Consider a one-way ANOVA design with 5 factors and 10 replicates per factor. Suppose that factor variance $\sigma_t^2$ is ten percent of the total variance $\sigma_T^2$ (i.e., $\sigma_t^2 / \sigma_T^2 = 0.10$).

(a) Given that the total variance equals the treatment plus error variance ($\sigma_T^2 = \sigma_t^2 + \sigma_e^2$), what is $\sigma_t^2 / \sigma_e^2$?

(b) What is the 95% critical value for the F-test?

(c) What is the power of this design (assuming a test of $\alpha = 0.5$) for a fixed-effects ANOVA?

(d) What is the power of this design under a random-effects ANOVA?

(e) Given these sample sizes, what is the smallest value of $\sigma_t^2 / \sigma_e^2$ that gives a (fixed-effects) 95% test a power of 0.90? (You will need to do this, and some the remaining problems, by trial and error.)

(f) Given these sample sizes, what is the smallest value of $\sigma_t^2 / \sigma_e^2$ that gives a random-effects 95% test a power of 0.90?

(g) How many replicates per factor are needed to give the fixed-effects ANOVA a power of 90% under a test of significant with $\alpha = 0.05$?

(h) How many replicates per factor are needed to give the random-effects ANOVA a power of 90% under a test of significant with $\alpha = 0.05$?