Section 9.1 (Ex Set. 9.1)

9.1 5.
H₀: μ₁ = μ₂  (claim)
H₁: μ₁ ≠ μ₂

C. V. = ± 2.58

$$\bar{X}_1 = 662.6111 \quad \bar{X}_2 = 758.875$$

$$z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{(662.6111 - 758.875) - 0}{\sqrt{\frac{32.25^2}{15} + \frac{23.8^2}{18}}} = -0.88$$

(TI83 answer is z = -0.856)

- 2.58 ↑ 0 2.58

- 0.88

Do not reject the null hypothesis. There is not enough evidence to reject the claim that the average lengths of the rivers is the same.

9.1 9.
H₀: μ₁ = μ₂
H₁: μ₁ > μ₂  (claim)

C. V. = 2.33

$$z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{(5.5 - 4.2) - 0}{\sqrt{\frac{3.2^2}{15} + \frac{4.5^2}{18}}} = 3.75$$

0 2.33 ↑ 3.75

Reject the null hypothesis. There is enough evidence to support the claim that the average stay is longer for men than for women.

9.1 11.
H₀: μ₁ = μ₂
H₁: μ₁ < μ₂  (claim)

C. V. = -1.65

$$z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{(3.16 - 3.32) - 0}{\sqrt{\frac{2.0^2}{15} + \frac{2.3^2}{18}}} = -2.01$$

↑ - 1.65 0

- 2.01

Reject the null hypothesis. There is enough evidence to support the claim that those who stayed have a higher GPA than those who left their profession.
1. continued
Reject the null hypothesis. There is enough evidence to support the claim that there is a significant difference in the values of the homes based upon the appraisers' values.

2. 4.
\[ \begin{align*}
H_0 & : \mu_1 = \mu_2 \\
H_1 & : \mu_1 > \mu_2 \quad (\text{claim})
\end{align*} \]

\[
\overline{X}_1 = 39.6667 \quad s_1 = 18.3703 \\
\overline{X}_2 = 28.8333 \quad s_2 = 17.1279
\]

C. V. = 3.365  \quad d. f. = 5

\[
t = \frac{(39.6667 - 28.8333) - 0}{\sqrt{\frac{18.3703^2}{19} + \frac{17.1279^2}{17}}} = 1.057
\]

Do not reject the null hypothesis. There is not enough evidence to support the claim that the average number of students attending cyber schools in Allegheny County is greater than those who attend cyber schools outside Allegheny County. One reason why caution should be used is that cyber charter schools are a relatively new concept.

3. 8.
\[ \begin{align*}
H_0 & : \mu_1 = \mu_2 \\
H_1 & : \mu_1 \neq \mu_2 \quad (\text{claim})
\end{align*} \]

C. V. = ± 2.898  \quad d. f. = 17

\[
t = \frac{(2.5 - 3.8) - 0}{\sqrt{\frac{2.5^2}{12} + \frac{3.8^2}{20}}} = -2.384
\]

-2.898 \quad -2.384

Do not reject the null hypothesis. There is not enough evidence to support the claim that there is a difference between the number of volunteer hours.
9.2

$H_0: \mu_1 = \mu_2$
$H_1: \mu_1 \neq \mu_2$ (claim)

$X_1 = 82.875 \quad s_1 = 6.8959$
$X_2 = 91.667 \quad s_2 = 3.7417$
C.V. = $\pm 2.365 \quad df = 7$

$t = \frac{(X_1 - X_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$

$t = \frac{(82.875 - 91.667) - 0}{\sqrt{\frac{6.8959^2}{7} + \frac{3.7417^2}{7}}} = -3.21$

$t = -2.365 \quad 0 \quad 2.365$

Reject the null hypothesis. There is enough evidence to support the claim that book scores are higher than DVD scores.

