Chapter 14

Randomness to Probability

Randomness

- An event is random when the possible outcomes are known, but do not know which one will occur
  - flipping a coin
  - picking a card from a deck
  - taking a sample from a population

Randomness

- Despite the fact that these events are unknown, the long term behavior of the event is predictable
  - 50% heads
  - each card has 1/52 chance of being drawn

Probability

- probability emerges from the idea of long term predictability
- the long term proportion of times a specific outcome occurs
  - always between 0 and 1
- P(A) = probability of event A occuring
- P(not A) = 1 - P(A)

Probability

- P(flipping a head)= .5
- P(don't flip a head)= 1 - .5 = .5
- P(drawing the10 of hearts) = 1/52 =.01923
- P(not drawing the 10 of hearts) =
- 1 – (1/52) = (51/52) = .98077
- The probability of the sum of all possible events is equal to 1

Independence

- When attempting to observe random phenomena, each trial needs to be independent of all other trials
  - i.e. the outcome of any one trial does not influence the outcome of any other trial
- Only observe true probability by observing many trials

Independence

- Suppose a fair coin is flipped 5 times and 5 heads are observed. You may be inclined to think that tails is due. **Incorrect!!** Because these trials are independent, it is equally likely that a head or a tail will be observed on the ensuing flip.

Roulette

- The numbers 1 through 36, 0, and 00 have an equally likely chance of being obesrved. They now have signs showing the preceding 10-15 numbers that have been observed. Does this sign give any advantage when placing our bets??

Law of Large Numbers

- In repeated trials, as the number of trials increases (**goes to infinity!!**), the long-run relative frequency of repeated independent trials gets closer to the true frequency.

LLN

- Flip a fair coin 5 times and we observe 5 tails. We then flip the coin 100 more times and observe 52 tails and 48 heads. After 105 flips we expect to have same number of heads and tails. We had a total of 57 tails and 48 heads. LLN says that if we kept flipping this coin **forever** then we would get closer to “50/50.”