

Stat 101L: Lecture 21

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 blue chip give everyone 3 Extra Credit Points.
- * Draw a red chip give everyone 1 Extra Credit Point.
- * Draw a white chip take 1 Extra Credit Point away from everyone.

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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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Formal Probability

- *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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Formal Probability

- *Event – a collection of outcomes.
 - Win extra credit 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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Formal Probability

- * 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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Formal Probability

- * 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 draws in a row will result in everyone getting extra credit 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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