Ex. Set. 9.3

9.3

Before | After | $D$ | $D^2$
-------|-------|-----|-----
9      | 9     | 0   | 0   
12     | 17    | -5  | 25  
6      | 9     | -3  | 9   
15     | 20    | -5  | 25  
3      | 2     | 1   | 1   
18     | 21    | -3  | 9   
10     | 15    | -5  | 25  
13     | 22    | -9  | 81  
7      | 6     | 1   | 1   

$\sum D = -28 \quad \sum D^2 = 176$

$H_0: \mu_D = 0$
$H_1: \mu_D < 0$ (claim)

C.V. = $-1.397 \quad d.f. = 8$

$D = \frac{\sum D}{n} = -3.11$

$s_D = \sqrt{\frac{\sum D^2 - (\sum D)^2}{n(n-1)}} = \sqrt{\frac{176 - (-28)^2}{9 \cdot 8}} = 3.3$

$t = \frac{-3.11 - 0}{\frac{3.3}{\sqrt{8}}} = -2.8$

$t = -1.397 \quad 0 \quad -2.8$

Reject the null hypothesis. There is enough evidence to support the claim that the seminar increased the number of hours students studied.
9.35.

\[
\begin{array}{cccc}
F - S & S - Th & D & D^2 \\
4 & 8 & -4 & 16 \\
7 & 5.5 & 1.5 & 2.25 \\
10.5 & 7.5 & 3 & 9 \\
12 & 8 & 4 & 16 \\
11 & 7 & 4 & 16 \\
9 & 6 & 3 & 9 \\
6 & 6 & 0 & 0 \\
9 & 8 & 1 & 1 \\
\end{array}
\]

\[
\sum D = 12.5 \quad \sum D^2 = 69.25
\]

H₀: \( \mu_D = 0 \)
H₁: \( \mu_D \neq 0 \) (claim)

C. V. = \( \pm 2.365 \)  
D. f. = 7

\[
\bar{D} = \frac{\sum D}{n} = \frac{12.5}{8} = 1.5625
\]

\[
s_D = \sqrt{\frac{\sum D^2 - (\sum D)^2}{n(n-1)}} = \sqrt{\frac{69.25 - (12.5)^2}{8(7)}} = 2.665
\]

\[
t = \frac{1.5625 - 0}{\frac{2.665}{\sqrt{8}}} = 1.6583
\]

Do not reject the null hypothesis. There is not enough evidence to support the claim that there is a significant difference in the mean number of hours slept.

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9.3 (c,d)

\[
z = \frac{(\bar{p}_1 - \bar{p}_2) - (p_1 - p_2)}{\sqrt{\frac{p(1-p)}{n_1} + \frac{p(1-p)}{n_2}}}
\]

\[
z = -1.87
\]

(TT: \( z = -1.867 \))

\[-2.58 \uparrow \quad 0 \quad 2.58
\]

\[-1.87
\]

Do not reject the null hypothesis. There is not enough evidence to support the claim that there is a significant difference in the proportions.

9.4

4.

\[
\bar{p}_1 = \frac{x_1}{n_1} = \frac{180}{300} = 0.6
\]

\[
\bar{p}_2 = \frac{x_2}{n_2} = \frac{200}{250} = 0.8
\]

\[
\bar{p} = \frac{x_1 + x_2}{n_1 + n_2} = \frac{180 + 200}{300 + 250} = 0.691
\]

\[
\bar{q} = 1 - \bar{p} = 1 - 0.691 = 0.309
\]

H₀: \( p_1 = p_2 \)
H₁: \( p_1 \neq p_2 \) (claim)

C. V. = \( \pm 2.58 \)

\[
z = \frac{(\bar{p}_1 - \bar{p}_2) - (p_1 - p_2)}{\sqrt{\frac{p(1-p)}{n_1} + \frac{p(1-p)}{n_2}}}
\]

\[
z = -5.05
\]

\[\uparrow - 2.58 \quad 0 \quad 2.58 \]

\[-5.05
\]

Reject the null hypothesis. There is enough evidence to support the claim that the proportion of students receiving aid has changed.

