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Statistics for laboratory scientists

Homework problems for lecture 5

1. The seed of Mendel's pea plants were either smooth or wrinkled, the result of a single gene with two alleles, **A** (smooth) and **a** (wrinkled), with **A** dominant to **a**, so that seed with genotype **AA** or **Aa** are smooth and seed with genotype **aa** are wrinkled.

We cross two pure-breeding lines, one with smooth seed and genotype **AA** and the other with wrinkled seed and genotype **aa**, to obtain the F_1 with genotype **Aa**

We self an F_1 and pick a random F_2 seed.

We grow up the F_2 and self it to obtain a random F_3 seed.

Calculate the following.

- a. $\Pr(F_2 \text{ seed is smooth})$
 - b. $\Pr(F_2 \text{ seed has genotype } \mathbf{Aa})$
 - c. $\Pr(F_2 \text{ seed has genotype } \mathbf{Aa} \mid \text{it is smooth})$
 - d. $\Pr(F_3 \text{ seed is smooth} \mid F_2 \text{ has genotype } \mathbf{AA})$
 - e. $\Pr(F_3 \text{ seed is smooth} \mid F_2 \text{ has genotype } \mathbf{Aa})$
 - f. $\Pr(F_3 \text{ seed is smooth})$
 - g. $\Pr(F_3 \text{ seed is smooth} \mid F_2 \text{ is smooth})$
2. Consider the case of two urns. Urn A has 5 red balls and 5 blue balls. Urn B has 10 red balls. I flip a fair coin. If the coin lands heads, I make 2 draws **with replacement** from urn A. If the coin lands tails, I make 2 draws **with replacement** from urn B.

Calculate the following.

- a. $\Pr(\text{balls are both red} \mid \text{coin was heads})$
 - b. $\Pr(\text{balls are both red} \mid \text{coin was tails})$
 - c. $\Pr(\text{2nd ball is red} \mid \text{1st ball is blue})$
 - d. $\Pr(\text{2nd ball is red} \mid \text{1st ball is red})$
3. Consider drawing 3 cards (***without replacement***) from a well-shuffled deck.

Calculate the following.

- a. $\Pr(\text{3rd card is a Jack})$
- b. $\Pr(\text{3rd card is a Jack} \mid \text{1st card is a heart})$
- c. $\Pr(\text{3rd card is a Jack} \mid \text{1st two cards are Jacks})$
- d. $\Pr(\text{All of the cards are Jacks})$
- e. $\Pr(\text{None of the cards are Jacks})$
- f. $\Pr(\text{At least one of the cards is a Jack})$