

6.4.1: Exercises

1. Pearl wonders if the majority of US adults are dissatisfied with the quality of the environment. According to a poll conducted by Gallup¹⁰ of 200 randomly surveyed US adults, 122 respondents were dissatisfied with the quality of the environment. Test Pearl's claim at a 5% level of significance.
 - a. p represents the proportion of US adults who are:
 - b. H_0 :
 - c. H_a :
 - d. What test should you use to find the P-value? Justify your answer.
 - e. Explain why the sampling distribution of sample proportions is approximately normal.
 - f. What is the sample proportion, \hat{p} ? Write your answer as a fraction and decimal.
 - g. Compute the Z-score for the sample proportion.
 - h. Use desmos to find the P-value from the standard normal distribution. Sketch a graph and shade the area that represents the P-value.
 - i. Make a decision about the null and alternative hypotheses. Justify your answer.
 - j. State the conclusion in context.

2. In a random sample of 300 Alzheimer's patients taking a new drug, 21 experienced nausea as a side effect. The drug manufacturer claims that fewer than 10% of patients who take its new drug for treating Alzheimer's disease will experience nausea. Test the claim at a 1% level of significance.

a. Step 1

b. Step 2

c. Step 3

d. Step 4

3. The proportion of smokers among persons who graduated from a four-year university has been widely reported as 22%. A sociologist student wonders if this is still true. They randomly sample 785 four-year university graduates and finds that 157 are smokers. They test the claim at a 5% level of significance. Spot the errors in the students solution below (there is at least one error in each step):

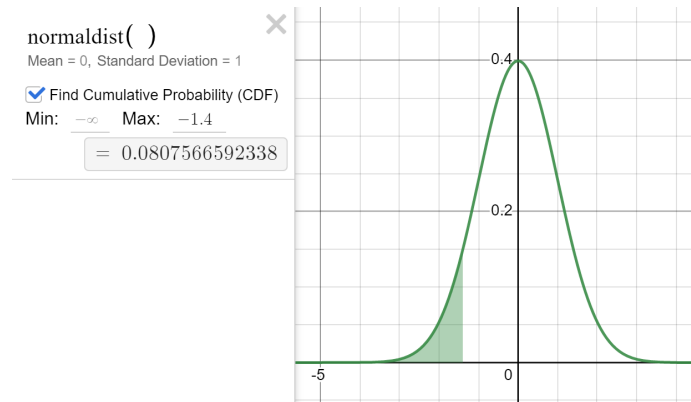
Step 1: p represents four-year university graduates who are smokers.

$$H_0 : \hat{p} = 0.22$$

$$H_a : \hat{p} \neq 0.22$$

Step 2: There are 157 successes in the sample and $785-157=628$ failures in the sample. These are greater than 10 so it's normal. $\hat{p} = \frac{157}{785} = 0.2$.

$$\text{Step 3: } Z = \frac{0.2 - 0.22}{\sqrt{\frac{0.2(1-0.2)}{785}}} \approx -1.40$$



Images are created with the graphing calculator, used with permission from Desmos Studio PBC.

The P-value is 0.0808.

Step 4: The P-value 0.0808 is greater than the level of significance 0.05. We accept the null hypothesis and reject the alternative hypothesis.

The sample data show that the four-year university graduates who are smokers is equal to 22%.

4. The proportion of smokers among persons who graduated from a four-year university has been widely reported as 22%. A sociologist student wonders if this is still true. They randomly sample 785 four-year university graduates and finds that 157 are smokers. Test their claim at a 5% level of significance. Clearly show each step of a hypothesis test.

Reference

¹⁰Jeffrey M. Jones, “Americans Offer Gloomy State of the Nation Report,” *Gallup.com*, February 2, 2022, accessed September 27, 2022, <https://news.gallup.com/poll/389309/americans-offer-gloomy-state-nation-report.aspx>

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