Ms. Chirby's AP Biology Review Packet
Thank you Ms Chirby!

Unit 1: Evolution and Classification

Thinking Practice Questions

1. As a field researcher you are sent to the Arizona desert to study the prairie dog species C. ludivincianus to determine if the population is in Hardy-Weinberg equilibrium. Specifically, you are studying this population with respect to the gene that determines the coat color in C. ludivincianus. This trait is coded for by a single gene (the NDY6 gene) with two alleles (N, n) and is passed down from one generation to the next. After sampling 170 of these prairie dogs, you find that 36% of the C. ludivincianus population is homozygous recessive for coat color. Assuming that the population is in Hardy-Weinberg equilibrium....
   a. What is the allele frequency of the N allele?

$q^2 = 0.36 \rightarrow q = 0.6 .... p + q = 1$ so $p = $ **0.4**

   b. What is the frequency of homozygous dominant prairie dogs?

$p^2 = (0.4)^2 = $ **0.16**

   c. What is the frequency of heterozygous prairie dogs?

$2pq = 2(0.4)(0.6) = 0.48$

   d. What conditions must be being satisfied for this population to be in HW equilibrium?

No natural selection, no sexual selection (random mating), no gene flow, no genetic drift, no mutation

2. Sixty flowering plants are planted in a flowerbed. Forty of the plants are red-flowering homozygous dominant. Twenty of the plants are white-flowering homozygous recessive. The plants naturally pollinate and reseed themselves for several years. In a subsequent year, 178 red-flowered plants, 190 pink-flowered plants, and 52 white-flowered plants are found in the flowerbed. Use a chi-square analysis to determine if the population is in Hardy-Weinberg equilibrium.

Total initial population size = 60

$q^2 = 20/60 = 1/3 \rightarrow q = 0.577 \rightarrow p = 0.423$

$p^2 = 0.179$

$2pq = 2(0.423)(0.577) = 0.488$

With a final population size of 420 (178+190+52), if the population is in HW equilibrium, the following values are expected (e)

Red flowered plants = 0.179 x 420 = 75

Pink flowered plants = 0.488 x 420 = 205

White flowered plants = 0.333 x 420 = 140

Chi square analysis

Null Hypothesis : The observed values for red-flowered plants, pink-flowered plants, and white-flowered plants are not significantly different from the expected values predicted by HW equilibrium.

Phenotype	o	e	$(o-e)^2 / e$
Red	178	75	141
Pink	190	205	1
White	52	410	313
		Sum = X^2	455

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Jiyuan Zhang

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