1. Calculate *sample* standard deviation s_x of the list $\{2, 4, 6\}$.
a) 2.00 b) 2.45 c) 2.16 d) 3.00 e) 1.45

2. If a with-replacement sample of n = 100 has sample standard deviation $s_x = 6.1$ give the estimated margin of error (MOE) of the sample mean. (**MOE is *always* from the 95% CI**)
a) 0.61 b) 6.1 c) 11.96 d) .1196 **e) 1.196**

3. If a *without*-replacement sample of 100 is selected from a population of 700 the estimated margin of error of the sample mean is multiplied by the finite population correction (FPC):
a) (700 - 1) / (700 - 100) b) (700-100) / (700-1)
c) $\sqrt{(700 - 1) / (700 - 100)}$ **d)** $\boldsymbol{\sqrt{(700 - 100) / (700 - 1)}}$
e) (100 / 700) (600 / 700)

4. The estimated margin of error of sample fraction $\hat{p} = 0.3$ in *with*-replacement sampling with large n is:
a) $1.96\sqrt{.3 \times .7} / n$ b) $\sqrt{.3 \times .7} / n$ **c)** $\boldsymbol{\sqrt{.3 \times .7} / \sqrt{n}}$
d) $\boldsymbol{1.96\sqrt{.3 \times .7} / \sqrt{n}}$ e) $1.96\sqrt{.3 \times .7}$
(note: gave credit for incorrect answer (c) also)

5. Determine the upper (right) endpoint of a 95% CI if the point estimate is 2.6 and its estimated margin of error is 0.3.
a) 2.6 b) 2.7 c) 2.8 **d) 2.9** e) 3.0

6. A with-replacement random sample of 100 children from the population of school children in a particular district finds sample average HDL cholesterol level 131 with sample standard deviation 28. Give the upper right limit of a 95% CI for the population mean HDL level.
a) 185.72 b) 164.79 c) 227.21 **d) 136.49** e) 155.26

7. A with-replacement random sample of 400 "16 ounce" food packages finds that 300 packages are "far overweight." Determine the upper right endpoint of a 95% CI for p = fraction of all "far overweight" packages in the population.
a) 0.792 b) 0.758 c) 0.881 d) 0.826 e) 0.849

8. Use the **T**-table to determine **z** replacing 1.96 in the **z-based** confidence interval if we want **99%** confidence.
a) 2.991 b) 2.680 **c) 2.576** d) 2.408 e) 2.279

9. Around 700 experimenters each (independently of each other) selects random samples and prepares a 95% CI for estimating their respective parameters. Assuming they use their methods correctly, around how many of them enclose their target parameter with their CI? **(.95 of 700)**
a) 750 b) 580 c) 525 **d) 665** e) 695

10-14. Contexts are described in which we may employ one of five different CI procedures. Give the correct match ups with:

(a) $\mathbf{P}(\mu_x \textbf{ in } (\sum_{i=1}^{i=k} W_i\, \overline{x_i}) \pm 1.96\sqrt{\sum_{i=1}^{i=k} W_i^2\, \frac{s_i^2 *^2}{n_i}}\,) \to .95$

(b) $\mathbf{P}(p_x \textbf{ in } \hat{p}_x \pm 1.96\, \frac{\sqrt{\hat{p}_x(1-\hat{p}_x)}}{\sqrt{n}} *) \to .95$

(c) $\mathbf{P}(\mu_x\text{-}\mu_y \textbf{ in } \overline{x}\text{-}\overline{y} \pm 1.96\sqrt{\frac{s_x^2 *^2}{n_x} + \frac{s_y^2 *^2}{n_y}}\,) \to .95$

(d) $\mathbf{P}(\mu_y \textbf{ in } (\overline{y} + (\mu_x\text{-}\overline{x})\, R\, \frac{s_y}{s_x}) \pm 1.96\, \frac{s_y *}{\sqrt{n}} \sqrt{1 - R^2}\,) \to .95$

(e) $\mathbf{P}(p_x\text{-}p_y \textbf{ in } \hat{p}_x\text{-}\hat{p}_y \pm 1.96\sqrt{\frac{\hat{p}_x(1-\hat{p}_x) *^2}{n_x} + \frac{\hat{p}_y(1-\hat{p}_y) *^2}{n_y}}\,) \to .95$

* Times a factor (or its square) if sampling is without-replacement.

