Stat 50, Quiz #4, Spring 2025 04/29/2025

Instructions. Write your name below, read these instructions before starting the exam. You have 30 minutes to complete the three questions below. You may use your z and t tables, a formula sheet and a calculator. Show your work and include units to get full credit. Use at least three decimal points when rounding the final probability expressions and proportions. If you have questions, raise your hand. No talking, disturbing, collaboration or straying eyes during the exam. No cell phones!

NAME:

1. The distribution of weights (in pounds) of male students at a college is approximately normal with an unknown mean μ and with an unknown standard deviation σ.

   (a) (1.5 pts) Assume that the average weight of a random sample of 20 male students in the college is 152.33 lb with a sample standard deviation of 15.24 lb. Determine a two-sided confidence interval for μ at 95% level of confidence using two-decimal places of rounding. Justify your steps including your choice of the interval estimation procedure (e.g. t-interval, z-interval etc.).

   (b) (1 pt) Assume that the population standard deviation of the weights of the male students is 15 lb. Based on this, determine the minimum sample size n needed to ensure that the margin of error at 98% level of confidence is not larger than 5 lb. Use an integer end result with proper units.

2. In a random sample of 64 cars registered in a certain state, 11 of them were found to have emission levels that exceed the state standard. Let p denote the actual (unknown) proportion of all cars registered in that state whose emission levels exceed the state standards.

   (a) (1.5 pts) Obtain a lower-bound confidence interval for p at 95% confidence level (use three decimal places). Justify the procedure that you apply.

   (b) (0.5 pts) Based on the interval above, can you reasonably conclude that p is larger than 0.1? Briefly explain.

3. (1 pt) Let $X \sim Bin(16, p)$ where p is unknown. Consider the estimator $\hat{\theta} = \frac{X+2}{20}$ for p. Determine $Bias(\hat{\theta}) = p - E[\hat{\theta}]$, $Var(\hat{\theta})$ and $MSE(\hat{\theta})$ in terms of the values of p.