Chapter 9.3 Inferences About Two Means: Independent Samples

Two samples are **independent** if there is no relation between the specific values of the two distributions.

*Example:*
Comparing mean exam scores of men and women.

Requirements:
- Independent Samples
- Simple Random Samples
- Either both populations are normal or \( n_1 > 30 \) and \( n_2 > 30 \)

Three cases:

1. \( \sigma_1, \sigma_2 \) known (rarely occurs)
2. \( \sigma_1, \sigma_2 \) not known, assume \( \sigma_1 = \sigma_2 \) (pooled variance)
3. \( \sigma_1, \sigma_2 \) not known, assume \( \sigma_1 \neq \sigma_2 \) (not pooled variance) we will assume this case and using the calculator to compute the Test Statistic and P–value.

Degrees of freedom = smaller of \( n_1 – 1, n_2 – 1 \)

**Computing the Test Statistic on the TI–83/4**

```
STAT TESTS 2–SampTTest
```

Choose Data for raw data otherwise choose Stats
Enter the data
For Pooled choose No
Then Calculate

**Computing the Confidence Interval on the TI–83/4**

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STAT TESTS 2–SampTInt
```

Choose Data for raw data otherwise choose Stats
Enter the data
For Pooled choose No
Then Calculate
Example 1:

A consumer group is testing camp stoves. To test the heating capacity of a stove, they measure the time required to bring 2 quarts of water from 50°F to boiling. Two competing models are under consideration. Twenty-four stoves of each model were tested and the following results were obtained.

Model 1: $\bar{x}_1 = 11.4$ min, $n_1 = 24$, $s_1 = 2.5$ min
Model 2: $\bar{x}_2 = 9.9$ min, $n_2 = 24$, $s_2 = 3.0$ min

a. Perform a hypotheses test to determine if there is any difference between the performances of these two models? Use a 5% significance level.

Claim: $\mu_1 = \mu_2$

$H_0: \mu_1 = \mu_2$

$H_1: \mu_1 \neq \mu_2$

$\alpha = 0.05$

$df = 23$

$TS: t = \frac{1.88}{2.069 - 2.069}$

$P$-value = $2P(t > 1.88) = 0.0664 > 0.05$

Do Not Reject $H_0$

There is not sufficient evidence to reject the claim that $\mu_1 = \mu_2$

It appears that there is no difference in the performance of the stoves.

b. Compute the 95% confidence interval and determine if there is a difference in the performance of the models.

The 95% confidence interval is: $-0.1059 < \mu_1 - \mu_2 < 3.1059$ Since zero is contained in the interval there appears to be no difference in the performance of the stoves.
Example 2

In the book *Life in America’s Small Cities*, the author points out that per capita spending at restaurants in Key West, Florida is higher than in most other small cities. In Key West, Florida, a random sample of nine adult residents who regularly eat at local restaurants was asked to record the amount of money each person spent in a given month at local restaurants. The same question was asked of a random sample of 11 adult residents in Fredericksburg, Virginia. Use the following data to test the book’s claim at a 5% significance level.

Key West: \( (x_1) \)  73  63  88  55  81  90  44  52  97
Fredericksburg: \( (x_2) \)  46  52  75  51  44  28  93  45  66  50  47

<table>
<thead>
<tr>
<th>Claim: ( \mu_1 &gt; \mu_2 )</th>
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</thead>
<tbody>
<tr>
<td>( H_0: \mu_1 = \mu_2 )</td>
</tr>
<tr>
<td>( H_1: \mu_1 &gt; \mu_2 )</td>
</tr>
<tr>
<td>( \alpha = 0.05 )</td>
</tr>
<tr>
<td>( df = 8 )</td>
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</tbody>
</table>

TS: \( t = 2.09 \) *See below for how to compute this*

\[
P\text{-value} = P(t > 2.09) = 0.0262 < 0.05
\]

Reject \( H_0 \)

The sample data support the claim that \( \mu_1 > \mu_2 \)

It appears that people in Key West spend more on restaurants than people in Fredericksburg.

Enter the data in L₁ \( (x_1) \) and L₂ \( (x_2) \)
To find the Test Statistic:

```
STAT TESTS 2-SampTTest
List1:L₁
List2:L₂
Freq1:1
Freq2:1
μ₁≠μ₂ <μ₂ Yes
Pooled:No Yes
```

*See below for how to compute this*