

PowerPoint Notes on Statistics, Probability, and Decision Making

Slide 1: The introductory cartoon, humorous, shows us several paths that may lead to our goal in life. But which one do we choose? Hopefully, probability and statistics can shed some light on this.

Slide 2: Suppose we have several measurements. Which one is closest to the "true" value? Most people would select the average but may not know why. (Law of Large Numbers)

Slide 3: We need to take a better look at our data as this slide shows. Suppose you calculate an average. But there is one point, the furthest from the others, 25.50. Is it an outlier, a bad point? How can we tell?

Slide 4: We could eliminate it but we've been told that we need a good reason to do so. Do we have a reason? Students must be taught that they shouldn't get rid of data unless they have a scientific reason. So we may have to fall back on statistics to make the decision.

Slide 5: The slide shows us how we can tell if we have a bad point. Note the colored fruit; good fruit is red and bad fruit is blue.

Slide 6: We need to make a decision of whether to get rid of it or not. But how?

Slide 7: If you have a small data set, one common way is applying the Q test. The slide shows how. You should tell students that they can only do this once.

Slide 8: Q test statistic for making a decision is shown. The fewer the points, the wider the range.

Slide 9: Q test decision making.

Slide 10: Another way to decide if you have a large data set that is random is to use the normal distribution. Here we apply the "3 sigma rule." If a value is outside of 3 sigma, it should be rejected. Remember that 3 sigma corresponds to 99% confidence.

Slide 11: Outliers are important factors in scientific data. They may skew the data and give us a wrong interpretation. But they are a fact of life when ever we gather data.

Slide 12: This shows a quality control chart that is used to regulate the quality of manufactured goods. In industry quality control is critically important and procedures such as ISO 9000 have been developed as standards across industries.