Exam III

Name________________________        TA’s Name________________

1 (10 points) __________  6 (10 points) __________
2 (5 points) __________  7 (5 points) __________
3 (10 points) __________ 8 (8 points) __________
4 (30 points) __________ 9 (15 points) __________
5 (7 points) __________

There are 4 pages and 9 questions.

To receive full credit for numerical problems, show your calculations and give the correct units for your answer. Partial credit may be given, so try to provide an answer for all questions.

1. In the space below, carefully draw in a single graph the immigration and extinction curves for a large island (AL) and a small island (AS). Carefully label the immigration and extinction curves for each island, and the equilibrium number of species on each island (SL and SS). You can assume that both islands share the same source pool of species.(10 points)

2. Suppose an island has reached its equilibrium of 100 species. If the maximum immigration rate (I) is 5 species/year and the maximum extinction rate (E) is 5 species/year, how many species are present in the source pool? What happens to the equilibrium number of species on the island if the source pool species number is reduced by 10%? (5 points)

3. List the assumptions of the MacArthur-Wilson equilibrium model. (10 points)
You are studying the population genetics of body color in barley beetles. Color in barley beetles is controlled by a single gene, with two alleles, C and c. The two homozygous genotypes each produce a pale yellow phenotype; the heterozygote is dark green. You survey a population of beetles and obtain the following genotypes:

CC = 80
Cc = 40
cc = 80

a) Compute the genotypic and allelic frequencies for this population. (10 points)

b) Compute the genotypic frequencies that would be expected in a population that had achieved Hardy-Weinberg equilibrium. If there were 200 beetles in this Hardy-Weinberg population, how many of them would be pale yellow? (10 points)

c) List the assumptions of the Hardy-Weinberg equilibrium model. (10 points)
5 In Mendel’s famous pea plant experiment, the cross between two heterozygous individuals produces offspring with phenotypic ratios for flower color of 3 red: 1 white. What genotypes could you cross to produce offspring with a phenotypic ratio for flower colors of 1 red: 1 white? In otherwords, the offspring of your cross produce equal numbers of red and white flowers. Draw the Punnett square for this cross and predict the frequencies of the genotypes in the offspring. (7 points)

6. A population geneticist studying wild orange trees discovers a rare phenotype: one out of every 100 orange trees produces fruit that is chocolate-flavored. She determines that the chocolate-flavored phenotype is a recessive trait controlled by one gene with two alleles (T = orange-flavor, t = chocolate-flavor). She also finds that the orange tree population is in Hardy Weinberg equilibrium for this gene.

a) what are the frequencies of the two alleles in this population (4 points)?

b) what proportion of the trees in this population are heterozygous carriers for this trait (3 points)?

c) In order to boost the yield of the chocolate-flavor fruit, she increases the inbreeding coefficient F to 0.5. What is the expected frequency of chocolate-flavored trees with inbreeding (3 points)?
8. If a population of zebras contains 200 males and 5 females, what is the effective population size? Explain whether genetic drift will be important in determining allele frequencies in this population. **(5 points)**

9. From a population genetics perspective, what are the evolutionary advantages and disadvantages of inbreeding? **(8 points)**

10. Briefly define or explain **(3 points each)**

   - evolution
   - allele
   - polyplody