Z-test Worksheet

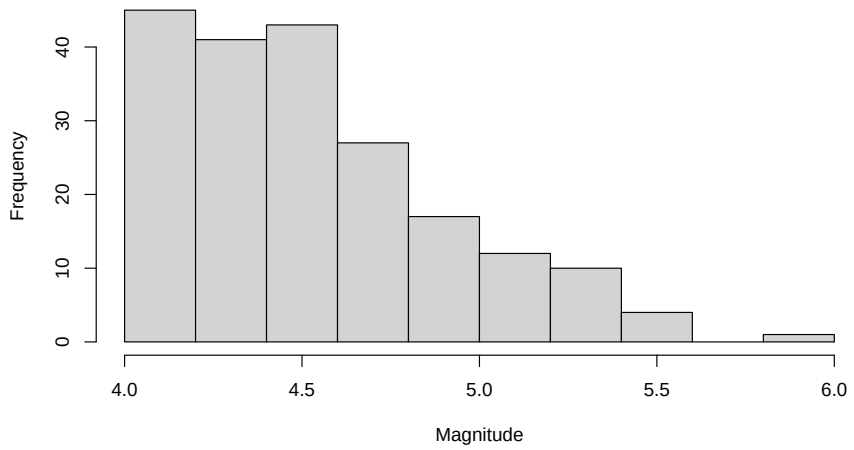
October 2026

1 Earthquakes

We will be talking about earthquakes with seismic events of MB > 4.0 (MB is body-wave magnitude, a measure of size of an earthquake). The events occurred in a cube near Fiji since 1964. The 200 observations we are working with are a random sample of all earthquakes (with MB > 4.0) in that area with an average MB of 4.62. Let's assume the researcher who collected this data is trying to show that, if an earthquake in and around Fiji has an MB > 4, then the earthquakes have an average magnitude greater than 4.5.

1. Please state the null and alternative hypothesis. Note here we are using averages and not proportions.

2. Below is the histogram of our sampled earthquakes. On the side, please describe the histogram and include the number of modes, if it's symmetric or skewed (or neither), and if their our outliers.



We will now need to check the assumptions....

3. First, was the sample randomly collected?

4. Next up is the population normally distributed or is the sample size large assumption
    1. Is the population normally distributed? How did you come to this conclusion?

2. Is the sample size sufficiently large?

3. Finally, is the sample independent and identically distributed assumption

    1. Is there a reason to believe the earthquakes would form subpopulations?

    2. Is there a reeason to believe that one earthquake will affet another earthquake?

3. Please write down the sampling distribution for the sample mean of the earthquake's magnitude for this Z-test. We believe that the variance of the population, $\sigma^2 = .25$ and that we have a sample size of 200.

4. Please standardize the sample mean we observed using the distribution you found in question 4, which will produce the test statistic. Hint: The formula is $\frac{observed - mean}{st.dev.}$

5. Please find the probability associated with your answer to question 5. Hint: use the normal calculator online again.

6. Write down your decision for the test. Please remember to state the strength of evidence. Reject/Fail to reject is wrong so do not write it (see notes for a discussion).

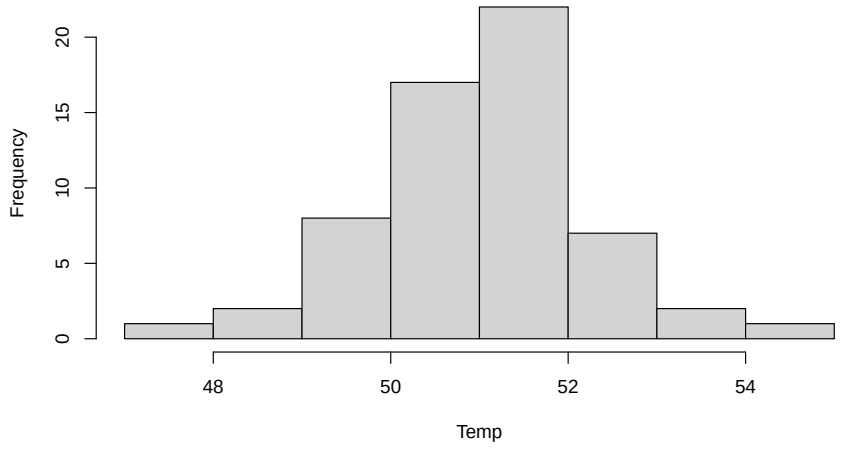
2 Temp.

One of my best friends is from New England and has a theory: Fahrenheit is superior to Celcius because it has a natural interpretation. 0 degrees is about as cold as it gets and 100 is about as hot as it gets in both the Midwest and New England which means you can think of it as "percent hot". Let's take his claim one step further: If Fahrenheit is percent hot, then the average annual temp is 50 degrees. Let's test this and see if we have evidence that it is different from 50.

To do this we will use data collected, every year, in New Haven, Conn. from 1912 to 1971, for a total of 60 observations and it is known that the population variance is 8 (the units are degrees F^2 but don't worry too much about that). The sample mean from this data was 51.16 degrees F.

1. Please write down the null and alternative hypothesis.

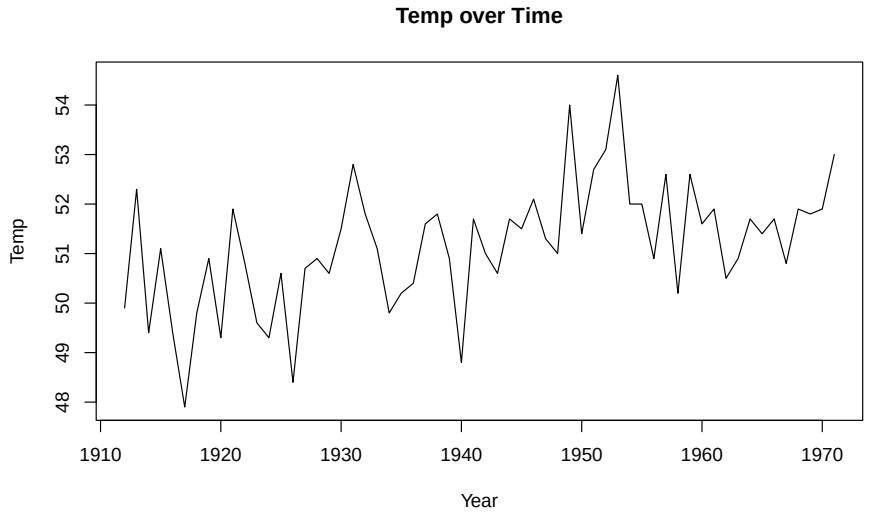
2. Below is the histogram of temps recorded. Please, off on the side, describe the number of modes, if it's symmetric or skewed, and if there are outliers or not.



3. Was the data randomly collected?

4. Is the population normally distributed OR is the sample size large? How did you come to this conclusion?

5. Is the data independent and identically distributed? HINT: use the graph below which shows the average yearly temp over time to answer this one.



6. Let's pretend we pass all of our assumptions. Please state the sampling distribution for the sample mean for average temp in New Haven.

7. Please standardize the sample mean we observed using the distribution you found in question 6, which will produce the test statistic. Hint: The formula is $\frac{observed - mean}{st.dev.}$

8. Please find the probability associated with your answer to question 7. Hint: use the normal calculator online again.

9. Write down your decision for the test. Please remember to state the strength of evidence. Reject/Fail to reject is wrong so do not write it (see notes for a discussion). Bonus question: Does the difference matter?