10.16. Find the number of degrees of freedom for $s^2$.
(a) $n_1 = 16$, $n_2 = 8$  
$$df = 4$$
(b) $n_1 = 10$, $n_2 = 12$  
$$df = 2$$

10.18. Independent random samples of $n_1 = 4$ and $n_2 = 5$ are selected from two normal populations. We wish to test if the distributions and their means differ at $\alpha = 1\%$.

<table>
<thead>
<tr>
<th>Pop 1</th>
<th>Pop 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample size</td>
<td>4</td>
</tr>
<tr>
<td>Sample mean</td>
<td>7</td>
</tr>
<tr>
<td>Sample std. dev.</td>
<td>3.9158</td>
</tr>
</tbody>
</table>

(a) State the alternate and null hypotheses.

$H_a$:  

$H_0$:  

Should you use the standard error with pooled sample deviations? Why?

(b) Find the pooled std. dev. $s$ and the standard error.

$$s = \underline{.} \underline{11}$$

SE $=$ \underline{12}

(c) $t =$ \underline{14}

(d) Find the $\alpha = 1\%$ acceptance region for $t$.

$$t_{a/2} =$ \underline{18}

(e) Find the $99\%$ confidence interval for $\mu_1 - \mu_2$.

$$\mu_1 - \mu_2 \in$$

(f) Should we accept $H_0$? Why?

10.22. An experiment to test the effectiveness of an antiplaque rinse tested the rinse on 7 volunteers and compared them with 7 controls who did not use the rinse. It measurements for plaque buildup were as follows.

<table>
<thead>
<tr>
<th>control</th>
<th>antiplaque</th>
</tr>
</thead>
<tbody>
<tr>
<td>mean</td>
<td>1.26</td>
</tr>
<tr>
<td>std. dev.</td>
<td>0.32</td>
</tr>
<tr>
<td>n</td>
<td>7</td>
</tr>
</tbody>
</table>

To be classified as effective, the rinse must reduce plaque buildup. Is it effective?

(a) $H_a$:  

$H_0$:  

Null region for difference:

10:29-31 (10). A paired-difference experiment has $n = 10$ pairs of observations.

Test $H_a$: $\mu_1 - \mu_2 \neq 0$ versus $H_0$: $\mu_1 - \mu_2 = 0$ for $\alpha = 5\%$.

The mean of the differences is $d = 0.3$ with variance $s_d^2 = 0.16$.

$$df = \underline{14}$$

$$SE = \underline{14}$$

$$t = \underline{14}$$

$$p\text{-value range} = \underline{7}$$

(a) Acceptance region for $t$:  

(b) $p\text{-value range} =$ \underline{7}

(c) Is the difference significant?

(d) Given this initial observation with 10 pairs, how many pairs of observations (total pairs, not additional pairs) do you need if you want to increase the accuracy of the estimate of $\mu_1 - \mu_2$ so that the margin of error is .2? Hint, as before, write $SE$ as a function of $n$. Substitute this into the equation $ME = 0.1$ and solve for $n$. Note, margin of error (by definition) always uses the $z$-value 1.96 rather than a $t$-value.

Equation:

$$n = \underline{7}$$