Section 3.11 Calculate and Interpret Hypothesis Tests

1. mod3_11

1.1 Calculate and Interpret Hypothesis Tests

Notes:

1. Now it is time to calculate and interpret hypothesis tests
2. Let's start with a test for a one sample continuous outcome
1.2 Learning Outcomes

Learning Outcomes

Calculate and interpret sample hypotheses for One-sample - continuous outcome

Notes:

1. Here are the module learning objectives.
2. Remember, the course evaluation you get to fill out will ask whether the learning objectives were appropriately covered and presented.
1.3 General Steps for Hypothesis Testing

Notes:

1. Before getting started, you should recognize that the same general steps can be used for testing a wide range of hypotheses and given different study designs.
1.4 Hypothesis Testing - One Sample

Continuous Outcome

Hypothesis Testing - One Sample Continuous Outcome

Compare a “historical control” mean (μc) from a population to a “sample” mean

Example:
Average annual health care expenses per person in the year 2005 (n=100, X = $3,190, s = $890) are lower than “historical” control costs in the year 2002 ($3,302)

1) Set up the hypothesis and determine the level of statistical significance (including 1 versus 2-sided hypothesis)

H₀: μ = $3,302
H₁: μ < $3,302 (one-sided hypothesis, lower-tailed test)
α = 0.05

Example:

Notes:
In this example, we wish to compare a mean value of a continuous variable (annual health care expenses per person) to historical costs.
The test is whether the health care costs from the sample are sufficiently different from the historical costs to conclusively declare them as different.

Because the sample size is 100, which is >=30, we use the z statistic.
Since we are interested in testing whether costs in the year 2005 are “lower” than the historical costs, this is a one-sided hypothesis test.

From table 1c in your textbook, the critical z-value for a type I error rate of 0.05 and with sample size of 100 is -1.645.
Computing the test statistic results in a z-value of -1.26.
Since -1.26 is greater than the critical value of -1.645, we do not reject the null hypothesis.
1.5 Practice Exercise - Step 1

Notes:

1. Now it is time to practice.
2. On your computer screen, type in the value for μ = for both the null (H₀) and alternative (H₁) hypothesis.
3. Also type in whether this example represents a 1-sided hypothesis and 1-tailed test, or a 2-sided hypothesis and 2-tailed test.
4. Programming note - these entries will be completed on the computer screen.
1.6 Answers

Notes:

1. Here are the answers for step 1. We are testing against the national average of cholesterol levels of 203.

2. This is a 2-sided hypothesis and test since we are testing whether the mean cholesterol levels from the Framingham Heart Study is 2002 are “different” from the national average.
# 1.7 Practice Exercise - Steps 2, 3, 4, and 5

## Notes:

1. For step 3, type in whether you should use the *t* or *z* statistic, and then type in the critical value for testing the null hypothesis as determined from table 1c in your textbook.
2. For step 4, perform the calculation and type in your answer to 2 decimal places, such as -2.98.
3. For step 5, type in whether you “reject” or “fail to reject” the null hypothesis.

## Example:
Total cholesterol levels in the Framingham Heart Study in the year 2002 (n=3,310, $X̄$ = 200.3, $s$ = 36.8) are different from the national average in 2002 (203.0).

2) Select the appropriate test statistic:
   - if ($n < 30$), then use *t*
   - if ($n > 30$), then use *z*

3) Set up the decision rule (look up _____ value - Table 1c).
   - Reject $H_0$ if _____

4) Compute the test statistic:

   $z = \frac{\overline{X} - \mu_0}{s / \sqrt{n}}$

4) Compute the test statistic:

   $z = \frac{\overline{X} - \mu_0}{s / \sqrt{n}} = _____$

5) Conclusion: _____
1.8 Practice Exercise Answers

Notes:

1. Here is a summary of correct answers for all 5 steps.
2. As you can see, we used the \( z \)-statistic with a critical value of \( \leq 1.96 \) or \( \geq 1.96 \).
3. The test statistic of \( z = -4.22 \) is below the critical value of -1.96, so we reject the null hypothesis.
1.9 Conclusion

End of Section 3.11