

# Stat 104 – Lecture 12

## 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 points.
- Draw a white chip lose 1 bonus points.

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# Stat 104 – Lecture 12

## 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, B, W).

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## Empirical Probability

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

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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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## Theoretical Probability

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

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## Properties of 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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## Surviving the Titanic

	Crew	First	Second	Steerage	Total
Saved	214	199	119	174	706
Lost	685	130	166	536	1517
	899	329	285	710	2223

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# Stat 104 – Lecture 12

## Probability of survival

- Relative frequency of saved
  - $706/2223=0.318$  or 31.8%
- Relative frequency of lost
  - $1517/2223=0.682$  or 68.2%
- Relative frequency of saved and first class
  - $199/2223 = 0.090$  or 9.0%

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## Probability Rules

- Complementary Event – collection of outcomes not in the Event
  - Event: Saved
  - Complementary event: Lost
- Complement rule
  - The probability of a complementary event occurs is 1 minus the event's probability.
  - $P(A^C) = 1 - P(A)$

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## Disjoint Events

- Two events, A and B, are disjoint if they do not have any outcomes in common.
- $P(A \text{ and } B) = 0$
- Example: First Class and Second Class on the Titanic.

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