ANSC 446 / IB 416 Population Genetics
Problem Set 3

1. Assume that the following mtDNA sequences were found in four sampled individuals.

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AATCGAGACTTTAGC
ATTCCAGATTTAAGC
ATTCCAGATTTAAGC
AATCGAGACTTTAGC
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   a) How many homologous nucleotide sites are aligned?

   b) How many sites are segregating?

   c) What is the *p* distance between the first and second sequences?

   d) How many pairwise comparisons are possible for this sample? Using unique sequences? Using all (even non-unique) sequences?

   e) Estimate nucleotide diversity.

   f) How many transitions are present between the first and the second sequences?

2. An AFLP marker in *Ambystoma* salamanders was found to be heterozygous in 390 salamanders and homozygous in 100 salamanders. Estimate the effective number of alleles at this marker.

3. Two populations of lions were sampled and found to have the following allele frequencies for two SNP sites:

	Site 1		Site 2	
	G	C	G	A
Ten African lions	.10	.90	.30	.70
Forty Indian lions	.45	.55	.35	.65

   a) Estimate the mean allele frequency of G at Site 1.

b) Estimate the weighted variance of allele frequency of G at Site 1.

c) Calculate the X^2 value for the two alleles at Site 1 (to be used towards determining if the two populations are different).

d) Calculate genetic identify and its three components for Site 1.

e) Estimate the standard genetic distance between the two lion populations at Site 1.

4. Coat color in horses is determined by multiple alleles. A complete black horse (C1 black horse with black mane and tail) is dominant to a bay horse (C2 brown horse with black legs, mane and tail) and a mahogany bay. A Bay is dominant to a mahogany bay (C3 brown horse with black roots, legs, mane, and tail). Your sample has 8000 horses (Black, bay, and mahogany bay).

Color	Observed Number
Black	4000
Bay	2400
Mahogany Bay	1600

a) Estimate the allele frequencies for C1, C2, and C3.

5. A population of caracals was sampled to determine the weight of adult males. The arithmetic mean weight of the sampled caracals was 15 kg, with a standard deviation of 3 kg.
   a) Assuming a normal distribution, within what weight range would 95% of adult male caracals be expected to fall?

   b) If 300 adult males were sampled, how many would be expected to weigh between 12 and 15 kg?