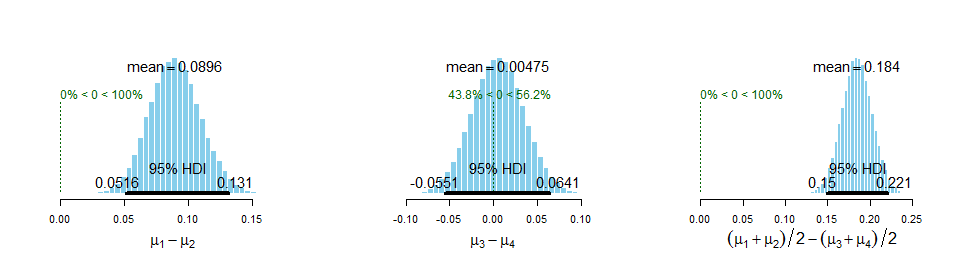
Jon Janelle

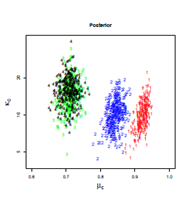
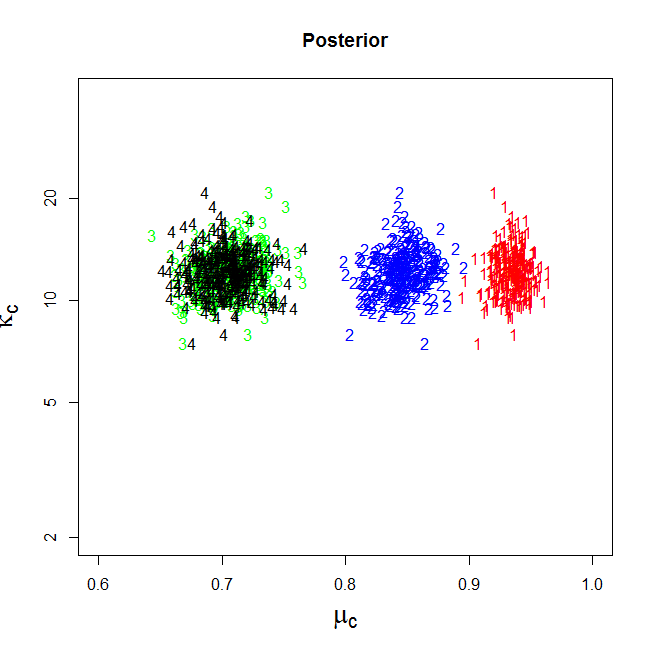
MAT 500

***Chapter 9 Homework***

**(9.2A)**

The histograms for the estimated differences, where K is constrained to be equal for all four groups, are shown below. The 95% HDI for is farther away from 0 than in Figure 9.16 because and are no longer correlated with , which reduces the random variation in and . When is chosen separately for each group, which is shown in Figure 9.19, there is a clear positive correlation between and and between and . Since is chosen separately for each group, it is possible for the K for group 1 to be randomly chosen high while the K for group is low, or vice versa. The distribution for is highly variable, which is seen in Figure 9.19, and consequently variability is added into and because of the positive association. This added variability causes more extreme values of - to be generated, which widens the HDI and pushes it closer to 0. Using the same mean K for all four groups reduces the association with and . This reduces their variability and narrows the HDI, pulling it farther away from 0.



Left Panel of Figure 9.19

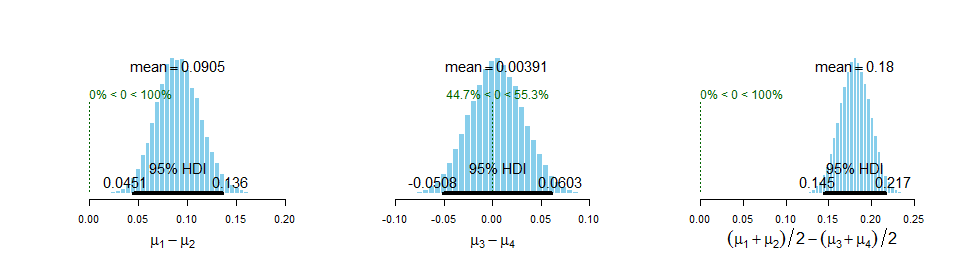
Different for Each Group

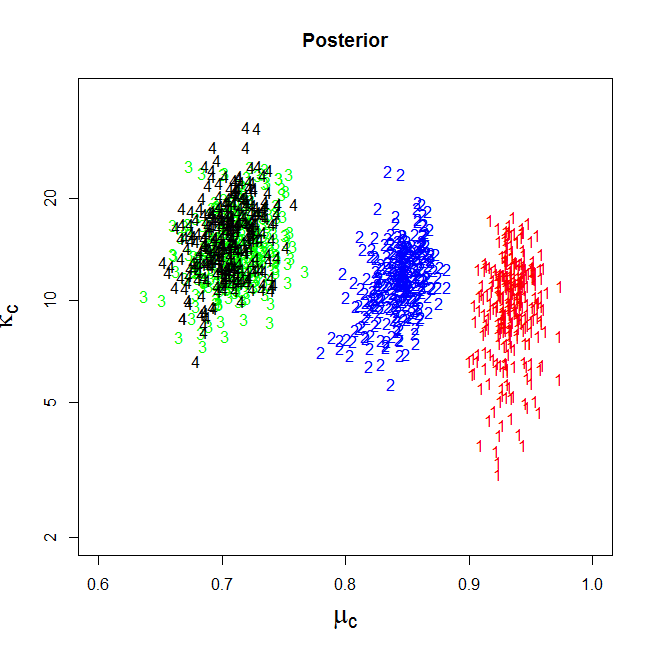
Scatterplot of Versus with

Same for Each Group

**(9.2B)**

The histograms for the estimated differences, where values of are mutually informed by an overarching distribution, are shown below. The 95% HDI for is farther away from 0 than when each group used the same K because there is less variability in the values of . The HDI for is closer to 0 than when each group used independent values because there is greater variability in the values of . When the variability in decreases, the effect of the correlation with is reduced, which reduces the variability in . Similarly, when the variability in increases, then so does the variability in . Since the variability in the values of is greater than when the same K is used, but less than when K are independent, it seems reasonable that the effect on falls in the middle.





Scatterplot of Versus with

Informed by Common Distribution

**(9.3)**

The graphs of the chains generated for the four kappas are shown below. The kappa values are mutually informed by the overarching distribution set in exercise 9.2B. Although the chains converge relatively quickly to their final regions, it does take more than 100 steps for chains to fully diverge from their equal starting values. The chains move together, which is particularly evident in the blue and red chains, until approximately 200 iterations have passed. Increasing the burn-in period would remedy this issue.

There are several signs of high autocorrelation. For example, both the red and blue chains appear stuck after approximately 75 iterations until approximately 200. Similar steaks of highly dependent values can be seen after approximately 500 and 700 iterations. Autocorrelation plots for the four kappas, shown below, confirm that high levels of autocorrelation are present. This highlights the need for thinning to reduce the dependencies between values in each chain. 