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9.4.3

\[
\bar{p}_1 = \frac{x_1}{n_1} = \frac{88}{300} = 0.3267
\]

\[
\bar{p}_2 = \frac{x_2}{n_2} = \frac{120}{100} = 0.4
\]

\[
\bar{p} = \frac{x_1 + x_2}{n_1 + n_2} = \frac{88 + 120}{300 + 300} = \frac{208}{600} = 0.363
\]

\[
\bar{q} = 1 - \bar{p} = 1 - 0.363 = 0.637
\]

H₀: \( p_1 = p_2 \)
H₁: \( p_1 \neq p_2 \) (claim)

C. V. = \( \pm 2.58 \)
9.4. \( \hat{p}_1 = \frac{10}{73} \approx 0.14 \quad \hat{p}_2 = \frac{16}{80} = 0.20 \)

\( \overline{p} = \frac{10.16}{73 + 80} = 0.17 \)

\( \overline{q} = 1 - 0.17 = 0.83 \)

\( H_0: p_1 = p_2 \)

\( H_1: p_1 \neq p_2 \) (claim)

C. V. = ± 1.96

\[ z = \frac{(0.14 - 0.20) - 0}{\sqrt{(0.17)(0.83)(\frac{1}{73} + \frac{1}{80})}} = -0.99 \]

\[-1.96 \uparrow 0 \quad 1.96 - 0.99\]

Do not reject the null hypothesis. There is not enough evidence to support the claim that there is a difference in the proportions.

9.5. 7.

\( H_0: \sigma_1^2 = \sigma_2^2 \)

\( H_1: \sigma_1^2 \neq \sigma_2^2 \) (claim)

C. V. = 2.53 \quad \alpha = 0.10

d. f. N = 14 \quad d. f. D = 14

\[ F = \frac{s_1^2}{s_2^2} = \frac{13.13}{6.19} = 4.52 \]

\[ 0 \quad 2.53 \uparrow \quad 4.52 \]

Reject the null hypothesis. There is enough evidence to support the claim that there is a difference in the variances of the best seller lists for fiction and non-fiction.

9.5. 9.

\( H_0: \sigma_1^2 = \sigma_2^2 \)

\( H_1: \sigma_1^2 \neq \sigma_2^2 \) (claim)

\( s_1 = 25.97 \quad s_2 = 72.74 \)

C. V. = 2.86 \quad \alpha = \frac{0.05}{2}

d. f. N = 15 \quad d. f. D = 15

\[ F = \frac{s_1^2}{s_2^2} = \frac{25.97^2}{72.74} = 7.85 \]

\[ 0 \quad 2.86 \uparrow \quad 7.85 \]

Reject the null hypothesis. There is enough evidence to support the claim that the variances of the values of tax exempt properties are different. Since both data sets vary greatly from normality, the results are suspect.

9.5. 11.

\( H_0: \sigma_1^2 = \sigma_2^2 \)

\( H_1: \sigma_1^2 \neq \sigma_2^2 \) (claim)

\( s_1 = 33.99 \quad s_2 = 33.99 \)

C. V. = 4.99 \quad \alpha = \frac{0.05}{2}

d. f. N = 7 \quad d. f. D = 7

\[ F = \frac{s_1^2}{s_2^2} = \frac{(33.99)^2}{(33.99)^2} = 1 \]

\[ 0 \quad \uparrow 4.99 \quad 1.00 \]

Do not reject the null hypothesis. There is not enough evidence to support the claim that the variance in the number of calories differs between the two brands.
13.
$H_0: \sigma_1^2 = \sigma_2^2$
$H_1: \sigma_1^2 > \sigma_2^2$ (claim)

$s_1 = 111.211$  $s_2 = 35.523$
$n_1 = 7$  $n_2 = 6$

d. f. N = 6  d. f. D = 5
C. V. = 4.950 at $\alpha = 0.05$
C. V. = 10.67 at $\alpha = 0.01$

$F = \frac{s_1^2}{s_2^2} = \frac{111.211^2}{35.523^2} = 9.801$

Reject the null hypothesis at $\alpha = 0.05$.
There is enough evidence to support the claim that the variance in area is greater for Eastern cities.

16.
$H_0: \sigma_1^2 = \sigma_2^2$
$H_1: \sigma_1^2 < \sigma_2^2$ (claim)

$s_1 = 98.2$  $s_2 = 118.4$
C. V. = 3.15  $\alpha = 0.01$

d. f. N = 19  d. f. D = 19

$F = \frac{(118.4)^2}{(98.2)^2} = 1.45$

Do not reject the null hypothesis. There is not enough evidence to support the claim that the variance of the areas in Indiana is less than the variance of the areas in Iowa.