



Gambling Lab

With Fall Break just around the corner, some of you may be thinking of road-tripping to Vegas, so here's a lab to help you make informed choices. Aside from the slot machine, cards and dice are the dominant implements of gambling. So in this lab, you'll examine the probabilities of underlying Poker and a simple dice game. We'll use pairs of dice (6 sided) and a standard deck of cards containing 52 cards will be used to play poker (5 cards, no jokers). The probabilities of various dice values and poker hands will be calculated prior to the experiment. During the experiment, you will keep track of the dice values you roll and the hands you are dealt. The entire class's data will be collected at the end of the experiment so that you can also calculate the occurrence of each dice value and each type of hand and compare this with the expected occurrence based on the probabilities.

Theory:

Statistics is the mathematics of making the most, in spite of missing information. In the case of thermodynamic systems, it is impossible to keep track of all 10^{23} particles individual behaviors, yet we can build a physically sound model of the whole system by treating the individuals statistically.

For the dice portion of this experiment, the individual 'particles' are the two, indistinguishable dice, each with 6 possible states. Since it would be impractical to model the dice's role (initial momentum, collisions with table, ...), the best we can do is treat the dice roles statistically.

For the poker portion of this experiment, the 'particles' are 52 distinguishable cards. Since we don't know their ordering in a shuffled deck, the best we can do is treat the system statistically.

Experimental:

Dice: Each member of the class will shoot a pair of 6 sided dice 10 times. In a notebook, you need to keep track of all your rolls.

Poker: Using a standard deck of cards, the entire class will play 5 card stud with nothing wild. In a notebook, you need to keep track of all of the hands you are dealt.

At the end of the period, the data will be copied for everyone in order to be analyzed. (If you are interested in "betting", marbles, monopoly money, or

M&M's can probably be scared up. I just need to know in advance so that the "chips" can be accumulated.)

Prelab: As a part of your discussion, you need to calculate the probabilities of the various rolls: a total value of 2, 3, 4,...12 and the probabilities of the various hands before the experiment commences. More specifically, calculate the probabilities that an individual player is dealt the following hands: Royal Flush, Straight Flush(five numbers in numerical order all of the same suit), Four of a Kind, Full House (three of one kind, two of another), Flush (five of one suit), Straight (five numbers in numerical order), Three of a Kind, Two Pairs, One Pair, Nothing. This list is in order from highest to lowest rank. I will walk you through a few of the calculations in class, you'll need to perform the rest.

Questions:

1. What are the probabilities of the different rolls occurring?
2. What was the actual occurrence / total number of rolls?
3. Do your answers in questions 1 and 2 agree within the uncertainty associated with the limited number of rolls?
4. What are the probabilities of the different hands occurring?
5. What was the actual occurrence / the total number of hands dealt?
6. Do your answers in questions 1 and 2 agree within the uncertainty associated with the limited number of hands dealt?
7. If you bet while playing these games, did you win or lose?
8. Did anyone appear to be "luckier" or "un-lukier" than the rest? Does the range in 'luck' fit within the uncertainties associated with the limited number of rounds played?
9. Qualitatively, what will happen to the calculated probabilities if a combined deck of 104 cards (two decks) were to be used? Quantitatively, support this by calculating the probability of a Royal Flush when two decks are used.