,23)} \\
\texttt{> qvalue <- qtukey(.95,4,23)} \\
\texttt{> cvalue<-qchisq(.95,23)} \\
\texttt{> cat( "t value with alpha = .05 and d = 23", tval, "\n")}

\texttt{t value with alpha = .05 and d = 23 1.713872}

\texttt{> cat( "F value with alpha = .05, d1 = 3 and d2 = 23", fvalue, "\n")}

\texttt{F value with alpha = .05, d1 = 3 and d2 = 23 3.027998}

\texttt{> cat( "q value for Tukey with m = 4, alpha=.05 and d=23", qvalue, "\n")}

\texttt{q value for Tukey with m = 4, alpha=.05 and d=23 3.91356}

\texttt{> cat( "chi-square value with alpha=.05 and d=23", cvalue, "\n")}

\texttt{chi-square value with alpha=.05 and d=23 35.17246}