Hardy Weinberg Problems
Evolution
Honors Biology
Lindemulder

Name: _____

Date: _____ Hour: _____

1) A study on blood types in a population found the following genotypic distribution among the people sampled: 1101 were MM, 1496 were MN and 503 were NN. Calculate the allele frequencies of M and N, the expected numbers of the three genotypic classes (assuming random mating). Using X^2, determine whether or not this population is in Hardy-Weinberg equilibrium.

2) A scientist has studied the amount of polymorphism in the alleles controlling the enzyme Lactate Dehydrogenase (LDH) in a species of minnow. From one population, 1000 individuals were sampled. The scientist found the following genotype frequencies: AA = .080, Aa = .280; aa = .640. From these data calculate the allele frequencies of the "A" and "a" alleles in this population. Use the appropriate statistical test to help you decide whether or not this population was in Hardy-Weinberg equilibrium.

3) The compound phenylthiocarbamide (PTC) tastes very bitter to most persons. The inability to taste PTC is controlled by a single recessive gene. In the American white population, about 70% can taste PTC while 30% cannot (are non-tasters). Estimate the frequencies of the Taster (T) and nontaster (t) alleles in this population as well as the frequencies of the diploid genotypes.

4) In another study of human blood groups, it was found that among a population of 400 individuals, 230 were Rh^+ and 170 were Rh^-. Assuming that this trait (i.e., being Rh^+) is controlled by a dominant allele (D), calculate the allele frequencies of D and d. How many of the Rh^+ individuals would be expected to be heterozygous?

5) Phenylketonuria is a severe form of mental retardation due to a rare autosomal recessive allele. About 1 in 10,000 newborn Caucasians are affected with the disease. Calculate the frequency of carriers (i.e., heterozygotes).

6) For a human blood, there are two alleles (called S and s) and three distinct phenotypes that can be identified by means of the appropriate reagents. The following data was taken from people in Britain. Among the 1000 people sampled, the following genotype frequencies were observed SS = 99, Ss = 418 and ss = 483. Calculate the frequency of S and s in this population and carry out a X^2 test. Is there any reason to reject the hypothesis of Hardy-Weinberg proportions in this population?

7) A botanist is investigating a population of plants whose petal color is controlled by a single gene whose two alleles are codominant. She finds 170 plants that are homozygous brown, 340 plants that are homozygous purple and 21 plants whose petals are purple-brown. Is this population in HWE (don't forget to do the proper statistical test)? Calculate "F" (inbreeding coefficient) and explain what is happening in this population.

$$\chi_c^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Degrees of Freedom	Probability										
	0.95	0.90	0.80	0.70	0.50	0.30	0.20	0.10	0.05	0.01	0.001
1	0.004	0.02	0.06	0.15	0.46	1.07	1.64	2.71	3.84	6.64	10.83
2	0.10	0.21	0.45	0.71	1.39	2.41	3.22	4.60	5.99	9.21	13.82
3	0.35	0.58	1.01	1.42	2.37	3.66	4.64	6.25	7.82	11.34	16.27
4	0.71	1.06	1.65	2.20	3.36	4.88	5.99	7.78	9.49	13.28	18.47
5	1.14	1.61	2.34	3.00	4.35	6.06	7.29	9.24	11.07	15.09	20.52
6	1.63	2.20	3.07	3.83	5.35	7.23	8.56	10.64	12.59	16.81	22.46
7	2.17	2.83	3.82	4.67	6.35	8.38	9.80	12.02	14.07	18.48	24.32
8	2.73	3.49	4.59	5.53	7.34	9.52	11.03	13.36	15.51	20.09	26.12
9	3.32	4.17	5.38	6.39	8.34	10.66	12.24	14.68	16.92	21.67	27.88
10	3.94	4.86	6.18	7.27	9.34	11.78	13.44	15.99	18.31	23.21	29.59
	Nonsignificant								Significant		