Livestock Breeding and Genomics - Exercise 6

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Problem 1: Parent Offspring Breeding Values

As shown in the course notes, the breeding value u_i of animal i can be decomposed into the average of the parent breeding values plus a mendelian sampling term (m_i). This means

$$u_i = \frac{1}{2}u_s + \frac{1}{2}u_d + m_i$$

where animal i has parents s and d. The mendelian sampling term m_i is the deviation of the single breeding value u_i from the parent average breeding value. Because m_i is modelled as a deviation, it follows that for a large number (N) of offspring from parents s and d, the average over all mendelian sampling terms must be 0.

Your Task

Show that the average mendelian sampling term over a large number of offspring is 0 using a single locus model for the following cases.

Case 1: Homozygous and Heterozygous Parents Parent s with genotype G_1G_1 and parent d with genotype G_1G_2

Case 2: Homozygous and Heterozygous Parents Parent s with genotype G_2G_2 and parent d with genotype G_1G_2

Case 3: Heterozygous Parents Both parents s and d have genotype G_1G_2