“THE PROBLEM OF POINTS”
or
“THE DIVISION PROBLEM”
THE BEGINNINGS OF PROBABILITY THEORY
EARLY HISTORY

- Probably has Arabic origin, but
- Was not in Fibonacci’s Liber Abaci
- Was seen in Italian manuscripts ~1380
- Fra Luca Pacioli considered it in his *Summa* (1494). This maybe the earliest version in print. (Ore, 413)
- And in French texts where de Mere may have seen it before he posed it to Pascal ~1654.
But let’s digress:

- First, note that the problem of rolling two dice looking for at least one “one” - the problem we did last week with Carmen - is the other main problem that is mentioned in the accounts of early probability theory.

- Both Tartaglia in 1494 and Cardano in 1525 write about the dice problem.

- Galileo gives a complete table of probabilities for all throws of three dice. (I am guessing, but it may be very similar to the ones we saw last week here in class.)

- And Pascal states that in addition to Fermat and himself, De Mere and Roberval could solve the dice problem.
De Mere, a French nobleman and sometime philosopher, is the person that brings to Pascal the following problem:

(We use Fra Luca’s version.)
The Problem of Points

“A team plays ball such that a total of 60 points is required to win the game, and each inning counts 10 points. The stakes are 10 ducats. By some incident, they cannot finish the game when one side has 50 points and the other 20*.”

How should the prize money be divided between the two teams?
The Problem of Points

- A team plays ball such that a total of 60 points is required to win the game, and each inning counts 10 points. The stakes are 24 ducats. By some incident, they cannot finish the game when one side has 50 points and the other 30.

- How should the prize money be divided between the two teams?
Work on this in your groups.

We’ll return to see how your solutions connect up with those offered by Fra Luca, Cardano, Tartaglia and Pascal.
Fra Luca’s idea is to divide the stakes according to the score 50 : 30. So out of 24 points, he’d split the 24 ducats into 15 and 9 ducats.  *(Summa, 1494)*

Cardano comments on this answer: “And there is evident error in the determination of the shares in the game problem as even a child should recognize, while he [Fra Luca] criticizes others, and praises his own excellent opinion.” *(Practical General Arithmetic, 1539)*
Cardano then proceeds to give a wrong answer to the problem. He suggests a split using a ratio of 1 : 6.

Tartaglia also dealt with this problem in his *General Treatise*, 1539, and comments on Fra Luca’s work:

“His [Fra Luca’s] rule seems neither agreeable nor good, since if one player has, by chance, 10 points, and the other no points, then, by following this rule, the player who has 10 points should take all the stakes, which obviously does not make sense.”
Tartaglia’s answer looks at the difference between the scores - 20 points - one third of the 60 needed to win and finds that the first player should get one third of the second players stake: 1/3 of 12 ducats is 4. So player one should get 12 + 4 = 16 ducats and player two, 12 - 4 = 8 ducats or a 2:1 ratio.

But … Tartaglia seems to lose faith in his answer and writes: