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 $$z = \frac{\hat{p} - p_o}{\sqrt{p_o(1-p_o)/n}} = \frac{\hat{p} - .10}{\sqrt{.10(.90)/n}}$$

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.

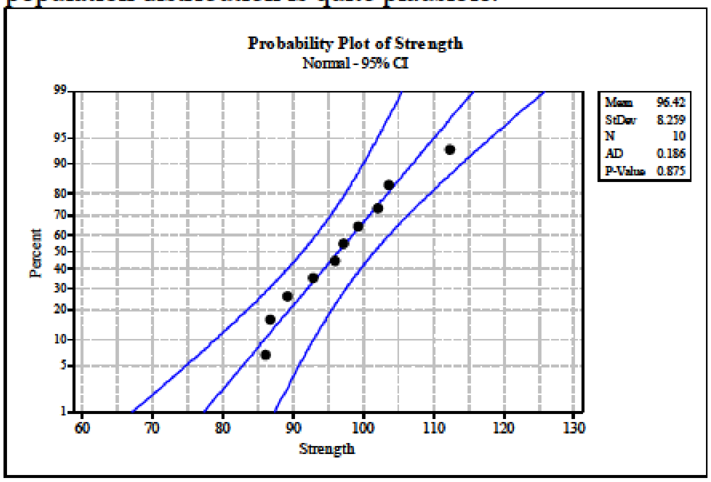
58. μ = the true average percentage of organic matter in this type of soil, and the hypotheses are H_0: $\mu = 3$ v. H_a: $\mu \neq 3$. With $n = 30$, and assuming normality, we use the t test:

$$t = \frac{\overline{x}-3}{s/\sqrt{n}} = \frac{2.481-3}{.295} = \frac{-.519}{.295} = -1.759$$

The P-value = $2[P(\, t > 1.759\,)] = 2(\,.041\,) = .082$. At significance level .10, since $.082 \leq .10$, we would reject H_0 and conclude that the true average percentage of organic matter in this type of soil is something other than 3. At significance level .05, 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.



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

68.

a. H_0: $\mu = 2150$ v. H_a: $\mu > 2150$

b. $t = \dfrac{\overline{x} - 2150}{s/\sqrt{n}}$

c. $t = \dfrac{2160 - 2150}{30/\sqrt{16}} = \dfrac{10}{7.5} = 1.33$

d. At 15df, P-value $= P(t > 1.33) = .107$ (approximately)

e. From **d**, P-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/mm^2.

2.

a. With large sample sizes, a 95% confidence interval for the difference of population means, $\mu_1 - \mu_2$, is $(\overline{x} - \overline{y}) \pm z_{\alpha/2}\sqrt{\dfrac{s_1^2}{m} + \dfrac{s_2^2}{n}} = (\overline{x} - \overline{y}) \pm 1.96\sqrt{[SE(\overline{x})]^2 + [SE(\overline{y})]^2}$. 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 <u>more</u> than 1 inch higher than for older women.
At the $\alpha = .001$ level, we will reject H_0 if $z \ge z_{.001} = 3.09$. The test statistic, z, is given by $z = \dfrac{(\overline{x} - \overline{y}) - \Delta_0}{SE(\overline{x} - \overline{y})} = \dfrac{1.8 - 1}{\sqrt{(.09)^2 + (.11)^2}} = 5.63$; since $5.63 \ge 3.09$, we reject H_0 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-value $= P(Z \ge 5.63) = 1 - \Phi(5.63) \approx 1 - 1 = 0$. Therefore, yes, we would reject H_0 at any reasonable significance level (since the P-value is lower than any reasonable value for α).

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.

1 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 μ_1 = 1064-grade average and μ_2 = 1078-grade average.

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

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

4 $$z = \frac{(\bar{x}-\bar{y})-\Delta_o}{\sqrt{\frac{s_1^2}{m}+\frac{s_2^2}{n}}} = \frac{(\bar{x}-\bar{y})-(-10)}{\sqrt{\frac{s_1^2}{m}+\frac{s_2^2}{n}}}$$

5 RR: We'll reject H_0 if the P-value is less than a reasonable α.

6 $$z = \frac{(107.6-123.6)-(-10)}{\sqrt{\frac{1.3^2}{129}+\frac{2.0^2}{129}}} = \frac{-6}{.210} = -28.57$$

7 For a lower-tailed test, the P-value = $\Phi(-28.57) \approx 0$, which is less than any reasonable α, 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 α.

$$\nu = \frac{\left(\frac{.164^2}{6}+\frac{.240^2}{5}\right)^2}{\frac{\left(\frac{.164^2}{6}\right)^2}{5}+\frac{\left(\frac{.240^2}{5}\right)^2}{4}} = 6.8 \searrow 6$$, and the test statistic $t = \frac{22.73-21.95}{\sqrt{\frac{.164^2}{6}+\frac{.240^2}{5}}} = \frac{.78}{.1265} = 6.17$ leads to a P-value of $2[P(t > 6.17)] < 2(.0005) = .001$, which is less than most reasonable α's, so we reject H_0 and conclude that there is a difference in the densities of the two brick types.

19. For the given hypotheses, the test statistic is $t = \frac{115.7-129.3+10}{\sqrt{\frac{5.03^2}{6}+\frac{5.38^2}{6}}} = \frac{-3.6}{3.007} = -1.20$, and the df is

$$\nu = \frac{(4.2168+4.8241)^2}{\frac{(4.2168)^2}{5}+\frac{(4.8241)^2}{5}} = 9.96$$, so use df = 9. We will reject H_0 if $t \le -t_{.01,9} = -2.764$; since $-1.20 > -2.764$, we don't reject H_0.