1. Problem 9.6. (a) and (b).

(a)  
\[ z = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{1.6^2}{40} + \frac{1.4^2}{32}}} = 3.78 > z_{0.01} = 2.33. \]

Therefore, we conclude \( H_0 : \mu_1 - \mu_2 > 0 \) at 0.01 significance level.

(b) The Type II error probability at \( \mu_1 - \mu_2 = 1 \) is
\[ P\left( \frac{\bar{X} - \bar{Y}}{\sqrt{\frac{1.6^2}{40} + \frac{1.4^2}{32}}} \leq 2.33 | \mu_1 - \mu_2 = 1 \right) \]
\[ = \Phi\left( -0.70 \right) \]
\[ = 0.2420. \]

2. Problem 9.7. Here we have \( \bar{x} = 2.7186, s_1 = 0.63342, m = 125, \bar{y} = 2.8639, s_2 = 0.49241, \) and \( n = 88. \) We use the large sample test as
\[ Z = \frac{2.7186 - 2.8639}{\sqrt{0.63342^2/125 + 0.49241^2/88}} = -1.88 \]
which is not greater than \( z_{0.005} = 2.58. \) Therefore, we conclude they are not different.

3. 9.17. The number of degrees of freedom is
\[ \nu = \frac{\left( \frac{S_1^2}{m} + \frac{S_2^2}{n} \right)^2}{\frac{S_1^2}{m^2} + \frac{S_2^2}{n^2}}. \]

(a)  
\[ \nu = \frac{\left( \frac{5.0^2}{10} + \frac{6.0^2}{10} \right)^2}{\frac{5.0^2}{10^2} + \frac{6.0^2}{10^2}} = \frac{37.21}{0.694 + 1.44} = 17.43 \approx 17 \text{ or } 18. \]

(b)  
\[ \nu = \frac{\left( \frac{5.0^2}{10} + \frac{6.0^2}{15} \right)^2}{\frac{5.0^2}{10^2} + \frac{6.0^2}{15^2}} = \frac{24.01}{0.694 + 0.411} = 21.7 \approx 21 \text{ or } 22. \]

(c)  
\[ \nu = \frac{\left( \frac{2.0^2}{9} + \frac{6.0^2}{14} \right)^2}{\frac{2.0^2}{9^2} + \frac{6.0^2}{14^2}} = \frac{7.84}{0.018 + 0.411} = 18.27 \approx 18 \text{ or } 19. \]

(d)  
\[ \nu = \frac{\left( \frac{5.0^2}{12} + \frac{6.0^2}{24} \right)^2}{\frac{5.0^2}{12^2} + \frac{6.0^2}{24^2}} = \frac{12.84}{0.359 + 0.98} = 26.05 \approx 26 \text{ or } 27. \]

4. 9.34.

(a) The 1 - \( \alpha \) level confidence interval for \( \mu_1 - \mu_2 \) is
\[ [\bar{X} - \bar{Y} - t_{\frac{\alpha}{2}, m+n-2} S_p \sqrt{\frac{1}{m} + \frac{1}{n}}, \bar{X} - \bar{Y} + t_{\frac{\alpha}{2}, m+n-2} S_p \sqrt{\frac{1}{m} + \frac{1}{n}}]. \]
(b) In this particular data, \( m = n = 4 \), \( \bar{x} = 13.9 \) and \( \bar{y} = 12.2 \), \( s_1^2 = 1.5 \) and \( s_2^2 = 1.02 \). Then,
\[
s_p = \frac{1}{6} [3s_1^2 + 3s_2^2] = \frac{1}{6} [3(1.5) + 3(1.02)] = 1.26.
\]
Therefore, the 95% confidence interval for \( \mu_1 - \mu_2 \) is
\[
[13.9 - 12.2 - t_{0.025,6} \sqrt{1.26} \sqrt{\frac{1}{4} + \frac{1}{4}}] \leq \mu_1 - \mu_2 \leq [13.9 - 12.2 + t_{0.025,6} \sqrt{1.26} \sqrt{\frac{1}{4} + \frac{1}{4}}] = [-0.24, 3.64].
\]
(c) The degrees of freedom can be computed by
\[
\mu = \frac{(S_1^2/m_1) + (S_2^2/n_2)}{m_1-1 + (n_2-1)} = \frac{(1.5 + 1.02)^2}{2 + 2} = \frac{0.7056}{0.125} = 5.644 \approx 5 \text{ or } 6.
\]
If you take \( df = 5 \), the confidence interval is
\[
[13.9 - 12.2 - t_{0.025,5} \sqrt{1.26} \sqrt{\frac{1}{4} + \frac{1}{4}}] \leq \mu_1 - \mu_2 \leq [13.9 - 12.2 + t_{0.025,5} \sqrt{1.26} \sqrt{\frac{1}{4} + \frac{1}{4}}] = [-0.34, 3.74];
\]
if you take \( df = 6 \), then the result is exactly given in (b).

5. 9.36. In this dataset, \( n = 8 \) thus \( df = 7 \), \( d = 7.25 \) and \( s_y^2 = 11.86^2 \). The level 0.01 test rejects \( H_0 \) if
\[
T = \frac{\bar{D}}{S_D/\sqrt{n}} \geq t_{0.01,7} = 2.998.
\]
The observe value of \( T \) is
\[
t = \frac{7.25}{11.86/\sqrt{8}} = 1.729 < 2.998.
\]
Therefore, \( H_0 \) is accept and we conclude that there is no enough evidence to decline the difference of \( \mu_1 \) and \( \mu_2 \) are significantly greater than 0.

6. 9.54. Here we have \( x = 18 \), \( m = 56 \), \( y = 12 \), and \( n = 51 \). Thus, we have \( \hat{p}_1 = 0.3214 \), \( \hat{p}_2 = 0.2353 \), and \( \hat{p} = 0.2804 \). Therefore, we have
\[
Z = \frac{0.3214 - 0.2353}{\sqrt{0.2804(1 - 0.2804)(1/56 + 1/51)}} = 0.9903
\]
and
\[
\tilde{Z} = \frac{0.3214 - 0.2353}{\sqrt{0.3214(1 - 0.3214)/56 + 0.2353(1 - 0.2353)/51}} = 0.9935.
\]
Because both \( Z \) are \( \tilde{Z} \) are less than \( z_{0.05} = 1.645 \) in absolute value, we conclude \( p_1 = p_2 \). (Note, using one of \( Z \) or \( \tilde{Z} \) is enough).

7. 9.65. For Epoxy, we have \( m = 4 \) and \( s_1^2 = 0.02576 \). For MIMA prepolymer, we have \( n = 4 \) and \( s_2^2 = 0.005492 \). Thus,
\[
F = \frac{s_1^2/(m-1)}{s_2^2/(n-1)} = \frac{0.02576}{0.005492} = 4.69.
\]
The 90% CI for \( \sigma_1^2/\sigma_2^2 \) is
\[
\left[ \frac{F_{0.95,3,3}}{4.69}, \frac{F_{0.95,3,3}}{4.69} \right] = \left[ \frac{0.108}{4.69}, \frac{9.28}{4.69} \right] = [0.023, 1.98].
\]