A Hardy Population Genetics Problem Set for you to Wein(berg) about

1. Please state the Hardy-Weinberg rule in mathematical form, defining each variable as accurately and using as few words as you can.

2. Please state 6 conditions that are necessary to establish Hardy-Weinberg equilibrium, describing for each – as accurately and using as few words as you can – the level at which the condition applies (*e.g.*, gene, trait, individual, population).

An antigen is a substance that can trigger an immune response, resulting in antibody production as a defense against infection and disease. Among the various antigens that reside on human red blood cells two comprise the M and N class. These antigens are used to define blood groups to conduct human population genetic analyses. Suppose that you were presented with the following blood-type data that were obtained from the inhabitants in an isolated, freakish population (*e.g.*,. professors at a retreat):

Individual Genotype	Frequency in Population
MM	406
MN	744
NN	332

3. Please demonstrate how to test whether this population were in Hardy-Weinberg equilibrium, describing as accurately and using as few words as you can each step in your demonstration.

Suppose that you were provided with additional data:

Genotypes for Mating Couples	Frequency in Population
MM x MM	58
MM x MN	202
MN x MN	190
MM x NN	88
MN x NN	162
NN x NN	41

4. Please state which among the conditions that you listed in responding to 2 you could test with these data.

5. Please perform the test that you identified in responding to 4.

Consider the following data concerning genotypes in 9 other freakish populations:

MM	MN	NN
0	0	100
0	100	0
4	32	64

25	25	5
25	5	25
33	33	33
5	25	25
64	32	4
986049	13902	49

6. Please calculate what commonly are called ‘allele frequencies’ for each population.

7. Please state which populations may be considered to be in Hardy-Weinberg equilibrium.

In sessions 28 and 29, we discussed situations in which the proportions for phenotypes corresponding to the genotypes AA, Aa, and aa within a population were weighted by absolute fitness values W_{AA}, W_{Aa}, and W_{aa}.

8. Please state in algebraic terms the absolute fitness values for codominant selection in which advantages are conferred to individuals whose genotypes include the allele a.

9. Please define – as accurately and using as few words as you can – the terms in the equation $dq / dt = s (1 – q) q$ and provide a solution for it.

10. Please use the solution that you provided in responding to 9 to produce a plot for the case in which $s = 0.01$ and, initially, $q = 0.04$ and describe – as accurately and using as few words as you can – what that plot reveals.

11. Please describe how the plot that you produced in responding to 10 would change if the parameter s were to increase.

12. Please predict the time at which $q = 0.5$ for the case in which $s = 0.0317825$ and, initially, $q = 0.04$.

13. Given that $p + q = 1$, please use the equation that you provided in responding to 9 to obtain an equation for p.

14. Please describe how a plot for the case in which $s = 0.01$ and, initially, $p = 0.96$ would appear, using as few words as you possibly could and NO graphs.

15. Please identify a recent event that was covered by the media (*e.g.*, Internet, television, or radio news broadcast) to which population genetic theory could be applied.