Name: Class quiz 5 October 6, 2017

I) Spell-checking software catches "nonword errors" that result in a string of letters that is not a word, as when "the" is typed as "teh". When undergraduates are asked to write a 250-word essay (without spell-checking), the number X of nonword errors has the following distribution

Value of X	0	1	2	3	4
Probability	0.1	0.2	0.3	0.3	0.1

a- Is the random variable X discrete or a continuous? Why?

The variable X is discrete because it is finite.

b- Write the event "at least one nonword error" in terms of X. What is the probability of this event?

"$X \geq 1$" and the probability is

$P(X \geq 1) = P(X = 1) + P(X = 2) + P(X = 3) + P(X = 4) = 1 - P(X = 0) = 0.9$

c- Describe the event $X \leq 2$ in words. What is the probability? "There was at most 2 nonword errors" and the probability is

$P(X \leq 2) = P(X = 0) + P(X = 1) + P(X = 2) = 0.6)$

II) A tea-drinking Canadian friend of yours claims to have a very refined palate. She tells you that she can tell if, in preparing a cup of tea, milk is first added to the cup and then hot tea poured into the cup, or the hot tea is first poured into the cup and then the milk is added. To test her claims, you prepare eight cups of tea. Four have the milk added first and the other four the tea first. In a blind taste test, your friend tastes all eight cups and is asked to identify the four that had the milk added first.

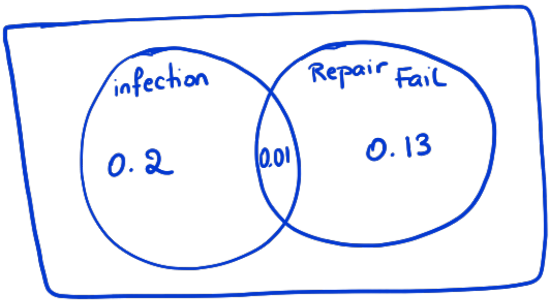
If your friend is just guessing, what is the probability that she correctly identifies the four cups with the milk added first? (Enter your probability as a fraction.)

The probability would be $=\frac{4}{8} \times \frac{3}{7} \times \frac{2}{6} \times \frac{1}{5}$

We can also think about it in terms of combinatorics so the answer would be in the form of

$$=\frac{\begin{pmatrix} 4 \\ 4 \end{pmatrix}}{\begin{pmatrix} 8 \\ 4 \end{pmatrix}} = \frac{1}{70}$$

III) You have torn a tendon and are facing surgery to repair it. The surgeon explains the risks to you: infection occurs in 3% of such operations, the repair fails in 14%, and both infection and failure occur together in 1%. Draw a Venn diagram representing the situation.



What is the probability of infection given that the repair is successful? (Round your answer to four decimal places.)

$P(\text{infection}/\text{success}) = \frac{P(\text{infection and success})}{P(\text{success})}$.

$P(\text{success}) = 1 - P(\text{fail}) = 1 - 0.14 = 0.86$

and $\quad P(\text{infection and success}) = P(\text{infection}) - P(\text{infection and fail}) = 0.03 - 0.01 = 0.02.$

$P(\text{infection}/\text{success}) = \frac{0.2}{0.86}$.

IV) About 6% of children in a country are allergic to peanuts. Choose three children at random and let the random variable X be the number in this sample who are allergic to peanuts. The possible values X can take are 0, 1, 2, and 3. What is the conditional probability that exactly two of the children will be allergic to peanuts, given that at least one of the three children suffers from this allergy? (Round your answer to four decimal places.)

You can use the tree diagram as we have shown in class before to find the probabilities or use the binomial distribution with number of trials 3 and probability of success $p = 0.06$, where X is the number of kid that are allergic.

$$P(\text{Exactly two allergic}/\text{at least one allergic}) = \frac{P(\text{Exactly two allergic and at least one allergic})}{P(\text{at least one allergic})}$$

$P(\text{Exactly two allergic and at least one allergic})$=$P(\text{Exactly two allergic})$

$= P(X = 2) = \begin{pmatrix} 3 \\ 2 \end{pmatrix} \times (0.06)^2 \times (0.94)^1$

$P(\text{At least one allergic})$=$1 - P(X = 0) = 1 - (0.94)^3$.