32. A catch of five fish of a certain species yielded the following ounces of protein per pound of fish: 3.1, 3.5, 3.2, 2.8, and 3.4. What is a 90% confidence interval estimate for ounces of protein per pound of this species of fish?

    (A) 3.2 ± 0.202
    (B) 3.2 ± 0.247
    (C) 3.2 ± 0.261
    (D) 4.0 ± 0.202
    (E) 4.0 ± 0.247

Answer Key

1. **C**	7. **D**	13. **C**	19. **B**	25. **C**	31. **C**
2. **D**	8. **B**	14. **D**	20. **D**	26. **E**	32. **C**
3. **A**	9. **D**	15. **E**	21. **A**	27. **E**	
4. **D**	10. **C**	16. **E**	22. **B**	28. **B**	
5. **E**	11. **E**	17. **E**	23. **C**	29. **E**	
6. **A**	12. **B**	18. **A**	24. **A**	30. **D**	

Answers Explained

1. **(C)** The critical *z*-scores will go from ±1.96 to ±2.576, resulting in an increase in the interval size: $\frac{2.576}{1.96} = 1.31$ or an increase of 31%.

2. **(D)** Increasing the sample size by a multiple of *d* divides the interval estimate by $\sqrt{d}$.

3. **(A)** The margin of error varies directly with the critical *z*-value and directly with the standard deviation of the sample, but inversely with the square root of the sample size.

4. **(D)** Although the sample proportion *is* between 77% and 87% (more specifically, it is 82%), this is not the meaning of ±5%. Although the percentage of the entire population is likely to be between 77% and 87%, this is not known for certain.

5. **(E)** There is no guarantee that 13.4 is anywhere near the interval, so none of the statements are true.

6. **(A)** The margin of error has to do with measuring chance variation but has nothing to do with faulty survey design. As long as *n* is large, *s* is a reasonable estimate of σ; however, again this is not measured by the margin of error. (With *t*-scores, there is a correction for using *s* as an estimate of σ.)

7. **(D)** $\sigma_{\hat{p}} = \sqrt{\frac{(.39)(.61)}{500}}$ and the critical *z*-scores for 90% confidence are ±1.645.

8. **(B)** $\sigma_{\hat{p}} = \sqrt{\frac{(.75)(.25)}{1000}} = .0137$

   $.75 \pm 1.96(.0137) = .75 \pm .027$ or $(.723, .777)$

9. **(D)** $\sigma_{\hat{p}} = \sqrt{\frac{(.17)(.83)}{1703}} = .0091$

$z(.0091) = .02 \quad z = 2.20, \quad .9861 - .0139 = 97.2\%$

10. **(C)** $1.645\left(\frac{.5}{\sqrt{n}}\right) \le .04$, $\sqrt{n} \ge 20.563$, $n \ge 422.8$, so choose $n = 423$.

11. **(E)** $\frac{19}{20} = 95\%$; $1.96\left(\frac{.5}{\sqrt{n}}\right) \le .03$, $\sqrt{n} \ge 32.67$, $n \ge 1067.1$, and so the pollsters should have obtained a sample size of at least 1068. (They actually interviewed 1148 people.)

12. **(B)** $\sigma_{\bar{x}} = \frac{0.35}{\sqrt{49}}$ and with $df = 49 - 1 = 48$, the critical t-scores are ± 1.677.

13. **(C)** Using t-scores: $28.5 \pm 2.045\left(\frac{1.2}{\sqrt{30}}\right) = 28.5 + 0.45$.

14. **(D)** $\sigma_{\bar{x}} = \frac{1.52}{\sqrt{64}} = 0.19$, $\frac{0.38}{0.19} = 2$, and $.4772 + .4772 = .9544 \approx 95\%$.

