The Gallup Poll periodically asks a random sample of U.S. adults whether they think economic conditions are getting better, getting worse, or staying about the same. When they polled 2976 respondents in March of 2010, only 1012 thought economic conditions in the United States were getting better. (*Source: Business Statistics by Sharpe, De Veaux, and Velleman*)

Questions:

1. Define the parameter of interest, π.

   Let π = the proportion of <u>all</u> U.S. adults that thought economic conditions in the U.S. were getting better.

2. Find the sample statistic, $\hat{\pi}$ (note that we call this the point estimate of π).

   $\hat{\pi}$ = 1012/2976 = 0.34 (or 34%)

3. Explain what is wrong with the following interpretation of $\hat{\pi}$: "34% of *all* U.S. adults thought the economy was improving."

   The sample statistic describes only the 2976 subjects that were in the sample, not *all* U.S. adults. If we want to make statements about all U.S. adults, then we must obtain an estimate for π using a confidence interval.

4. Find the standard error of the point estimate.

   standard error $= \sqrt{\dfrac{\hat{\pi}(1-\hat{\pi})}{n}} = \sqrt{\dfrac{.34(1-.34)}{2976}} = \sqrt{\dfrac{.34(.66)}{2976}} = 0.0087$

5. Find the margin of error for this poll.

   For a 95% confidence interval, margin of error = 1.96 × standard error = 1.96 × 0.0087 = 0.017.

6. Find a 95% confidence interval for π using the Wald method (we call this the interval estimate of π).

   Lower endpoint = 0.34 - 0.017 = 0.323 = 32.3%
   Upper endpoint = 0.34 + 0.017 = 0.357 = 35.7%

7. Explain what is wrong with the following interpretation of the confidence interval: "Between 32% and 36% of all U.S. adults thought the economy was improving."

    This statement is too definitive. Our confidence interval approach allows us to attach a level of certainty to our statement, and this level of certainty is missing in the above interpretation. A better interpretation is as follows: "We are 95% certain that the proportion of all U.S. adults that thought the economy was improving was somewhere between 32% and 36%."

8. Explain what is wrong with the following interpretation of the confidence interval: "We are 95% certain that between 32% and 36% of the adults that were surveyed thought the economy was improving."

    We are 95% certain that our confidence interval has captured the true proportion of all U.S. adults that thought the economy was improving; we are 100% certain, however, that the percentage <u>of adults surveyed</u> that felt this way (34%) lies between 32% and 36%. In summary, a 95% confidence interval allows us to make a statement regarding the <u>population parameter</u> with 95% certainty. So, they describe populations and not samples. We could fix the above interpretation as follows:

    "We are 95% certain that between 32% and 36% of all U.S. adults ~~that were surveyed~~ thought the economy was improving."

9. Give a correct interpretation of this confidence interval.

    This was actually done in the solutions to problems 7 and 8. Either of these is appropriate:

    - **"We are 95% certain that the proportion of all U.S. adults that thought the economy was improving was somewhere between 32% and 36%."**
    - **"We are 95% certain that between 32% and 36% of all U.S. adults thought the economy was improving."**