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# 2.6 Estimation & Hypothesis Testing

## Estimation

Estimation involves using sample data to approximate population parameters.

* **Point estimate** – A single best guess (e.g., sample mean) for an unknown parameter【333199965929234†L169-L177】.
* **Interval estimate (confidence interval)** – A range of values likely to contain the parameter with a specified confidence level (see Unit 1.5)【333199965929234†L169-L177】.

## Hypothesis testing

Hypothesis testing is a systematic method for evaluating claims about population parameters【722030731437478†L302-L331】. The steps are:

1. **State hypotheses** – Formulate a null hypothesis (H₀) and an alternative hypothesis (H₁).
2. **Collect data** and choose a significance level (α, e.g., 0.05).
3. **Compute test statistic** and corresponding p‑value.
4. **Decision rule** – If p ≤ α, reject H₀; otherwise, fail to reject H₀【722030731437478†L302-L331】.
5. **Interpretation** – Explain the result in the context of the problem【722030731437478†L375-L417】.

Common tests include z‑tests, t‑tests, chi‑square tests and ANOVA. The choice depends on sample size, distribution and parameter of interest.

## Example

A manufacturer claims that light bulbs last an average of 1 000 hours. To test this, we sample 50 bulbs, calculate the sample mean and use a one‑sample t‑test to assess whether the mean lifetime differs from 1 000 hours.

## Summary

Estimation provides approximate values for population parameters, while hypothesis testing evaluates specific claims. Both rely on sampling theory and require careful interpretation of p‑values and confidence levels【333199965929234†L169-L177】【722030731437478†L302-L331】.

## Reflection questions

1. Describe the difference between the null and alternative hypotheses.
2. Why is a low p‑value evidence against the null hypothesis?
3. When would you use a t‑test instead of a z‑test?

## References