R Tutorial for STAT 350 Lab 5

Author: Leonore Findsen, Chunyan Sun, Sarah H. Sellke, Jeremy Troisi

1. T Procedure for One Population

The same function, t.test(), is used for both the confidence interval and significance test. However, there are some additions that are required from what was mentioned in Lab 5. In general, the same t.test() command should be used for both the confidence interval and significance test for a particular problem.

Example (DATA SET: DMS.txt – website) Many food products contain small quantities of substances that would give an undesirable taste or smell if they were present in large amounts. An example is the "off-odors" caused by sulfur compounds in wine. Oenologists (wine experts) have determined the odor threshold, the lowest concentration of a compound that the human nose can detect. For example, the odor threshold for dimethyl sulfide (DMS) is given in the oenology literature as 25 micrograms per liter of wine (μg/L). Untrained noses may be less sensitive, however. Here are the DMS odor thresholds for 10 beginning students of oenology:

31 31 43 36 23 34 32 30 20 24

(a) Make a boxplot and histogram to verify that the distribution is roughly symmetric with no outliers.
(b) Make a Normal quantile plot to confirm that there are no systematic departures from Normality.
(c) Calculate the 95% lower bound for the mean DMS odor threshold among all beginning oenology students.
(d) Are you convinced that the mean odor threshold for beginning students is higher than the published threshold, 25 μg/L? Carry out a significance test to justify your answer. Your significance level should be consistent with what was given in part (c).

Solution:

```
>wine=read.table(file="DMS.txt",header=T)
>wine
```

(a) Make a boxplot and histogram to verify that the distribution is roughly symmetric with no outliers.

See the tutorials for Lab 1 and Lab 2 for details.

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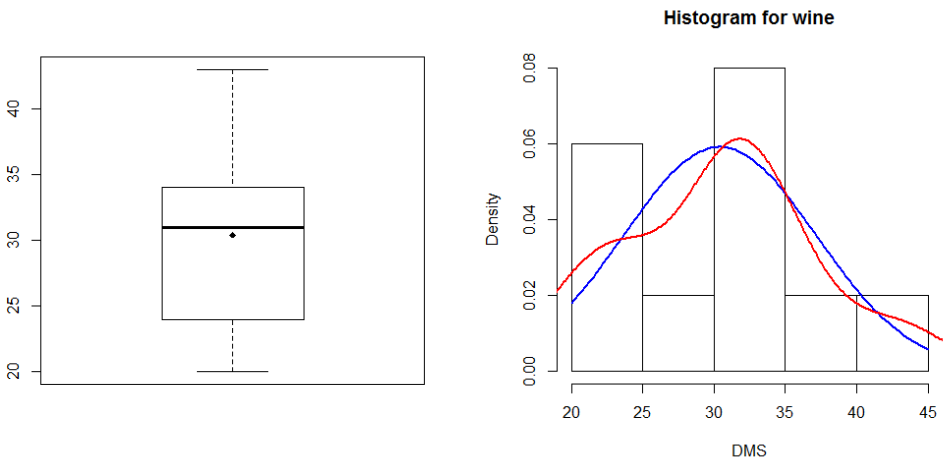

The median is close to the mean in the boxplot so it is symmetrical. The histogram indicates that it is close to normal and symmetric better than the boxplot because the blue and red curves are close together. I see no outliers in the boxplot or the histogram.

(b) Make a Normal quantile plot to confirm that there are no systematic departures from Normality.

See the tutorials for Lab 3 for details.

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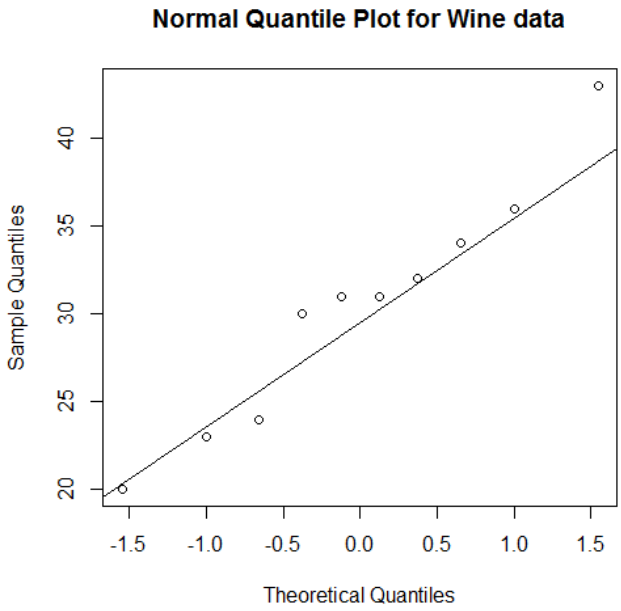

The points on the probability plot roughly follow a straight line. This indicates that the distribution is approximately normal.

(c) Calculate the 95% lower bound for the mean DMS odor threshold among all beginning oenology students.

Note: There should be the same code for both parts (c) and (d).

```
# Parameters for t.test
# mu: mu_0
# You always indicate confidence level, alpha = 1 - C
# possibilities for alternative are "two.sided" (confidence interval),
#   "less" (upper confidence bound for one-sided test), "greater"
#   (lower confidence bound for one-sided test)
#
>t.test(wine$DMS, conf.level=0.95, mu = 25, alternative = "greater")
```

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```
        One Sample t-test

data:  wine$DMS
t = 2.5288, df = 9, p-value = 0.01615
alternative hypothesis: true mean is greater than 25
95 percent confidence interval:
 26.48554      Inf
sample estimates:
mean of x
     30.4
```

The output for this part is highlighted in yellow.

The 95% lower bound is 26.48554 (26.48554, ∞)

(d) Are you convinced that the mean odor threshold for beginning students is higher than the published threshold, 25 *μ*g/L? Carry out a significance test to justify your answer. Your significance level should be consistent with what was given in part (c).

The output for this part is highlighted in green above.

Step 0: Definition of the terms

μ is the population mean order threshold for beginning students.

Step 1: State the hypotheses

H_0: μ = 25
H_a: μ > 25

Step 2: Find the *Test Statistic, report DF*.

t_t = 2.5288
DF = 9

Step 3: Find the *p-value:*

P-value = 0.01615

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Step 4: Conclusion:

$\alpha = 1 - C = 1 - 0.95 = 0.05$

Since $0.01615 \leq 0.05$, we should reject H_0

The data provides strong evidence (P-value = 0.0161) to the claim that the mean odor threshold for beginning students is higher than the published threshold, 25 μg/L.