Name _____   **Elementary Statistics**

When finished submit your answers at **https://pryor.mathcs.wilkes.edu/submissions**.
  If you feel the answer is none of the choices given, submit no answer to the question.

1. The 98% confidence interval for the mean length of frog jumps is (12.0 cm, 14.0cm). Which
     of the following statements is a correct interpretation of 98% confidence?

> **(A)** Of the total number of frogs in your area of the country, 98% can jump between
>   12.0 cm and 14.0 cm.
> **(B)** There's a 98% chance that the mean length of frog jumps falls between 12.0 cm and
>   14.0 cm.
> **(C) If we were to repeat this sampling many times, 98% of the confidence intervals
>   we could construct would contain the true population mean.**
> **(D** 98% of the confidence intervals we could construct after repeated sampling would go
>   from 12.0 cm to 14.0 cm.

2. True or False: A 95% confidence interval is narrower than a 90% confidence interval for the
     same data set.

> **(A)** True   **(B) False**

3. Which of the following is true about the Student's *t*- distribution?
> **(A) It is symmetric with a mean of 0 and a varying standard deviation determined
>   by the number of degrees of freedom**.
> **(B) It is leptokurtic, meaning a higher degree of kurtosis than normal.**
> **(C)** Its is a "contrived" distribution used in the estimating population variances.
> **(D)** All of choices A, B, and C are characteristic of Student's *t*.

4. A researcher at an agricultural experiment station knows that the standard deviation in butterfat
     production for Holstein-Friesian dairy cattle is 80 lb per year. He treats a group of 25
     dairy cattle by adding inorganic nitrate to their diet. His sample yields an average of 465
     lb of butterfat? What is the margin of error for a 90% confidence interval in estimation
     the mean butterfat production for the dairy cattle population?

> **(A)** 27.374   **(B)** 33.022   **(C) 26.317**   **(D)** 31.359

5. Using a random sample of 4,000 students, you compute a 95% confidence interval to estimate
     the mean calories consumed by 8th graders. You decide to compute another 95%
     confidence interval using a different sample, this time with only 1,000 students. What
     change would you expect from the first confidence interval to the second?

> **(A)** The margin of error will be 4 times as wide.
> **(B) The margin of error will be 2 times as wide.**
> **(C) The margin of error will increase.**
> **(D)** The confidence interval will be smaller

6. You want to design a study to estimate the proportion of students on your campus who agree with the statement "The student government is an effective organization for expressing the needs of students to the administration." You will use a 92% confidence interval and you would like the margin of error to be 0.05 or less. In previous years, it has been noted that the 35% of the campus agree with the statement. The minimum sample size required is approximately

    (A) 88   **(B)** 335   **(C) 279**   **(D)** 350

7. Out of a sample of 150, selected from patients admitted over a two year period to a large hospital, 129 had some type of hospitalization insurance. In a sample of 160 similarly selected patients, from a second hospital, 144 had some type of hospitalization insurance. Find the 98% confidence interval for the true difference in population proportions.

$$-0.125 < \hat{p}_1 - \hat{p}_2 < 0.045$$

8. A survey of 1800 men in King of Prussia Mall showed that 47% preferred blondes while 53% preferred brunettes (as for red heads ... well they just couldn't gain any support). Find a 95% confidence interval for the proportion of men who prefer blondes.

$$0.446 < \hat{p} < 0.493$$

9. The mean serum indirect bilirubin level of 16 four-day-old infants was found to be 5.98 mg/100cc. Assuming bilirubin levels in four-day-old infants are approximately normally distributed with a standard deviation of 3.5 mg/100cc, find a 99% confidence interval for the average bilirubin level in four-day-old infants. $\mathbf{3.72 < \mu < 8.233}$

10. In a study of myocardial transit times, appearance transit times were obtained on a sample of 35 patients with coronary artery disease. The sample variance was 1,000,000. Construct a 90% confidence interval for the **standard deviation** of the population.
not normally distributed

11. A health department nutritionist, wishing to construct a survey among a population of teenage girls, to determine their average daily protein intake, feels that the population standard deviation is probably about 20 g. She would like an interval of error about 10 units wide. What size sample should she use to be 95% confident? $\boldsymbol{n = 62}$

12. An oncologist is evaluating the effect of a heavy metal compound as a treatment for cervical cancer, and on each patient a measurement is taken on sensory nerve amplitude (in μamps) before treatment begins, and after she has been on the treatment for six months. Construct a 95% confidence interval for the difference in the means from before and after treatment. $\mathbf{- 0.860 < \mu_d < 2.480}$

13.

Patient:	1	2	3	4	5	6	7	8	9	10
Before:	6.7	7.0	7.1	9.0	9.8	10.0	10.1	10.2	10.8	11.0
After:	7.6	3.3	9.1	9.3	10.7	7.2	12.3	6.7	9.5	7.9

Arterial blood gas analysis performed on a sample of 15 physically active adult males yielded an average resting PaO_2 standard deviation of 5.303 and a mean value within an interval of confidence (76.766, 82.966). Rounded to the nearest whole percent, what level of confidence was used for this interval calculation ? Enter your choice below, followed by a comma, and then an explanation of why you made your choice.

(A) 95%   (B) 90%   (C) 98%   (D) 92%

***** BONUS PROBLEM *****

$$\mu = \frac{1}{2}(76.766 + 82.966) = 79.866$$

$$\varepsilon = 79.866 - 76.766 = 3.1$$

$$\varepsilon = t_{\frac{\alpha}{2}, n-1}\left(\frac{s}{\sqrt{n}}\right) \text{ so } 3.1 = t_{\frac{\alpha}{2}, n-1}\left(\frac{5.303}{\sqrt{15}}\right) \text{ or}$$

$$t_{\frac{\alpha}{2}, n-1} = 3.1\left(\frac{3.872}{5.303}\right) = 2.263$$

from StatDisk / Analysis / Probability Distributions / Student's-*t* Distribution

t Value: 2.263000
Prob Dens: 0.0378236

Cumulative Probs
Left: 0.979970
Right: 0.020030
2 Tailed: 0.040059
Central: 0.959941   < ------------- ≈ **96%**

14 Degrees of Freedom