

Probability module Day 2 at-home exercises

Please do the following exercises at home before class. Similar exercises will be done in class the next day and turned in for a grade. Do not get hung up on the details of the biology here – these are just general problems of counting some of which I've changed to be about molecular biology

1. Which of the following numbers is larger: $\binom{93}{30}$ or $\binom{93}{31}$?
2. An E. coli library contains 24 cloned genes, of which 4 are pseudogenes (i.e. they do not make functional proteins). Each of the 24 is present in an equal number of cells. If they are plated out and four colonies are picked at random, what is the probability that all 4 will be pseudogenes?
3. If A and B are disjoint events (their intersection is the empty set) and $\Pr(B) > 0$, what is the numerical value of $\Pr(A|B)$ (give a number).

4. Assuming A and B are independent events, use the definition of independence to show that A^c and B^c are also independent of each other. (The superscript C indicates the set complement.)

Hint1: You will need to use one of Demorgan's Laws: $A^c \cap B^c = (A \cup B)^c$.

Hint 2: At some point you will end up with a sum of four terms. Try factoring it into a product of two sums.

5. If A and B are independent events and $\Pr(B) < 1$, how can you simplify the expression $\Pr(A^c | B^c)$?