Homework due May 6

Assigned exercises:

From Ch.9, OpenStax: ex. 66(g-j), 68, 74, 75, 76, 84, 85, 90, 98, 107. (total=10 numbered exercises)

Graded exercises:

Ch.9, OpenStax: 66(g-h), 74, 85, 98.

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.

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(66) (g) In this situation, the hypotheses would be:

H_0: half of Americans prefer to live away from cities

H_A: the proportion of Americans who prefer to live away from cities is not half

Type I error = we conclude the proportion of Americans who prefer to live away from cities is not half, when it actually is half.

Type II error = we conclude the proportion of Americans who prefer to live away from cities IS half when, in fact, it is not.

(h) H_0: Europeans get a mean paid vacation of 6 weeks per year

H_A: the mean paid vacation Europeans get is not 6 weeks per year

Type I error = we conclude the mean paid vacation Europeans get is not 6 weeks per year, when it actually is.

Type II error = we conclude the mean paid vacation Europeans get is 6 weeks, when it is actually not.

Grade: (g) = (h) =2 points each.
For each: 1+1 pt for correct Type I and Type II error.
Doesn't have to say the same as what I have, but must contain the right idea.

(74)
* The conditions that must be satisfied are: (1) independence, and (2) large enough sample. For (1), we generally require a random or representative sample, and no relevant info has been given to verify that. The sample size of 28 may be large enough if the population is unimodal, without strong skew.
* Let μ = true mean number of miles the tire lasts. The hypotheses are
  $H_0 : \mu = 50,000$
  $H_A : \mu \neq 50,000$ [NOTE: It is acceptable if a student says $\mu < 50,000$ here]
* If we assume the conditions are met, since the population standard deviation is known ($\sigma = 8000$), the sampling distribution model is:

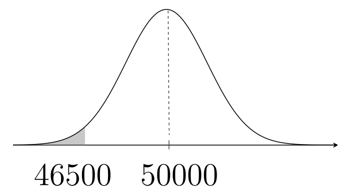
$$\overline{x} \sim N(50000, \tfrac{8000}{\sqrt{28}})$$

* Computation of P-value:
The sample mean is: $\overline{x} = 46,500$

$$z = \frac{46500 - 50000}{(8000/\sqrt{28})} = -2.315$$

From z-table, $P(|z| > 2.315) = 2 \times 0.0102$

$N(50000, 8000/\sqrt{28})$



* Conclusion: The P-value is 0.02. Since $\alpha = 0.05$, we reject H_0 and conclude that the true mean number of miles the tires last is not 50,000. We note, however, that this conclusion may not be reliable, as it is not clear whether the sample satisfies the independence requirement.

Grade:
0.5 pt = some attempt at checking conditions.
1.5pt = correct shape, mean, SD (i.e., N, 50000, $8000/\sqrt{28}$) of model.
1pt = correct z-score and P-value.
1pt = correct conclusion that says we reject H_0.
NOTES: z-score and P-values will vary somewhat, and that is okay. A one-tailed H_A will result in half the P-value, and that is okay.

(85) * Conditions that must be met: (1) independent sample, and (2) approximately normal population. Since the sample consists of "10 engineering friends in start-ups," the independence condition may not be met. According to instructions at the beginning of the section, we may assume normal populations wherever needed. Thus (2) is met.

* Hypotheses: Let μ = true mean work week (in hours) for engineers in start-ups.
$H_0 : \mu = 60$
$H_A : \mu < 60$ (one-tail)
I will use $\alpha = 0.1$.

* Model:
From the sample data, we compute: $n = 10$, $\overline{x} = 57.0$, $s_x = 7.149$
If we assume the conditions are met, the sampling distribution model is:

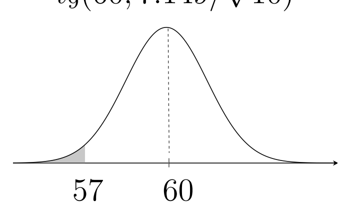
$$\overline{x} \sim t_9(60, \tfrac{7.149}{\sqrt{10}})$$

* Computation of P-value:

$$t = \frac{57 - 60}{(7.149/\sqrt{10})} = -1.327$$

From t-table, $P(t_9 < -1.327) > 0.1$

$t_9(60, 7.149/\sqrt{10})$

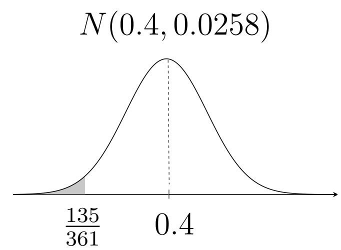


* Conclusion: The P-value $> \alpha$. Thus, we fail to reject H_0. The sample does not provide statistically significant evidence to conclude the mean work week is shorter than 60 hours. We note, however, that this conclusion may not be reliable, as it is not clear whether the sample satisfies the independence requirement.

Grade:
0.5 pt = some attempt at checking conditions.
1.5pt = correct shape, mean, SD (i.e., t_9, 60, $7.149/\sqrt{10}$) of model.
1pt = correct t-score and P-value.
1pt = correct conclusion that says we fail to reject H_0.

(98)

- This problem is about proportions. The conditions that must be met: (1) independent, and (2) large enough sample. The 361 individuals were randomly selected. If we assume the school has more than 3610 students, then it is reasonable to say independence is met. To check (2): $n \cdot p = (361)(0.4) \approx 144$, and $n \cdot (1-p) \approx 217$, both ≥ 10. Thus, the sample is large enough.
- Let p = true proportion of students at that school who fear public speaking.
  $H_0 : p = 0.4$
  $H_A : p < 0.4$ (one-tail). I will use $\alpha = 0.1$.
- Model:
  The sample data is: $n = 361$, $\hat{p} = 135/361$. The sampling distribution model is:
  $$\bar{p} \sim N(0.4, \sqrt{\tfrac{(0.4)(0.6)}{361}}) = N(0.4, 0.0258)$$
- Computation of P-value:
  $$z = \frac{135/361 - 0.4}{0.0258} = -1.01$$
  From z-table, $P(z < -1.01) = 0.1562$



- Conclusion: The P-value $> \alpha$. Thus, we fail to reject H_0. The sample does not provide statistically significant evidence to conclude the fear of public speaking at that school is lower than 40%.

Grade:
0.5 pt = some attempt at checking conditions.
1.5pt = correct shape, mean, SD (i.e., N, 0.4, 0.0258) of model.
1pt = correct z-score and P-value.
1pt = correct conclusion that says we fail to reject H_0.