

# Module 5a – Probability (Ch 12 and 13)

[Review Against All Odds: Unit 18](#)

[Review Against All Odds: Unit 19](#)

# Probability in Statistics

- Inference is based on laws of probability
  - We have “confidence” in certain theories and explanations based on evidence (not proof)
- Chance/Random Behavior
  - Unpredictable in the short term but predictable in the long run (Example: Casino industry)
- Personal Probability
  - Gut feeling – not based on evidence or analysis (Example: She’s due for a hit; I have a feeling...)

# Probability in Statistics

- Probability Model: A list of all possible outcomes with the probability of each
  - Ex: Heads: .50; Tails: .50
  - Ex: Hearts: .25; Spades: .25; Clubs: .25; Diamonds .25
- Connection to percentiles
  - Probability of any randomly selected individual scoring above average on SAT: .50 (50%)

# Probability Rules

- 1: A probability value has to be between 0 and 1 (0 to 100%)
- 2. All possible outcomes combine to equal 100 percent
- 3. Addition Rule for disjoint events: The probability that ***one or the other*** occurs is the sum of the two.
  - $P(A \text{ or } B) = P(A) + P(B)$
- 4. Multiplication Rule for independent events: The probability that ***both events*** occurs is the product of the two.
  - $P(A \text{ and } B) = P(A) * P(B)$

# Probability Rules - example

- M&Ms – Probability Model (fictional)
  - Red: .10; Blue: .10; Green: .10; Orange: .20; Brown: .30; Yellow: .20
- Addition Rule: Pick one M&M at random. What is the probability that it is either Red **OR** Blue?
- $P(A \text{ or } B) = P(A) + P(B)$
- Multiplication Rule: Pick two M&Ms at random. What is the probability that they are Orange **AND** Yellow?
- $P(A \text{ and } B) = P(A) * P(B)$