ISBE 8.1 multiple choice:
  a) $\bar{X}$ ... $\mu$
  b) $\sigma/\sqrt{n}$ ... standard error SE
  c) 2 ... $\mu$
  d) about 50 times ... would NOT
  e) wider

ISBE 8.6 $\bar{X} = 148,000$ and $s = 62,000$
  a) $n=25$, so use $t$ percentage point in interval (24 degrees of freedom).
  The formula:
  \[ \mu = \bar{X} \pm t_{0.025} * s/\sqrt{n} \]
  \[ t_{0.025,df=24} = 2.06, \text{ so} \]
  \[ \mu = 148,000 \pm 2.06 * 62,000/5, \]
  and the interval is [122456, 173544].
  b) The confidence interval in part a) gives a range of plausible values for the mean of the distribution of home sale prices. Look, instead, at the distribution of sample sale prices: sample mean is $148,000 and sample standard deviation is $62,000. The friend paid $206,000 for a home, this is less than one standard deviation above the sample mean ($210,000), not unusual at all.

ISBE 8.11 Confidence interval for a difference in population means using unmatched data.
  a) sample mean for women, $\bar{X}_W$, is 11; sample mean for men, $\bar{X}_M$, is 16. sample variance for women, $s^2_W=10$; sample variance for men, $s^2_M=21.5$. This is an unmatched problem, and the 2 population variances are unknown, use formula 8-20. Degrees of freedom for the $t$ value are, using 8-22, 10-2=8. For a 95% confidence interval $t_{0.025,df=8} = 2.31$. Using 8-21,
  \[ s_p^2 = \frac{4 * s^2_W + 4 * s^2_M}{4 + 4} = 15.75. \]
  The confidence interval for the difference in women’s and men’s salaries, $\mu_W - \mu_M$, is
  \[ \mu_W - \mu_M = \bar{X}_W - \bar{X}_M \pm t_{0.025} * s_p * \sqrt{\frac{1}{n_W} + \frac{1}{n_M}} \]
  where $n_W = n_M = 5$, so
  \[ \mu_W - \mu_M = -5 \pm 2.31 * 3.97 * 0.632, \]
  hence
  \[ \mu_W - \mu_M = -5 \pm 5.8. \]
b) This only provides very weak evidence that, on average, women earn less than men. Indeed, the confidence interval contains 0 and hence is consistent with no discrimination. Furthermore, this analysis does not take into account possible explanations for this difference (e.g., experience, training, etc.) and so, while a policy of discrimination would likely result in a difference, a difference is not, in itself, proof of discrimination.

ISBE 8.15 Confidence interval for a difference in population means using matched data. The data is matched by litter.

a) Use formula 8.12. Start by forming the differences between treatment and control, \( D = \text{Treatment} - \text{Control} \). The sample mean difference, \( \bar{D} \), is 3 and the sample variance, \( s_D^2 \), of \( D \) is 3.56. \( n = 10 \), so d.f. = 9 and \( t_{0.025, \text{df}=9} = 2.26 \).

\[
\Delta = \bar{D} \pm t_{0.025, \text{df}=9} \times s_d/\sqrt{10},
\]

\[
\Delta = 3 \pm 2.26 \times 0.396,
\]

\[
\Delta = 3 \pm 1.35.
\]

b) The experiment provides evidence that an interesting environment leads to greater brain development, as measured by brain weight.

ISBE 8.17 Confidence interval for a proportion. In a sample of size \( n \) tires, a proportion, \( P = 0.10 \), failed to meet standards.

a) (n=10) Expected number of 'successes' is 0.10 \( \times 10 = 1 < 5 \), so need to use the graphical method. Find \( P = 0.10 \) on the horizontal axis and read off the 95% interval from the vertical axis (n=10):

\[
0 \leq \pi \leq 0.45.
\]

b) (n=25) Expected number of 'successes' is 0.10 \( \times 25 = 2.5 < 5 \), so need to use the graphical method. Find \( P = 0.10 \) on the horizontal axis and read off the 95% interval from the vertical axis (half way between n=20 and n=30):

\[
0.01 \leq \pi \leq 0.30.
\]

c) (n=50) Expected number of 'successes' is 0.10 \( \times 50 = 5 \), so can use either method. Using the graphical method, find \( P = 0.10 \) on the horizontal axis and read off the 95% interval from the vertical axis (n=50):

\[
0.04 \leq \pi \leq 0.22.
\]

Using formula 8.27,

\[
\pi = P \pm 1.96 \times \sqrt\frac{P(1-P)}{n},
\]
\[ \pi = 0.1 \pm 1.96 \times \sqrt{\frac{0.1(0.9)}{50}}, \]
\[ \pi = 0.1 \pm 0.08, \]
d) \( n=200 \) Use formula 8.27,
\[ \pi = P \pm 1.96 \times \sqrt{\frac{P(1-P)}{n}}, \]
\[ \pi = 0.1 \pm 1.96 \times \sqrt{\frac{0.1(0.9)}{200}}, \]
\[ \pi = 0.1 \pm 0.04. \]

ISBE 8.19 Confidence intervals for differences in proportions. Use formula 8.29 for parts a and b:

a) \( n_{us} = n_{japan} = 300 \). \( P_{us} = 0.40 \) and \( P_{japan} = 0.33 \)
\[ \pi_{us} - \pi_{japan} = P_{us} - P_{japan} \pm 1.96 \times \sqrt{\frac{P_{us}(1-P_{us})}{n_{us}} + \frac{P_{japan}(1-P_{japan})}{n_{japan}}}, \]
\[ \pi_{us} - \pi_{japan} = 0.07 \pm 1.96 \times 0.039, \]
\[ \pi_{us} - \pi_{japan} = 0.07 \pm 0.07, \]
b) \( n_{us} = n_{la} = 300 \). \( P_{us} = 0.40 \) and \( P_{la} = 0.57 \)
\[ \pi_{us} - \pi_{la} = P_{us} - P_{la} \pm 1.96 \times \sqrt{\frac{P_{us}(1-P_{us})}{n_{us}} + \frac{P_{la}(1-P_{la})}{n_{la}}}, \]
\[ \pi_{us} - \pi_{la} = -0.17 \pm 0.079, \]