Evolutionary Biology EEB 2245
Spring 2011
Problem Set 2 Answer Key

1-
a. The alternative explanation is that genetic drift caused different islands to have either checkered or banded snails. This explanation assumes that one genotype results in checkered snails and one genotype results in banded snail. It also assumes there were originally both banded and checkered snails on all the islands. Because the populations are small, genetic drift occurred, resulting in the fixation of the checkered pattern in some populations and the fixation of the banded pattern in other populations.
b. Genetic drift leads to the fixation of one genotype in a population, making all of the individuals on one island look the same which is a lack of variation within populations. Because it is by chance which genotype is fixed in a population, resulting in either the banded or checkered patterns, different islands have different patterns which is a high variation between populations.
c. If genetic drift is what led to either checkered or banded snails on different islands, you would predict the following 1- populations sizes are small, 2- there is no migration between islands, 3- if you put checkered snails on an island with banded snails, and vica versa, they would survive and reproduce successfully.

2- You would not expect the genotype frequencies to be exactly the same because genetic drift will be affecting the mountain top populations because they are small. You would expect that the genotype frequencies would change for each population but not in the same way for all 5 populations.

3- This is a relatively small population which is why the Giant Panda Bear is considered a Critically Endangered Species. Compared to the Polar Bear (also a Critically Endangered Species), the Giant Panda Bear population is very small. Because the Panda Bear population size is small, given enough time, drift will decrease genetic variation within this population.

4- a.

Trial	Freq of A allele
1	0.5 = 100 A alleles/ (100 individuals x 2 alleles)
2	0.1
3	0.5
4	0.2
5	0.5
6	0.2

b. The following answers are approximations and your answers may differ

Trial	Number of Generations to fixations of A allele
1	200
2	100
3	1,800
4	1,000
5	>10,000

6 9,000

c. No. Genetic drift influences all populations but has stronger effects in smaller populations
d. genetic drift decreases genetic variation within populations
e. Genetic drift affects smaller populations more rapidly.
f. An allele is more likely to be lost if it has a low frequency allele to start with.

5- a. about 180 individuals to have 5 out of 10 simulations retain both alleles.
b. Fewer than 5 out of 10 simulations retain both alleles. The A allele is more likely to be lost rather than fixed in the populations.

6- Yes. It is more likely an allele will be fixed if it starts with a high initial frequency and it is more likely to be lost if it starts with a low allele frequency.

7- Inbred individuals are more likely to have the same 3-5 recessive lethal alleles which means they are more likely to be homozygous recessive at a lethal gene. Individuals who do not inbreed are very unlikely to have a recessive lethal allele at the same genes as their partner which means they are much less likely to produce offspring that are homozygous recessive for a lethal gene. THIS HAS NOT BEEN COVERED IN LECTURE YET

8-
i. Migration rate = m = #migrants/population = 37/279 = 0.13
ii. Fringe-toe in western populations = F(t)
Fringe-toe in eastern populations = Fe
$F(t+1) = (1-m)F(t) + mFe$
$F(t+1) = (1-0.13)(0.12) + (0.13)(0.88) = 0.1044 + 0.1144 = 0.22$
OR
$F(t+1)= F(t) + m(Fe-F(t))$
$F(t+1) = 0.12 + 0.13(0.88-0.12) = 0.12 + 0.0988 = 0.22$
This is the same equation written 2 ways but they both produce the same answer.

iii. A population experiencing migration will experience changing allele frequencies every generation which means that it can't be in HWE (which assumes allele and genotype frequencies are constant).

9- In population genetics, migration is the movement of alleles from one population to a different population. This means that individuals have to move from one population into another and successfully reproduce. Monarch butterfly migrations are when the entire population changes locations and the allele frequencies presumably stay constant.

10- a. The probability an allele will be fixed in a population is its starting frequency. The probability that the E allele will become fixed in the population is 0.54 or 54%. The F allele will become fixed in the population with a probability of 0.46 or 46%.
b. THIS HAS NOT BEEN COVERED IN LECTURE YET

11- THIS HAS NOT BEEN COVERED IN LECTURE YET