10. In randomized trials of two vaccines A, B, a CI is prepared for the difference between the fraction of patients experiencing side effects for vaccine A with that for vaccine B. **(e)**

11. A random sample of 400 vials of vaccine is selected without-replacement and examined to determine a CI for the ***population fraction*** of vials that have lost potency. **(b)**

12. A random sample of taxpayers is selected in order to establish a CI for the population average of the federal refunds for all taxpayers in a community. Instead of only looking at the refund for each sample taxpayer, notice is also made of the declared income for the year previous. The community-wide population average income for the year previous is available from public records. The CI will exploit this additional score. **(d)**

(tip: we *know* μ_x and "notice is also made of ..)

13. Our purpose is to compare the **difference between** the **average annual salaries** of men vs women for employees of a large organization who were all trained for the same entry level position in 1994. Random samples are selected from each group separately and "independently." **(c)**

14. Women comprise 70% of a particular population. A random sampling of 70 persons is selected with the purpose of establishing a CI for the mean body fat ratio of this population. It is suspected that body fat ratio tends to differ between the sexes and this will be addressed by the method used. **(a)**

15-18. A population of farm raised salmon is monitored often to check on weight gains and adjust feed levels accordingly. The population distribution of fish weights is approximately normal. A sample of **16** fish will be selected by net dipping which has been tested and found consistent with equal probability sampling. For such a sample we find sample mean $\overline{x}$ = 23 ounces with sample standard deviation s_x = 2 ounces.

15. Determine the **T**-score used in lieu of 1.96 when preparing a **90%** CI for the mean weight of fish.

a) 1.746 b) 1.341 c) 1.337 **d) 1.753** e) 1.740

16. Give a point estimate of *population* standard deviation.

a) 2 b) 3.506 c) 0.5 d) 0.876 e) 0.438

(s_x)

17. Give a point estimate of the standard deviation of the list of all possible *sample means* (they are less variable than single scores).

a) 2 b) 3.506 **c) 0.5** d) 0.876 e) 0.438

$(s_x / \sqrt{n})$

18. Determine the *upper right endpoint* of the 95% CI for μ_x.

a) 25   b) 26.506 c) 23.5 **d) 23.876** e) 23.438

19-20. In each case ***determine the preferred point estimate*** of the population mean in the given setting.

19. An equal probability with-replacement sample of partons of an internet site is obtained. The purpose is to estimate the average age of patrons. From previous records we know **58%** of customers purchase clothing. For our sample

75% purchase clothing

sample avg age of those purchasing clothing is 48

sample avg age of those not purchasing clothing is 59

Give the *preferred estimate* of averge age of the population.

a) .75 48 + .25 59   b) .75 59 + .25 48   **c) .58 48 + .42 59**

d) .58 59 + .42 48   e) .5 48 + .5 59 $(\sum_{i=1}^{i=k} W_i \overline{x_i})$

20. A random sample of young sheep is sampled and each has its weight y recorded. Our purpose is to estimate the population mean weight μ_y. For each sample sheep its mother's weight x is read from information encoded with the sheep. It is known that $\mu_x = 183$ pounds. The sample gives:

$\overline{x} = 175$ (pounds) $\overline{y} = 6.3$

$s_x = 12$ $s_y = 0.8$ $R = 0.62$

Give the *preferred estimate* of the population average weight μ_y

of sheep.

a) 6.3 **b) 6.63** c) 6.97 d) 3.91 e) 6.18

(μ_y in ($\overline{y}$ + (μ_x-$\overline{x}$) R $\frac{s_y}{s_x}$)