

**College Bound Math Solutions #19**  
week of March 23, 2015

1. (a)  $\frac{93}{162} = 0.574$

(b)  $\left(\frac{93}{162}\right) \times 100\% = 0.574 \times 100\% = 57.4\%$

- (c) Strictly speaking, the answer is "No." However, it's a bit of a mouthful to call it a "winning rate as a three-place decimal." Some countries use "per mille," written ‰, to mean per thousand, so you can write 574‰. You might say a team has a *permillage* of 574, but would you be understood?!

Thousandths turn up in some other contexts. National birthrates, for example, are given as births per thousand of a nation's population. Salinity of seawater is stated in thousandths of salt mass per water mass (in the same units).

2. Think of it this way. Two Martians in a spaceship headed for Earth make a bet. They know that earthlings have 7 days, 5 of which are weekdays. However, they haven't got a clue about what day it is or when they'll land. Martian-A wants to bet 1 mum (Martian Unit of Money) against 1 mum that they will land on a weekday. "No fair," says Martian-B, "you have 5 ways to win and I have only 2. Let's put seven labeled tickets in the pot. You buy the 5 weekday ones for 5 mums and I'll buy the 2 weekend ones for 2 mums. Then, whoever is right gets the 7 mums that we've put in the pot." Martian-A, can see that this is fair, but to simplify, he suggests they skip the business with the pot. If you win, I'll give you the 5 mums that would have been your net gain (7-2) and if I win you give me the 2 mums that would have been *my* net gain (7-5). And that is how 5-to-2 odds were invented.

(a) There is 1 way for you to win but 29 equally likely ways for you to lose.

(b)  $\frac{1}{30}$ . There are 30 equally likely events, 1 out of the 30 is a winner for you.

(c) If it's repeated 30 times then 1 win is the most likely outcome, so it should come as no surprise and certainly not be an omen. (The next most likely number of wins for you is zero, though it's close.)

3. (a) A reasonable guess would be way less than 0.5, yet more than 0.

(b) I got 44,500 hits. As usual you can find out interesting things on the web. The chart I mentioned tells you that 93 is just barely within the range of the outcomes that are considered *not* to be significantly out of the ordinary.

(c) I googled "binomial calculator." The first hit was stattrek.com where I put 0.5, 162 and 93 in the first three boxes and found that  $P(X \geq 93) \approx 0.035$ , so a number of heads *or tails* (the distribution is symmetric) equal to *or beyond* 93 occurs with probability  $2 \times 0.035 = 0.07$ , which is not generally considered significant, that is, not enough to reject a coin as being unfair.