Homework due April 29

Assigned exercises:

From Ch.8, OpenStax: ex. 97(c-g), 98(d-h), 100, 102, 103, 106(d-e), 107, 108(a-c), 112, 115. (total=10 numbered exercises)

Graded exercises:

From Ch.8, OpenStax: 98(d-h), 103, 106(d-e), 108(a-c).

Total (maximum) possible points = 20.

4 pt for each of 4 graded problems, plus 4 for completion of the rest.

-0.5 pt for each (ungraded) missing problem; if a graded problem is missing, student loses the points allotted to it.

---

(98) (d) Since the population standard deviation is given ($\sigma = 0.1$ ounce), we can use the normal distribution $N(\mu, \frac{\sigma}{\sqrt{n}}) = N(\mu, \frac{0.1}{\sqrt{16}})$, where μ = population mean.

Of course, this assumes the conditions for the Central Limit Theorem (CLT) are met, which is not entirely clear, since there is no information on how the sample was selected.

(e) 90% confidence interval: Error bound $= z^* \cdot \frac{\sigma}{\sqrt{n}} = 1.645 \cdot 0.025 = 0.041$

Confidence interval $= 2 \pm 0.041 = [1.959, 2.041]$ ounces.

(f) Not graded, but here are the answers:
Error bound $= z^* \cdot \frac{\sigma}{\sqrt{n}} = 2.33 \cdot 0.025 = 0.058$

Confidence interval $= 2 \pm 0.058 = [1.942, 2.058]$ ounces.

(g) The error bound (or margin of error) is given by $= z^* \cdot \frac{\sigma}{\sqrt{n}}$. If the confidence level increases then z^* increases, and since everything else remains the same, the width of the CI increases.

(h) Not graded, but here is the answer:
We are 98% confident that the true mean weight of the candy bags lies between 1.942 and 2.058 ounces. We note, however, that this conclusion may not be reliable, as it is not clear whether the sample satisfies the independence requirement.

Grade: (d) = (e) = 1.5 points each, (g) = 1 point.
For (d): 0.5+0.5+0.5 pt = correct shape (normal) + correct SD + reason.
For (e): 0.5+0.5+0.5 pt for correct z^* + error bound + confidence interval.
For (g): Any reasonable answer about the widening effect of higher confidence levels is sufficient.

(103) To estimate the sample size we use the same error bound formula: $EBM = z^* \frac{\sigma}{\sqrt{n}}$

For 93% confidence level, look up the z-table for 0.965: $z^* = 1.81$.
Other known/given quantities: $\sigma = 2.5$", $EBM = 1.0$". Plug in and solve for n:

$$1 = 1.81 \left(\frac{2.5}{\sqrt{n}} \right) \Rightarrow n = (1.81)^2 (2.5)^2 \approx 20.48$$

Answer: The minimum sample size to ensure the error bound is within 1" is 21.

Grade:
1pt = find correct z^* value.
1pt = know/show correct value of σ.
0.5 pt = setup EBM equation correctly with only n being unknown.
1pt = solve for correct value of n.
0.5 pt = write a reasonable answer for sample size (must be whole number).

(106) (d) Doing this problem requires assuming the sample has met the relevant conditions, which I will assume.

Since this problem is about sample means, and the population σ is unknown, we must use the t-distribution with $df = n - 1 = 80$.

95% confidence interval: $EBM = t^*_{80} \cdot \frac{\sigma}{\sqrt{n}} = (1.992)\frac{4}{\sqrt{81}}$ $\boxed{= 0.8853}$

Confidence interval $= 8 \pm 0.8853 \approx$ $\boxed{[7.11, 8.89] \text{ hours}}$

NOTE: I've used t^*_{75} instead of t^*_{80}, since it was the closest available lower df in the t-tables. Student answers may vary slightly if they use a more exact t^*_{80} value.

(e) We are 95% confident that the true mean time wasted by individuals waiting to be called for jury duty at the courthouse lies between 7.11 and 8.89 hours.

Grade: 3 points for (d) + 1 point for (e).
For (d): 0.5+0.5pt = know we need to use a t-model + know its correct df.
0.5+0.5 pt = find correct t^* + know SD expression (i.e., $4/\sqrt{81}$).
1 pt = compute correct confidence interval, preferably with correct units.
For (e): Write a reasonable conclusion that includes the context of the application.

(108) (a)
i. $\overline{x} = 6$ months
ii. $s_x = 3$ months
iii. $n = 14$
iv. $n - 1 = 13$

(b) X = number of months an individual child had to use training wheels when learning to ride a two-wheel bike.

(c) $\overline{X}$ = mean number of months of training wheels usage for random samples of 14 children.

Grade: (a) = 2 points, (b) and (c) = 1 point each.
For (a): 0.5pt for each of 4 correct answers.
For (b) and (c): Any reasonable answer that captures the flavor of the above answers is sufficient.