38. 

a. 
1. \( p = \) true proportion of all nickel plates that blister under the given circumstances.
2. \( H_0: \ p = .10 \)
3. \( H_a: \ p > .10 \)
4. 
   \[ z = \frac{\hat{p} - p_0}{\sqrt{p_0(1-p_0)/n}} = \frac{\hat{p} - .10}{\sqrt{.10(.90)/n}} \]
5. Reject \( H_0 \) if \( z \geq 1.645 \)
6. 
   \[ z = \frac{14/100 - .10}{\sqrt{.10(.90)/100}} = 1.33 \]
7. Fail to Reject \( H_0 \). The data does not give compelling evidence for concluding that more than 10% of all plates blister under the circumstances.

The possible error we could have made is a Type II error: Failing to reject the null hypothesis when it is actually true.

b. \( \beta(.15) = \Phi \left[ \frac{.10 - .15 + 1.645\sqrt{.10(.90)/100}}{\sqrt{.15(.85)/100}} \right] = \Phi(-.02) = .4920 \) When \( n = 200 \),
\[ \beta(.15) = \Phi \left[ \frac{.10 - .15 + 1.645\sqrt{.10(.90)/200}}{\sqrt{.15(.85)/200}} \right] = \Phi(-.60) = .2743 \]

c. 
\[ n = \left[ \frac{1.645\sqrt{.10(.90)} + 1.28\sqrt{.15(.85)}}{.15 - .10} \right]^2 = 19.01^2 = 361.4 \) so use \( n = 362 \).

40. 

a. Let \( X = \) the number of couples who lean more to the right when they kiss. If \( n = 124 \) and \( p = 2/3 \), then \( E[X] = 124(2/3) = 82.667 \). The researchers observed \( x = 80 \), for a difference of 2.667. The probability in question is \( P(X = 82.667 \geq 2.667) = P(X \leq 80 \text{ or } X \geq 85.33) = P(X \leq 80) + [1 - P(X \leq 85)] = B(80; 124, 2/3) + [1 - B(85; 124, 2/3)] = 0.634 \). (Using a large-sample z-based calculation gives a probability of 0.610.)

b. We wish to test \( H_0: \ p = 2/3 \) v. \( H_a: \ p \neq 2/3 \). From the data, \( \hat{p} = \frac{80}{124} = .645 \), so our test statistic is
\[ z = \frac{.645 - .667}{\sqrt{.667(.333)/124}} = -0.51 \] We would fail to reject \( H_0 \) even at the \( \alpha = .10 \) level, since \( |z| = 0.51 < 1.645 \). There is no statistically significant evidence to suggest the \( p = 2/3 \) figure is implausible for right-leaning kissing behavior.

53. The \( P \)-value is greater than the level of significance \( \alpha = .01 \), therefore fail to reject \( H_0 \). The data does not indicate a statistically significant difference in average serum receptor concentration between pregnant women and all other women.
58. \[ \mu = \text{the true average percentage of organic matter in this type of soil, and the hypotheses are } H_0: \mu = 3 \text{ v. } H_a: \mu \neq 3. \text{ With } n = 30, \text{ and assuming normality, we use the } t \text{ test:} \]
\[ t = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{2.481 - 3}{.295} = -1.759. \text{ The } P\text{-value} = 2[\Pr(t > 1.759)] = 2(.041) = .082. \text{ At significance level } .10, \text{ since } .082 \leq .10, \text{ we would reject } H_0 \text{ and conclude that the true average percentage of organic matter in this type of soil is something other than 3. At significance level } .05, \text{ we would not have rejected } H_0. \]

59. 

a. The accompanying normal probability plot is acceptably linear, which suggests that a normal population distribution is quite plausible.

![Normal Probability Plot]

b. The parameter of interest is \( \mu = \text{the true average compression strength (MPa) for this type of concrete}. \) The hypotheses are \( H_0: \mu = 100 \text{ versus } H_a: \mu < 100. \) Since the data come from a plausibly normal population, we will use the \( t \) procedure. The test statistic is 
\[ t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{96.42 - 100}{8.26/\sqrt{10}} = -1.37. \text{ The corresponding one-tailed } P\text{-value, at } df = 10 - 1 = 9, \text{ is } P(T \leq -1.37) \approx .102. \text{ The } P\text{-value slightly exceeds } .10, \text{ the largest } \alpha \text{ level we'd consider using in practice, so the null hypothesis } H_0: \mu = 100 \text{ should not be rejected. This concrete should be used.}
68.  

a.  \( H_0: \mu = 2150 \) v. \( H_a: \mu > 2150 \)

b.  \( t = \frac{\overline{x} - 2150}{s/\sqrt{n}} \)

c.  \( t = \frac{2160 - 2150}{30/\sqrt{16}} = \frac{10}{7.5} = 1.33 \)

d.  At 15df, \( P\text{-value} = P(t > 1.33) = .107 \) (approximately)

e.  From d, \( P\text{-value} > .05 \), so \( H_0 \) cannot be rejected at this significance level. The mean tensile strength for springs made using roller straightening is not significantly greater than 2150 N/mm².

