Math 151- Exam 3 - Fall 2006   Lou Gross

Do all your work on the sheets provided, not this question sheet (please use only one side of each sheet). Be sure to SHOW YOUR WORK, and please put your name on each sheet. Please circle the final answer to each problem.

Honor Statement: By signing this statement I agree that I will not discuss any aspects of the material covered in this exam with any other individual until after 6:00PM Knoxville time on Tuesday November 14. Additionally, if anyone approaches me before 6PM requesting any information regarding the exam, I will report this individuals' action to Dr. Gross.

Signature: _____Section #:_____

1. Suppose that 9% of a population has genotype AA and there are only 3 genotypes (AA, Aa, and aa). If the population is at Hardy-Weinberg equilibrium, (5 pts each part)

  (a) what percentage of the population is type Aa ?

  (b) what is the gene frequency of the allele a in the population's gametes?

2. For infections of humans by *Mycobacterium tuberculosis* which causes the disease tuberculosis, 35% of infections are resistant to the drug rifampin, 50% are resistant to the drug ethambutol, and 15% are resistant to both drugs. (5 pts each part).

  (a) What fraction of tuberculosis infections are resistant to only rifampin or ethambutol, but not both?

  (b) Given that a tuberculosis infection is resistant to ethambutol, what is the probability that the infection is also resistant to rifampin?

  (c) Given than an infection is **not** resistant to ethambutol, what is the probability the infection is resistant to rifampin?

3. What are the sample spaces for the following experiments: (6 pts. each)

  (a) An island contains 3 species of spiders (species A, B and C) with many individuals present of each species. Two spiders are collected from the island, chosen one at a time.

  (b) An individual's blood type is determined (A, B, AB or O), as is their Rh factor (+ or -).

4. The bear population in a park is completely surveyed and it is found that there are 250 females of which 50 have bacterial eye infections. Of the total of 220 males, 80 have bacterial eye infections. A bear is chosen randomly from this population. (7 pts each)

  (a) What is the probability the bear has a bacterial eye infection?

 (b) What is the probability the bear is a male without a bacterial eye infection?

5. Among individuals entering an emergency room complaining of confusion and severe headache , medical tests indicate that 60% have had a stroke. A standard symptom of stroke is sudden numbness on one side of the body, which occurs in 90% of all individuals who have had a stroke. With other cases (non-stroke) complaining of confusion and severe headache , only 40% have numbness of one side of the body as a symptom.

(a) What is the probability an individual entering the emergency room complaining of confusion and severe headache has had a stroke and does not have numbness on one side of the body? (6 pts)

(b) An individual enters an emergency room complaining of confusion and severe headache, but does not have numbness of one side of the body. What is the probability this person has had a stroke? (9 pts)

6. Consider a family having the following pedigree for a single-locus disease. AA individuals all have the disease, Aa individuals do not have the disease, and aa individuals do not have the disease. Jill does not have the disease, and Jim is known to be of type aa. (8 pts each)
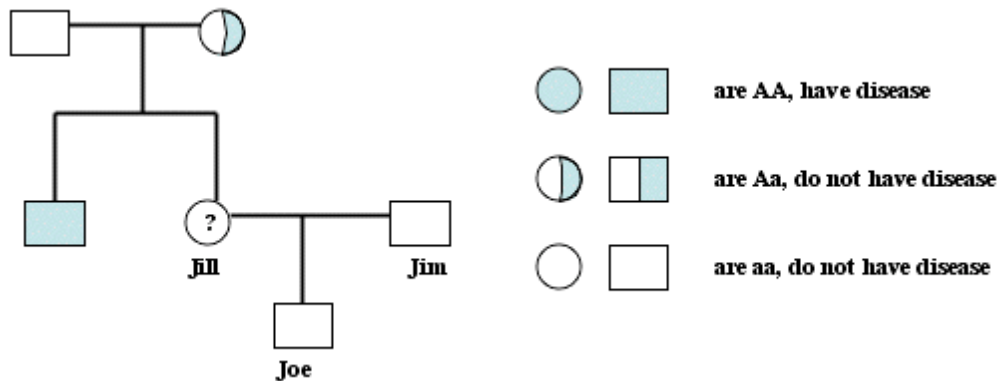
(a) What is the probability that Jill is Aa?

(b) What is the probability that Jill and Jim's child is aa?

7. A meerkats study classified individuals as helping to feed pups (F) or not, and helping to guard the colony (G) or not. It was found that 12% of all meerkats were males which helped feed pups and guard; 25% were females which helped feed pups and guard; 6% were males which fed pups but did not guard; and 8% were females which guarded but did not feed pups. Overall, 58% of the meerkats helped feed pups, 55% helped guard, and 50% were males. (6 pts each). Hint: Use a Venn diagram.

   (a) What percentage of meerkats studied were males which did not feed pups or guard?

   (b) What percentage of meerkats studied were females which did not feed pups or guard??

   (c) Given that you choose a meerkat from the study which feeds pups, what is the probability the meerkat is a female?