Lesson 11-1 Inference for the Mean of a Population

# Assumptions for inference about a mean

Our data are a **simple random sample** (SRS) of size *n* from the population.

Observations from the population have a **normal distribution** with mean μ and standard deviation σ. Both μ and σ are unknown parameters.

# Standard Error

When the standard deviation of a statistic is estimated from the data, the result is called the **standard error** of the statistic. The standard error of the sample mean Ë is s/√n.

# One-sample t statistic

The statistic *t* has the same interpretation as any standardized statistic: it says how far Ë is from its mean μ in standard deviation units. There is a different *t* distribution for each sample size. We specify a particular *t* distribution by giving its degrees of freedom. We will write the *t* distribution with *k* degrees of freedom as *t(k)* for short.

# Using the one- sample t-procedures

* ***Except in the case of small samples, the assumption that the data are an SRS from the population of interest is more important than the assumption that the population distribution is normal.***
* ***Sum of the sample size less than 15***. Use *t* procedures if the data are close to normal. If the data are clearly non-normal or if outliers are present, do not use *t* procedures.
* ***Sum of the sample size at least 15.*** The *t* procedures can be used except in the presence of outliers or strong skewness.
* ***Large samples.*** The *t* procedures can be used even for clearly skewed distribution when the sample is large, roughly n ≥ 40.
* A confidence interval or significance test is called ***robust*** if the confidence level or P-value does not change very much when the assumptions of the procedure are violated. The t procedures are robust against non-normality except when there are outliers.

# Matched Pairs *t* Procedures

To compare the responses to the two treatments in a matched pairs design, apply the one-sample *t* procedures to the observed differences.

1. The normal range of values for blood phosphate levels is 2.6 to 4.8 milligrams of phosphate per deciliter of blood. The results of a patient’s blood tests are given below. We want to determine if this is good evidence that the patient’s mean level in fact falls above 4.8 mg/dl.
2. State HO and HA.
3. What test of significance should you use? Explain why.
4. The data for this patient, in mg/dl, are: 5.6 5.1 4.6 4.8 5.7 6.4

Use this data to carry out a t test at a significance level of 5% and report the P-value.

**d)** What is the 95% confidence interval for the data provided?

**e)** Is this good evidence that the patient’s mean level falls above 4.8 mg/dl? Explain.