"Struck by Lightning" Supplementary Materials

Supplementary Exercise about "Gambler's Ruin"

(To be completed <u>after</u> completing the original Gambler's Ruin exercise.)

1. Write your final Gambler's Ruin answer (from the original Gambler's Ruin exercise) as a nice, simple formula, giving $s(a)$ for all different values of a.

2. Go over your full solution (from the original Gambler's Ruin exercise) one more time, making sure that *everyone* in your group understands it.

3. How does the true value of $s(6)$, that we originally asked about, compare to your guess a few classes ago? Do you find the true value surprising?

4. How do your guesses of the other values of $s(a)$ (from question 10 of the original Gambler's Ruin exercise) compare to the true values?

5. Suppose now that there are a total of "N" pennies (instead of "8"), so that **A** starts with a pennies and **B** starts with $N - a$ pennies, for some integer a between 0 and N. All other rules remain the same. Find the formula for $s(a)$ for this modified game. [Hint: Modify the reasoning used to solve the original game.]

6. Suppose in the original game each bet is for TWO pennies instead of one. Now what is the probability that **A** will win? [Hint: if we count money in units of two cents, then we could say that **A** started with 3 units and **B** started with 1 unit, and each bet is for one unit. Then the previous answer may help.]

7. Now suppose that on each bet, player **A** has probability "p" (instead of "1/3") of winning one penny (and probability $1 - p$ of losing one penny), for some number p between 0 and 1. All other rules remain the same. Find the formula for $s(a)$ for this modified game. [Hint: Again, follow the reasoning used to solve the original game. This time more steps change, but they still don't change by too much.]

8. Verify the figure of $1/37,650$ on page 27 of the text, for the probability of reaching \$2,000 before losing all your money when you start with \$1,000 and repeatedly bet \$10 on Red at roulette. [Hint: Since each bet is \$10, count money in terms of \$10 units, so that e.g. \$1,000 counts as 100.]

9. If you have finished all of the above, and are confident of your solutions, and that everyone in your group understands all of your reasoning, then you can either (a) offer to help other groups finish the assignment (don't tell them the actual answers, just offer them some hints – if they want – to help them move along); or (b) come up with a "lesson plan" for how you think the Gambler's Ruin problem should best be taught to new students.