1. Falconer (1981) reported a partially dominant gene in the mouse called *pg* "pygmy." At six weeks of age, they produce the following average weight phenotypes in grams (the actual weight of the heterozygote was 12, but it was reduced to 10 for this example):

$+/+ : 14, \quad +/pg : 10, \quad pg/pg : 6$

If the population of mice is randomly mating with $p+ = 0.3$, $q^{pg} = 0.7$

Genotype	Phenotypic value	Deviated	Expected freq
+/+	14	4	$0.3^2 = 0.09$
+/dw	10	0	2(0.3)(0.7) = 0.42
Dw/dw	6	-4	$0.7^2 = 0.49$

$$\text{Midpoint} = \frac{(14+6)}{2} = 10$$

a=14-10=4,

d=10-10=0

raw data $\quad \bar{y} = 0.09 \times 14 + 0.42 \times 10 + 0.49 \times 6 = 8.4$

$\sigma_y^2 = 0.09 \times 14^2 + 0.42 \times 10^2 + 0.49 \times 6^2 - (8.4)^2 = 6.72$

deviated $\quad \bar{y} = 0.09 \times 4 + 0.42 \times 0 - 0.49 \times 4 = -1.6$

$\sigma_y^2 = 0.09 \times 4^2 + 0.42 \times 0^2 + 0.49 \times (-4)^2 - (-1.6)^2 = 6.72$

$$\alpha = a + d(p_2 - p_1) = 4 + 0(.7 - .3) = 4$$

$$\sigma_A^2 = 2pq\alpha^2 = 2(.7)(.3)4^2 = 6.72$$

$$\sigma_D^2 = 4p^2q^2d^2 = 0$$

$$\sigma_Y^2 = \sigma_A^2 + \sigma_D^2 + \sigma_e^2 = 6.72 + 0 + 0 = 6.72$$

d) If the allele frequency is increased by .5, i.e. *p*+=.8, what is the expected change in mean weight? Could this result have been predicted from the answer given in part b?.

$$\bar{y} = 0.64 \times 4 + 0.32 \times 0 - 0.04 \times 4 = 2.4$$

$$\Delta y = 2.4 - (-1.6) = 4$$

A regression gives the expected change in y per change in x, α is the change in y per allele substitution. The number of allele substitutions is $2\Delta p = 2(.8 - .3) = 1$, and α=4 thus $\Delta y = \alpha(2\Delta p) = 4(2)(.8 - .3) = 4$

2) A breeder notes that as a line of chickens has become inbred over generations. Over those generations no selection has occurred but the mean number of eggs decreases while egg weight remained unchanged, what is a possible explanation for this result? (for discussion)