**Dice Problem:**

**Recall the Problem:** Your friends are playing an (endless) game of dice in the next room. You say to yourself, “I think I’ll go in and observe; I’ll stay until ‘snake eyes’ comes up.” Snake Eyes, of course, is just two ones on the dice.

You try to make a reasonable guess for how long you will be in the room before snake eyes appears on the dice. So you call up your friend who’s taking a statistics class what they think. He says, with certainty, “Oh, well if the probability of Snake Eyes is 1/36, a reasonable estimate would be to say that you’ll have to wait 36 rolls before you see snake eyes.”

You are not convinced. You call up another math major friend of yours, and he says, “Oh, that’s easy! You’re expect to, on average, walk in the HALFWAY point between two Snake Eyes, so there should be 18 on either side. So, you should expect to see Snake Eyes in 18 rolls.”

You’re baffled. Who is right, and why? What makes the incorrect argument fallacious?

**Answer:** The first person is right. This is because the future is independent of the past with a game of dice.

However, we cannot completely discredit the second person. It is true that you should expect to walk in halfway between two snake eyes, but the way he was thinking about it, it’s as if it had to be 18 on either side on average, and that is not the case. Think of it this way (the line represents a SAMPLE continuous ‘rolling’ of dice, and each X represents a snake eyes):



You pop in at any point along the line; but you are *more likely* to pop in between two snake eyes that are very far apart than you are to pop in between, say, the second and third snake eyes, which are very close together.

So although the second person is right that you are expected to walk in “halfway” between to rolls, he hasn’t taken into account this “line” visualization of the dice rolls. That’s the fallacy.

(For the people who like probability theory, most of these brain teasers will be counting based and probability based)