Genome 562 Spring, 2007
Population Genetics J. Felsenstein

Homework no. 7
Due Wednesday, May 16

1. (13 points) Suppose that a diploid plant population has N individuals and is partly self-fertilizing. Every generation, a fraction s of the offspring are produced by choosing a random parent and having them self-fertilize. The other $1 - s$ are produced by sampling gametes from the whole population at random (with accidental selfing allowed). How does the identity by descent in this population change with time? Work out the equations. *Hint – You have to use a different quantity for the probability of non-IBD in a single individual and in genes from two individuals.* You can either solve for the asymptotic rate of decline of the non-IBD or you can just calculate some numbers for a value of s and a value of N. What effect does the rate s of selfing seem to have on the rate of approach to identity by descent? On the probability of identity by descent? What happens if $s = 1$?

2. (12 points) Suppose that a standard selfing-allowed diploid population has f of its individuals have great resources, so that they contribute exactly $(1/f) + 1$ gametes each to the next generation. The rest have poor resources and contribute only 1 gamete each. What is the effective population size in terms of f? If $f = 1/2$, is the effective population size larger or smaller than the census population size? (Note that in the notes there are two formulas for the way effective population size depends on variation of offspring number. This question relates to the one using actual numbers of gametes contributed to the next generation.)

In addition: Now is the time to download the program `PopG` using the link at the course web site. There are Windows, Mac OS X, and Linux executables available (plus C source code that you are welcome to recompile yourself if you want). Familiarize yourself with the program and try some cases of genetic drift with migration, with mutation, and with selection. Nothing to report back to me now, but next week you will be asked to do a computer simulation using this program. Playing around with different cases will help give you a good feel for the effects of various evolutionary forces.