

Section 5.6

Confidence Intervals (day 2)

Learning targets:

Understand how the margin of error, confidence level and sample size affect each other.





Sample size, margin of error and confidence level affect each other:

- All survey results using samples contain **uncertainty** (reflected in the margin of error and confidence level).
- **Larger sample sizes** in general produce **more reliable results** (seems pretty reasonable).
- **“More reliable” means either:**
 - **Lower margin of error; or**
 - **Higher confidence level**

But how, exactly, are these last two things related if the sample size is unchanged?

- Think of “**confidence interval**” as being a **target** and “**confidence level**” as how likely you are to hit the target.
- A low margin of error creates a smaller target.
Ex. $50 \pm 5 \rightarrow 45 \text{ to } 55$ (target is 10 wide)
- A higher margin of error creates a wider target.
Ex. $50 \pm 10 \rightarrow 40 \text{ to } 60$ (target is 20 wide)
- The wider the target, the more likely you are to hit the target.

Summary:

-  • If you want a higher confidence level without increasing your margin of error, you'd have to increase your sample size.
-  • If you want a smaller margin of error, without changing your confidence level, you'd have to increase your sample size.
-  • If you want a smaller margin of error, without increasing your sample size, you'd have to be willing to accept a lower confidence level.
-  • If you want a higher confidence level without increasing your sample size, you'd have to be willing to accept a higher margin of error.

Example #1: **Confidence Levels in Sampling**

To meet regulation standards, baseballs must have a mass from 142.0 g to 149.0 g. A manufacturing company has set its production equipment to create baseballs that have a mean mass of 145.0 g.

Quality control managers need to randomly select baseballs to measure their mass to ensure that the production equipment is running properly. When running properly, the mean mass of the baseballs they produce needs to be within 0.3 g of 145.0 g. If the mean mass is outside of these acceptable limits, then adjustments are made to the equipment.

The quality control manager refers to the following chart when conducting his random sampling:

Confidence Level	Sample Size Needed
99%	110
95%	65
90%	45

- What is the confidence interval and margin of error the quality control manager is using for his testing?
- How can we interpret the table?
- What is the relationship between confidence level and sample size?

a) 145 ± 0.3
 $144.7 - 145.3$

The quality control manager refers to the following chart when conducting his random sampling:

Confidence Level	Sample Size Needed
99%	110
95%	65
90%	45

- What is the confidence interval and margin of error the quality control manager is using for his testing?
- How can we interpret the table?
- What is the relationship between confidence level and sample size?

a) 145 ± 0.3
 $144.7 - 145.3$

b) In order to be 99% confident that baseballs produced are between 144.7g - 145.3g he needs to test 110 baseballs. When confidence level drops he only needs to test 65 baseballs for 95% confidence level and 45 baseballs for 90% confidence level.

c) Higher confidence levels require larger sample sizes for same margin of error.

You try:

After making adjustments to the equipment, the quality control manager decided that the mean mass of baseballs must lie in the range 144.3 g to 146.4 g.

- What margin of error is being used in the new sampling process? ± 1.05
- What is the mean mass of a baseball that the engineer is trying to achieve? 145.35g
- Will the baseballs produced by this equipment meet regulation standards? Yes because it falls between $142\text{g} - 149\text{g}$.

ASSIGNMENT:

Page 274-276: #2, 8 (day 2)