Basic Probability, Soc 303

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Contents

Administration Items

1. Homework 1 is due Next Monday!
2. Today, we are covering Probability, Hypothesis, and Research Methods (briefly!)
3. You will have lab time again to work on your homework....keep working on it :)
4. Next Week: Chapters 7 and 8 :)
5. Keep working on the research part of your drafts.

Probability Key Concepts

- Experiment: process by which an observation (or measurement) is obtained.
- Simple Event: the outcome that is observed on a single repetition of the experiment.
- Event: collection of simple events.
- Mutually Exclusive: when one event occurs, the other cannot, and vice versa.
- S: set of all simple events.
- Probability of an event A is equal to the sum of the simple events contained in A.
- The *union* of events A and B, denoted by $A \cup B =$ either A or B occurring.
- The *intersection* of events A and B, denoted by $A \cap B =$ BOTH A AND B OCCUR.
- The *complement* of an event A = A^C ... where A does not occur!
- Independent: Two events, A and B, are said to be *independent* if and only if the probability of event B is not influenced or changed by the occurrence of event A, or vice versa.
- Random Variable: A variable x is a *random variable* if the value that it assumes, corresponding to the outcome of an experiment, is a chance or random event.
- Experiment: process by which an observation or measurement is obtained.

Probability

- In previous Chapters we introduced topics such as qualitative (Nominal and Ordinal) and quantitative (Interval and Ratio) variables. Today, we are talking about Discrete Random Variables and Their Probability Distributions.
- However, even qualitative variables can generate numerical data if the categories are numerically coded to form a scale. For example, if you toss a single coin, the qualitative outcome could be recorded as "0" if a head and "1" if a tail.
- We can record outcomes and describe the results using probability and statistics.

Concepts

An experiment is the process by which an observation or measurement is obtained.

Examples:

1. Recording weight
2. Recording vital signs in the E.R.
3. Recording an opinion (yes or no)
4. Toss two coins
5. Values for a card

Simple Events

These are the outcomes that are observed on a single repetition of the experiment. We can use a deck of cards to record values for probability and statistical purposes :)

- The basic element to which probability is applied.
- One and only one simple event can occur when the experiment is performed.

A simple event is denoted by E with a subscript. E_a.

Each simple event will be assigned a probability, measuring "how often" it occurs. The set of all simple events of an experiment is called the sample space, S.

TOSSING A COIN

Outcome	Frequency
E_{Head}	number
E_{Tail}	number

S = $\{E_{Head}, E_{Tail}\}$

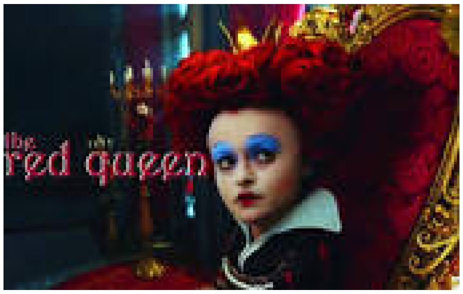
Events

A collection of simple events. For example a deck of cards.

- ♡ Hearts: King, Queen, Jack, 10, 9, 8, 7, 6, 5, 4, 3, 2, Ace
- ♣ Clubs: King, Queen, Jack, 10, 9, 8, 7, 6, 5, 4, 3, 2, Ace
- ♠ Spades: King, Queen, Jack, 10, 9, 8, 7, 6, 5, 4, 3, 2, Ace
- ♢ Diamonds: King, Queen, Jack, 10, 9, 8, 7, 6, 5, 4, 3, 2, Ace

Total Cards = 52 (26 Black and 26 Red)

Basic probability without replacement for a red queen (think Alice in Wonderland):



P(Red) = 26/52 or ½ , P(Queen) is 4/52 or 1/13 so P(Red and Queen) = ½ * 1/13 = 1/26

The Probability of an Event

The probability of an event A is found by adding the probabilities of all the simple events contained in A.

- We can find probabilities by using:
  - Estimates from empirical studies
  - Common sense estimates based on equally likely events
- Coin Toss: P(Head) = 1/2 = .50 = 50%
- 10% of a sample have red hair: P(Red Hair) = 10% = .10

For this class

You will not be required to know probability theory, rather, you will be asked to engage in probability techniques through statistical analysis. This is a back story. Statistics is built on the probability that your hypotheses are set up in such a way, that you can see the probability that you accept or reject the null in favor of the alternative.

Brief Example

In a certain population, 10% of the people can be classified as being high risk for a heart attack. Three people are randomly selected from this population. What is the probability that exactly one of the three are high risk?

- Let P = Probability and Set up definitions:
  - H = high risk and N = not high risk
- Set up the events:
  - P(H) = .10
  - P(N) = .90

- Math: P(H) + P(N) = 1.0 –> .10 + .90 = 1.00 :)
  - P(exactly one high risk) = P(HNN) + P(NHN) + P(NNH)
  - = P(H)P(N)P(N) + P(N)P(H)P(N) + P(N)P(N)P(H)
  - = (.1)(.9)(.9) + (.9)(.1)(.9) + (.9)(.9)(.1)= 3(.1)(.9)2 = .243
- Answer: 0.243

Next Week

- Homework one is due: 9/29/14 Monday
- Chapter 7: Statistical Inference
- Chapter 8: Probability – z and t test
- Keep working on your writing drafts…research and documentation
- Homework two will be released on 10/06
- Midterm exam: 10/22/14