

Answers Problem set 3

Recall Problem 1 of Set 2: 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 $p^+ = 0.3$, $q^{pg} = 0.7$

Assume an Environmental variance of 7 and no environmental effects common to families. Compute the regression or intraclass correlation for the following

- a) one parent-offspring
- b) half-sib
- c) Full-sib

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

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

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

$$\sigma_Y^2 = \sigma_A^2 + \sigma_D^2 + \sigma_e^2 = 6.72 + 0 + 7 = 13.72$$

Parent-Offspring $b_{o,p} = \frac{1}{2}\sigma_A^2 / \sigma_P^2 = .5\left(\frac{6.72}{13.72}\right) = .245$

Half-Sib $t_{HS} = \left(\frac{1}{4}\sigma_A^2\right) / \sigma_P^2 = .25\left(\frac{6.72}{13.72}\right) = .1224$

Full-Sib $\frac{\frac{1}{2}\sigma_A^2 + \frac{1}{4}\sigma_D^2 + \sigma_{E_c}^2}{\sigma_P^2} = \frac{.5(6.72) + 0 + 0}{13.72} = .245$

d) If the frequency of the wild allele (+) increased to .5, would you expect these values to increase, decrease, or remain the same, Why (?) (for discussion)