

9.1 Null and Alternative Hypothesis

Section 9.1 Null and Alternative Hypothesis

Learning Objective:

In this section, you will:

- Understand the general concept and use the terminology of hypothesis testing

I claim that my coin is a fair coin. This means that the probability of heads and the probability of tails are both 50% or 0.50.

1. Out of 200 flips of the coin, tails is tossed 102 times. What can we conclude about my claim?
2. Out of 200 flips of the coin, tails is tossed 21 times. What can we conclude about my claim?

Hypothesis is a claim about the value of a population parameter.

Hypothesis Testing is a procedure for determining whether the hypothesis stated is a reasonable statement and should not be rejected, or is unreasonable and should be rejected.

Hypothesis testing begins by considering two hypotheses. They are called the **null hypothesis** and the **alternative hypothesis**. These hypotheses contain opposing viewpoints.

1. The **null hypothesis**, typically denoted with **H₀**. The null is not rejected unless the hypothesis test shows otherwise. The null statement must always contain some form of equality ($=$, \leq or \geq)
2. The **alternative hypothesis**, typically denoted with **H_a or H₁**, using less than, greater than, or not equals symbols, (\neq , $>$, or $<$).
3. If we reject the null hypothesis, then we can assume there is enough evidence to support the alternative hypothesis.
4. Never state that a claim is proven true or false. Keep in mind the underlying fact that hypothesis testing is based on probability laws; therefore, we can talk only in terms of non-absolute certainties.

Example 1: We want to test whether the mean GPA of students in American colleges is different from 2.0 (out of 4.0). The null and alternative hypotheses are:

Example 2: We want to test if college students take less than five years to graduate from college, on the average. The null and alternative hypotheses are:

Example 3: In an issue of U.S. News and World Report, an article on school standards stated that about half of all students in France, Germany, and Israel take advanced placement exams and a third pass. The same article stated that 6.6% of U.S. students take advanced placement exams and 4.4% pass. Test if the percentage of U.S. students who take advanced placement exams is more than 6.6%. State the null and alternative hypotheses.

For more information and examples see online textbook OpenStax Introductory Statistics pages 505-508.

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