Example 3: Aspirin bottles are filled by weight, so if the pills are larger than they should be, fewer pills will be put in a bottle. The production process is designed so that pills should have an average weight of 5 grams. Say 100 pills are randomly selected and we find that the average weight in this group is 5.13 g and the standard deviation is 0.35 g. Does this give us enough evidence to say that the production process is creating pills that weigh more than they should? Test at a significance level of $\alpha = 0.01$.

$n=100$ is large $\Rightarrow$ $\bar{x}$ is normally distributed

1. Define the parameter of interest using the correct notation. Then, state the null and alternative hypotheses for this study.

testing μ - true mean weight of the pills

$H_0: \mu = 5$

$H_1: \mu > 5$

one-tailed test

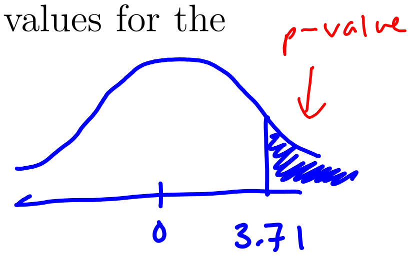
2. Calculate the observed value of the test statistic. State the distribution (and degrees of freedom if needed) it follows. use z distribution

$$z_{obs} = \frac{\overbrace{\bar{x}}^{\text{measured}} - \underbrace{\mu}_{\leftarrow \text{from } H_0}}{s/\sqrt{n}} = \frac{5.13-5}{0.35/\sqrt{100}} = 3.71$$

3. Compute the p-value or provide a range of appropriate values for the p-value.

same as in H_1

$$\begin{aligned} p\text{-value} &= P(z > 3.71) \\ &= 1 - P(z \le 3.71) \\ &\approx 1 - 1 \quad \leftarrow \text{since } z = 3.71 \text{ is off the end of our } z \text{ table} \\ &= 0 \end{aligned}$$



4. Using the significance level $\alpha = 0.01$, state your conclusions about the pills created by the production process.

p-value $\approx 0 \le \alpha = 0.01 \Rightarrow$ p-value is small $\Rightarrow$ reject H_0.

We conclude that there is enough evidence to say the mean is greater than 5g, so the process creates pills that weigh more than they should.