Distributions and Simulation: Key Ideas in Statistical Reasoning

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Agenda

- Welcome & Introductions

Distributions and Simulation: Key Ideas in Statistical Reasoning

- Introduction to Data
  - Distributions
  - Summary statistics
    - Mean as fair share
    - Means and deviations
    - Mean as balance point
- Introduction to Inference
    - Comparing populations
    - Sampling
    - Comparing samples

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Expected Outcomes:

- **Explore** a sequential, coordinated series of concepts that support the development of key statistical standards
- **Learn** how TI technology can give students meaningful opportunities to develop an understanding of variability and distributions, and how simulation can be used to explore variability in sampling and the fundamental reasoning behind inference on two populations.

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Suppose you are given the maximum speeds of a variety of animal types. Predict what you think "typical values" for the speeds will be. For example, "What do you think are typical top speeds of land animals?"

Adapted from Kader & Memer, 2008

An Introduction to Data

The story in the data- what is typical and what is not:

Shape, Center and Variability

Adapted from Kader & Memer, 2008

Mean as Fair Share

A Statistical Exploration

The total number of goals scored by all the teams in a tournament is 54. If the teams were evenly matched, they would have scored 6 goals each.

Make a graph showing the number of goals each team might have scored using the constraints: exactly four of the teams had 3 goals, one team had the most goals at 10, and every team had at least 1 goal.

Adapted from Kader & Memer, 2008

Which tournament “has the least evenly matched teams”? The most? Rank the teams in terms of least to most evenly matched.

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The question: in which tournament would there be the greatest variability among the teams? The least?

How can I “measure” the variability in order to rank the tournaments?

9
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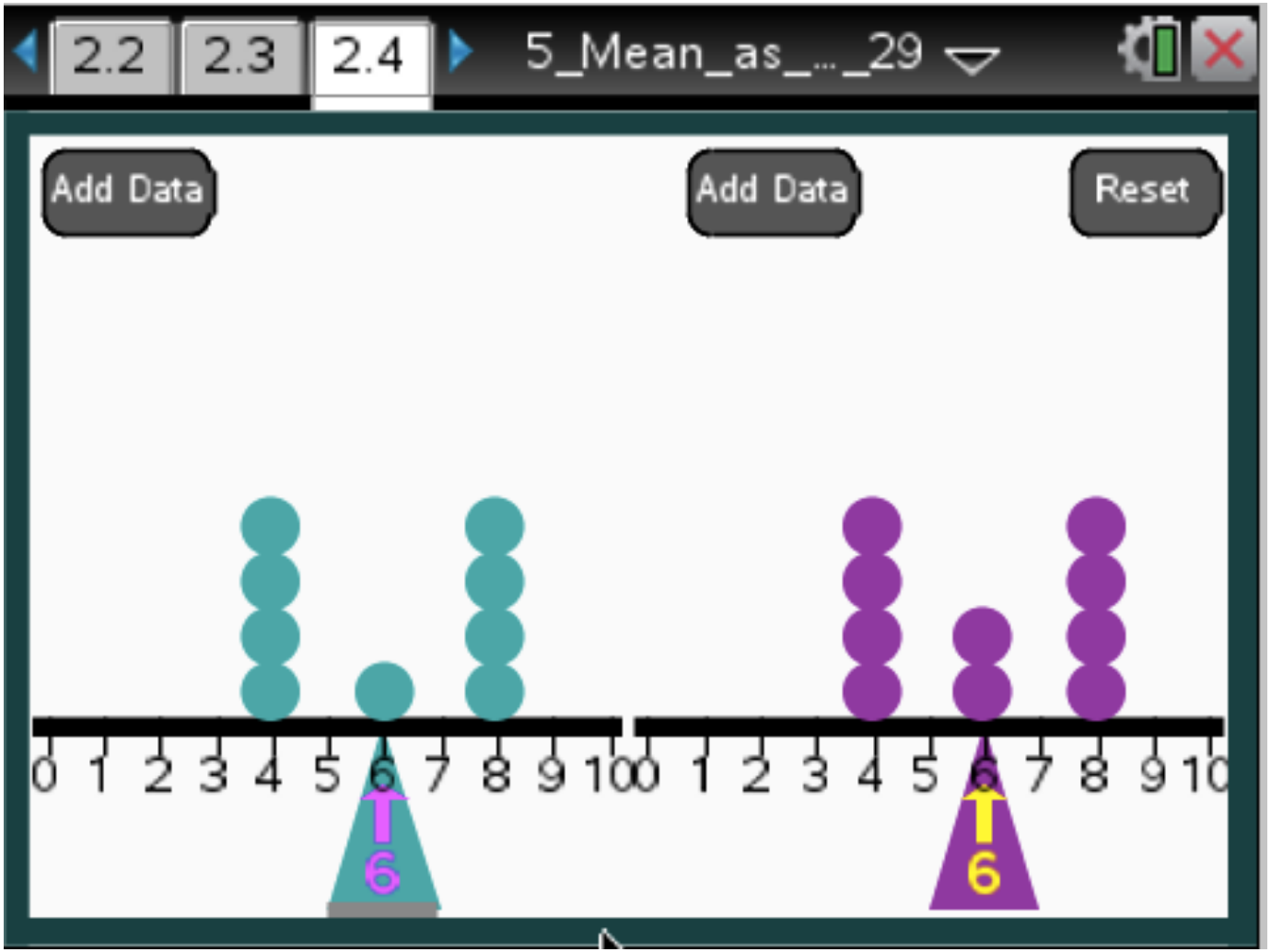
Which tournament had the greatest variation in teams?



Connecting to high school:

» Transforming the concept of MAD to standard deviation

How would you find the standard deviation in the number of goals for the teams in a tournament if the total number of goals per team was 2, 6, 8, 2, 8, 7, 3, 8,10?

11
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MAD to SD

standard deviation=

$$\sqrt{\frac{\sum(x_i-\bar{x})^2}{n}}$$

where x_i = a data value, $\bar{x}$ is the mean and n is the number of data values.

12
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Introduction to inference

Where do we start and where do we go?

13

I wonder . . .

Are boys taller than girls?

Tonight's data collected via

Random Sampler, a part of Census at School—United States courtesy of American Statistical Association

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Inference in grades 6-12:

- compare two populations directly
- study how samples relate to population
- compare a sample from each of two populations
- study sampling distributions of means
- quantify expected variability (w/in sampling distributions)
- quantify uncertainty (confidence level, alpha-value)
- relate CL/alpha to sampling distribution

16
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Grade 6:

Develop understanding of statistical variability.

- 1. Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers.
- 2. Understand that a set of data collected to answer a statistical question has a distribution . . . which can be described by its center, spread, and overall shape.
- 4. Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

17

Grade 7:

Use random sampling to draw inferences about a population.

» 2. Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.

Draw informal comparative inferences about two populations.

» 3. Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability.

» 4. Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.

18