15. **(E)** Using t-scores:

$$335\left[9540 \pm 2.756\left(\frac{1205}{\sqrt{30}}\right)\right] = 335(9540 \pm 606.3) = \$3{,}196{,}000 \pm \$203{,}000.$$

16. **(E)** $1.96\left(\frac{1.1}{\sqrt{n}}\right) \le 0.2$, $\sqrt{n} \ge 10.78$, and $n \ge 116.2$; choose $n = 117$.

17. **(E)** To divide the interval estimate by d without affecting the confidence level, multiply the sample size by a multiple of d^2. In this case, $4(50) = 200$.

18. **(A)**

$$n_1 = 361 \qquad n_2 = 86$$
$$\hat{p}_1 = \frac{210}{361} = .582 \quad \hat{p}_2 = \frac{34}{86} = .395$$
$$\sigma_d = \sqrt{\frac{(.582)(.418)}{361} + \frac{(.395)(.605)}{86}} = .0588$$
$$(.582 - .395) \pm 1.96(.0588) = .187 \pm .115$$

19. **(B)**

$$n_1 = 300 \quad n_2 = 400$$
$$\hat{p}_1 = .65 \quad \hat{p}_2 = .48$$
$$\sigma_d = \sqrt{\frac{(.65)(.35)}{300} + \frac{(.48)(.52)}{400}} = .0372$$
$$(.65 - .48) \pm 2.576(.0372) = .17 \pm .096$$

20. **(D)** $1.645\left(\frac{.5\sqrt{2}}{\sqrt{n}}\right) \le .03$, $\sqrt{n} \ge 38.77$, and $n \ge 1503.3$; the researcher should choose a sample size of at least 1504.

21. **(A)** $\sigma_d = \sqrt{\frac{(19.1)^2}{347} + \frac{(19.9)^2}{561}}$ and with $df = \min(347 - 1{,}561 - 1)$, critical t-scores are ± 1.97.

22. **(B)** $\sigma_{\bar{x}_1 - \bar{x}_2} = \sqrt{\frac{(6.3)^2}{274} + \frac{(6.3)^2}{90}} = 0.765$

$(33.0 - 28.6) \pm 1.645(0.765) = 4.4 \pm 1.26$

23. **(C)** $\sigma_{\bar{x}_1 - \bar{x}_2} = \sqrt{\frac{(4.5)^2}{n} + \frac{(4.5)^2}{n}} = \frac{6.364}{\sqrt{n}}$

$1.645\left(\frac{6.364}{\sqrt{n}}\right) \le 1$, $\sqrt{n} \ge 10.47$, $n \ge 109.6$; choose $n = 110$.

24. **(A)** The sample mean is at the center of the confidence interval; the lower confidence level corresponds to the narrower interval.

25. **(C)** Narrower intervals result from smaller standard deviations and from larger sample sizes.

26. **(E)** Only III is true. The 90% refers to the method; 90% of all intervals obtained by this method will capture μ. Nothing is sure about any particular set of 100 intervals. For any particular interval, the probability that it captures μ is either 1 or 0 depending on whether μ is or isn't in it.

27. **(E)** In determining confidence intervals, one uses sample statistics to estimate population parameters. If the data are actually the whole population, making an estimate has no meaning.

28. **(B)** $\frac{1.88(.5)\sqrt{2}}{\sqrt{n}} \le .07$ gives $\sqrt{n} \ge 18.99$ and $n \ge 360.7$.

29. **(E)** With $df = 15 - 1 = 14$ and .05 in each tail, the critical t-value is 1.761.

30. **(D)** $\bar{x} = 4.048$, $s = 2.765$, $df = 20$, and

$$4.048 \pm 1.725\left(\frac{2.765}{\sqrt{21}}\right) = 4.048 \pm 1.041.$$

31. **(C)** The confidence interval estimate of the set of nine differences is

$$11.61 \pm 2.306\left(\frac{4.891}{\sqrt{9}}\right) = 11.61 \pm 3.76.$$

32. **(C)** $df = 4$, and $3.2 \pm 2.132\left(\frac{0.274}{\sqrt{5}}\right) = 3.2 \pm 0.261$.