

## Hypothesis testing:

1. Read the claim. Establish the Null Hypothesis,  $H_0$  and the alternative Hypothesis,  $H_1$ .
2. What is the significance level  $\alpha$ ? Is it a left, right or two tailed test?  
Find critical values and rejection region.
3. Calculate the test statistic:  
Three main types:
  - One proportion
  - One sample T
  - One sample ZAlso: 2 proportions; 2 samples T.
4. Compare the result of the test statistics to the critical values OR the p-value (calculator or software) to the significance level.
5. Conclusion: if Test Statistic absolute value is greater than critical value or p-value is less than  $\alpha$ , Reject the Null Hypothesis; otherwise, fail to Reject the Null Hypothesis. Address the claim in technical terms.

## Examples:

**In all cases create the corresponding confidence interval.**

I. Claim: the mean temperature in the town of ALPHA for the month of January is 60 degrees Fahrenheit. A sample of 20 days is taken, the mean temp for those 20 days is 57 degrees, the standard deviation is 3 degrees. Use a 0.01 level of significance to test the claim.

II. The mayor of the town of ALPHA claims that over 60% of the citizens approve his job as mayor. A random sample of 200 residents, all voters of the town, are interviewed; 130 of them agrees with the mayor. Use a 0.05 level of significance to test the claim.

III. 1,500 women followed the Atkin's diet for a month. A random sample of 29 women gained an average of 6.7 pounds. Use a 0.05 level of significance to test the claim that the average weight gain per woman for the month was over 5 pounds. The standard deviation for all women in the group was 7.1.

### IV: Weight Loss for Diet vs Exercise

Diet Only: sample mean = 5.9 kg; sample standard deviation = 4.1 kg; sample size:  $n = 42$

Exercise Only: sample mean = 4.1 kg; sample standard deviation = 3.7 kg; sample size:  $n = 47$

Did dieters lose more fat than the exercisers? Set  $\alpha = 0.01$  and assume that the populations standard deviations are not equal.

### V: Two medications:

A medication for blood pressure was administered to a group of 13 randomly selected patients with elevated blood pressure while a group of 15 was given a placebo. At the end of 3 months, the following data was obtained on their Systolic Blood Pressure. **Control group:**  $n=15$ , sample mean = 180,  $s=50$ . **Treated group:**  $n=13$ , sample mean =150,  $s=30$ . Test if the treatment has been effective, use  $\alpha=0.01$ . Assume that the populations variances are not equal.

### VI: Another case of two medications.

Two types of medication for hives are being tested to determine if there is a difference in the percentage of adult patient reactions. Twenty out of a random sample of 200 adults given medication A still had hives 30 minutes after taking the medication. Twelve out of another random sample of 200 adults given medication B still had hives 30 minutes after taking the medication. Assume that the populations variances are not equal. Test at a 1% level of significance.

**Study 1:** Quitting Smoking with Nicotine Patches: Compare the smoking cessation rates for smokers randomly assigned to use a nicotine patch versus a placebo patch.

*Results: Higher smoking cessation rates were observed in the active nicotine patch group at 8 weeks (46.7% vs 20%) ( $P < .001$ ) and at 1 year (27.5% vs 14.2%) ( $P = .011$ ). (Hurt et al., 1994, p. 595)*

Null hypothesis: The proportion of smokers in the population who would quit smoking using a nicotine patch and a placebo patch are the same.

Comment on the results.

**Study 2:** Smoking During Pregnancy and Child's IQ:

*Children born to women who smoked 10+ cigarettes per day during pregnancy had developmental quotients at 12 and 24 months of age that were 6.97 points lower (averaged across these two time points) than children born to women who did not smoke during pregnancy (95% CI: 1.62, 12.31,  $P = .01$ ); at 36 and 48 months they were 9.44 points lower (95% CI: 4.52, 14.35,  $P = .0002$ ). (Olds et al., 1994, p. 223)*

Comment on the results.