Homework questions (2 points each, except where noted):

1. Define haploinsufficiency and explain why haploinsufficient dominant mutations are rare.

2. Speculate on whether, among mutations in the coding region of a gene, a missense or a nonsense mutation is more likely to be dominant.

3. Is it possible to exclude paternity by examination of a single locus (examination of the same single locus in the two individuals, one of which is conjectured to be the father of the other)? Explain (if so, how? if not, why not?).

4. Is it possible to exclude the possibility that two people are siblings by examination of a single locus (examination of the same single locus in the two individuals that may be siblings)? Explain (if so, how? if not, why not?).

5. How many marker loci does it take to be 99% sure of excluding a brother of the true father in a paternity test? Assume that all of these marker loci are "infinitely polymorphic" (i.e. that all alleles can be distinguished; in this case you can assume that if a child has inherited an allele from the brother it will be identical to one that could have been inherited from the mother's husband only if it is identical by descent). Further assume that you know the identity of the alleles at each locus for the child and the mother.

6. (3 points) In diagramming developmental signaling pathways, the symbol ---| is used to indicate repression: that the activity of one gene negatively regulates the activity of the next. For the pathway A ---| B ---| C if A is on, then B will be off. If B is on, then C will also be on. You are studying mutations that affect the sensory rays in the male tail development of C. elegans and you have defined two genes, ray-1 and ray-2. Loss-of-function mutations in ray-1 result in males with extra rays, more than the normal number. Loss-of-function mutations in ray-2 result in males with no sensory rays in the tail. Which of the following regulatory pathways would be consistent with these results (check all that apply)?

   a. ray-1 ---| ray-2 ---| ray formation.
   b. ray-1 ---| ray-2 ---| ray formation.
   c. ray-1 ---| ray-2 ---| ray formation.
   d. ray-1 ---| ray-2 ---| ray formation.
   e. ray-2 ---| ray-1 ---| ray formation.
   f. ray-2 ---| ray-1 ---| ray formation.
   g. ray-2 ---| ray-1 ---| ray formation.
   h. ray-2 ---| ray-1 ---| ray formation.

7. (3 points) In further studies you find that a ray-1; ray-2 double mutant looks identical to a ray-2 single mutant (i.e. no rays are produced). Which of the pathways is most consistent with this result?

8. Problem 18-20 from Hartwell (pg. 648)

9. Problem 11-8 from Hartwell (pg. 410).