MATH 120: Quiz 9 - 5/06/2022

According to the Centers for Disease Control, in 2011 about 18% of high school students had smoked a cigarette. A community service organization wants to conduct a hypothesis test to determine whether their local high school, which has approximately 1,200 students, has a lower proportion of smokers. They selected 162 students from a science class, surveyed them, and found 88 had smoked.

a. Check whether their sample satisfies the independence condition.

b. Check whether the "large enough" condition is met.

c. State the parameter of interest and write the hypotheses.

d. If we assume the conditions are met, what is the random variable, and what is the sampling distribution model it follows?

Solution

a. A reasonable check for independence is if the sample is random and less than 10% of the population. In this exercise, it appears that the sample is selected from a single class, and also there is no indication whether this was done randomly. In addition, 162 is more than 10% of all the students at that high school. Therefore, the sample fails to satisfy the independence condition.

b. For this we must check whether the number of successes and failures is at least 10.
We are given: $n = 162$, $p = 0.18$.
$n \cdot p \approx 30$ and $n \cdot (1 - p) \approx 132$
Therefore, the sample is large enough.

c. The parameter: $p =$ true proportion of smokers among the local high school students.
The hypotheses are: Null hypothesis $H_0 : p = 0.18$
Alt. hypothesis $H_A : p < 0.18$

d. Random variable is: $\hat{p} =$ proportion of smokers in random samples of size 162 drawn from the population of interest. It follows the model:

$$\hat{p} \sim N(0.18, \sqrt{\frac{0.18(1 - 0.18)}{162}})$$

Grading: Total points possible = 6.
(a) = (b)=1 pt
(c)=(d)=2 pt