2.  

a.  With large sample sizes, a 95% confidence interval for the difference of population means, \( \mu_1 - \mu_2 \), is 
\[
(\overline{x} - \overline{y}) \pm z_{a/2} \sqrt{\frac{s_1^2}{m} + \frac{s_2^2}{n}} = (\overline{x} - \overline{y}) \pm 1.96 \sqrt{[SE(\overline{x})]^2 + [SE(\overline{y})]^2} .
\]
Using the values provided, we get
\[
(64.9 - 63.1) \pm 1.96 \sqrt{(.09)^2 + (.11)^2} = 1.8 \pm .28 = (1.52, 2.08).
\]
Therefore, we are 95% confident that the difference in the true mean heights for younger and older women (as defined in the exercise) is between 1.52 inches and 2.08 inches.

b.  The null hypothesis states that the true mean height for younger women is 1 inch higher than for older women, i.e., \( \mu_1 = \mu_2 + 1 \). The alternative hypothesis states that the true mean height for younger women is more than 1 inch higher than for older women.

At the \( \alpha = .001 \) level, we will reject \( H_0 \) if \( z \geq z_{0.001} = 3.09 \). The test statistic, \( z \), is given by
\[
z = \frac{(\overline{x} - \overline{y}) - \Delta_0}{SE(\overline{x} - \overline{y})} = \frac{1.8 - 1}{\sqrt{(.09)^2 + (.11)^2}} = 5.63; \text{ since } 5.63 \geq 3.09, \text{ we reject } H_0 \text{ and conclude that the true mean height for younger women is indeed more than 1 inch higher than for older women.}
\]

c.  From the calculation above, \( P\text{-value} = P(Z \geq 5.63) = 1 - \Phi(5.63) \approx 1 - 1 = 0. \) Therefore, yes, we would reject \( H_0 \) at any reasonable significance level (since the \( P\text{-value} \) is lower than any reasonable value for \( \alpha \)).

d.  The actual hypotheses of (b) have not been changed, but the subscripts have been reversed. So, the relevant hypotheses are now \( H_0: \mu_2 - \mu_1 = 1 \) versus \( H_a: \mu_2 - \mu_1 > 1 \). Or, equivalently, \( H_0: \mu_1 - \mu_2 = -1 \) versus \( H_a: \mu_1 - \mu_2 < -1 \).
8.

a. Parameter of interest: $\mu_1 - \mu_2$ = the true difference of mean tensile strength of the 1064-grade and the 1078-grade wire rod. Let $\mu_1 = 1064$-grade average and $\mu_2 = 1078$-grade average.

$H_0$: $\mu_1 - \mu_2 = -10$

$H_a$: $\mu_1 - \mu_2 < -10$

$$z = \frac{(\bar{x} - \bar{y}) - \Delta_0}{\sqrt{\frac{s_1^2}{m} + \frac{s_2^2}{n}}} = \frac{(\bar{x} - \bar{y}) - (-10)}{\sqrt{\frac{1.3^2}{129} + \frac{2.0^2}{129}}}$$

RR: We’ll reject $H_0$ if the $P$-value is less than a reasonable $\alpha$.

$$z = \frac{(107.6 - 123.6) - (-10)}{\sqrt{\frac{1.3^2}{129} + \frac{2.0^2}{129}}} = -6.210 = -28.57$$

For a lower-tailed test, the $P$-value = $\Phi(-28.57) \approx 0$, which is less than any reasonable $\alpha$, so reject $H_0$. There is very compelling evidence that the mean tensile strength of the 1078 grade exceeds that of the 1064 grade by more than 10.

b. The requested information can be provided by a 95% confidence interval for $\mu_1 - \mu_2$:

$$(\bar{x} - \bar{y}) \pm 1.96 \sqrt{\frac{s_1^2}{m} + \frac{s_2^2}{n}} = (-16) \pm 1.96(.210) = (-16.412, -15.588).$$

18. With $H_0$: $\mu_1 - \mu_2 = 0$ v. $H_a$: $\mu_1 - \mu_2 \neq 0$, we will reject $H_0$ if the $P$-value is less than $\alpha$.

$$\nu = \frac{(\frac{16^2}{6} + \frac{24^2}{5})^2}{\frac{16^2}{5} + \frac{24^2}{5}} = 6.8 > 6, \text{ and the test statistic } t = \frac{22.73 - 21.95}{\sqrt{\frac{16^2}{6} + \frac{24^2}{5}}} = .78 = 6.17 \text{ leads to a } P\text{-value of } 2[P(t > 6.17)] < 2(.0005) = .001, \text{ which is less than most reasonable } \alpha\text{'s, so we reject } H_0 \text{ and conclude that there is a difference in the densities of the two brick types.}$$

19. For the given hypotheses, the test statistic is $t = \frac{115.7 - 129.3 + 10}{\sqrt{\frac{5^2}{6} + \frac{11^2}{5}}} = -3.6 = -1.20$, and the df is

$$\nu = \frac{(4.2168 + 4.8241)^2}{\frac{4.2168^2}{5} + \frac{4.8241^2}{5}} = 9.96, \text{ so use df } = 9. \text{ We will reject } H_0 \text{ if } t \leq -t_{0.05} = -2.764;$$

since $-1.20 > -2.764$, we don’t reject $H_0.$