Problem 9

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$$1 - n \sum_{i=2}^{12} Pr\big[X = i\big] Pr\big[X < i\big]^{n-1}$$

The probability that more than one player ties when rolling two dice is shown above. The summation is the probability that anyone player wins while it is subtracted from one to ensure that we calculate the complement, a tie amongst more than one of the players. The multiplication by n ensures that we account for any of the n players winning the roll. The first probability in the summation represents the probability of the winner having rolled a value between 2 and 12. The second probability accounts for everyone else ($n-1$ as the exponent) obtaining a roll value less than that of the winner.

The multiplication inside the summation is included below for the first three values of i.

$$i = 2 : 0, \text{ impossible to win with a value of 2}$$
$$i = 3 : \left(\tfrac{2}{36}\right)\left(\tfrac{1}{36}\right)^{n-1}$$
$$i = 4 : \left(\tfrac{3}{36}\right)\left(\tfrac{3}{36}\right)^{n-1}$$