

Stat 101 – Lecture 20

Probability

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

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The Deal

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

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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.

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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).

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Empirical Probability

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

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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.

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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.

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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.

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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.
 - $P(A) = 1 - P(A^C)$

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Probability Rules

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

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Probability Rules

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

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Example

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

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

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