

# Stat 101 – Lecture 20

## Probability

- Subjective (Personal)
  - Based on feeling or opinion.
- Empirical
  - Based on experience.
- Theoretical (Formal)
  - Based on assumptions.

1

---

---

---

---

---

---

---

## The Deal

- Bag o' chips (poker chips).
  - Some are red.
  - Some are white.
  - Some are blue.
- Draw a chip from the bag.

2

---

---

---

---

---

---

---

## The Deal

- Draw a red chip win 3 bonus points.
- Draw a blue chip win 1 bonus point.
- Draw a white chip lose 1 bonus point.

3

---

---

---

---

---

---

---

# Stat 101 – Lecture 20

**Is this a good deal?**

- Subjective (personal) probability
  - Based on your beliefs and opinion.
- Empirical probability
  - Based on experience.
  - Conduct a series of trials.
  - Each trial has an outcome (R, W, B).

4

---

---

---

---

---

---

---

**Empirical Probability**

- Look at the long run relative frequency of each of the outcomes.
  - Blue
  - Red
  - White

5

---

---

---

---

---

---

---

**Theoretical Probability**

- Look in the bag and see how many
  - Blue chips –
  - Red chips –
  - White chips –
- Assumption
  - Each chip has the same probability of being chosen. Equally likely.

6

---

---

---

---

---

---

---

# Stat 101 – Lecture 20

## Law of Large Numbers

- For repeated independent trials, the long run relative frequency of an outcome gets closer and closer to the true probability of the outcome.

7

---

---

---

---

---

---

---

## Probability Rules

- A probability is a number between 0 and 1.
- Something has to happen rule.
  - The probability of the set of all possible outcomes of a trial must be 1.

8

---

---

---

---

---

---

---

## Probability Rules

- Event – a collection of outcomes.
  - Win bonus points (Blue or Red chip)
- Complement rule
  - The probability an event occurs is 1 minus the probability that it doesn't occur.
  - $P(A) = 1 - P(A^C)$

9

---

---

---

---

---

---

---

# Stat 101 – Lecture 20

## Probability Rules

- Disjoint events – no outcomes in common.
- Addition Rule for disjoint events.
  - $P(A \text{ or } B) = P(A) + P(B)$
  - $P(\text{Blue or Red}) = P(\text{Blue}) + P(\text{Red})$

10

---

---

---

---

---

---

---

---

## Probability Rules

- Independent trials
- Multiplication rule for independent trials.
  - $P(\text{outcome 1}^{\text{st}} \text{ and outcome 2}^{\text{nd}}) = P(\text{outcome 1}^{\text{st}}) * P(\text{outcome 2}^{\text{nd}})$

11

---

---

---

---

---

---

---

---

## Example

- What is the chance that two people in a row win bonus points?

$$P(\text{win 1}^{\text{st}} \text{ and win 2}^{\text{nd}}) = P(\text{win 1}^{\text{st}}) * P(\text{win 2}^{\text{nd}})$$
$$P(\text{win 1}^{\text{st}}) = P(\text{Blue or Red}) = P(\text{Blue}) + P(\text{Red})$$
$$P(\text{win 2}^{\text{st}}) = P(\text{Blue or Red}) = P(\text{Blue}) + P(\text{Red})$$

12

---

---

---

---

---

---

---

---