1. Write the null and alternative hypotheses, in words and then symbols, for each of the following situations.

(a) New York is known as the city that never sleeps’. A random sample of 25 New Yorkers were asked how much sleep they get per night. Do these data provide convincing evidence that New Yorkers on average sleep less than 8 hours a night?

(b) Employers at a firm are worried about the effect of March Madness, a basketball championship held each spring in the US, on employee productivity. They estimate that on a regular business day employees spend on average 15 minutes of company time checking personal email, making personal phone calls, etc. They also collect data on how much company time employees spend on such non-business activities during March Madness. They would like to determine if these data provide convincing evidence that employee productivity significantly decreases during March Madness.

(c) Since 2008, chain restaurants in California have been required to display calorie counts of each menu item. Prior to menus displaying calorie counts, the average calorie intake of diners at a restaurant was 1100 calories. After calorie counts started to be displayed on menus, a nutritionist collected data on the number of calories consumed at this restaurant from a random sample of diners. Do these data provide convincing evidence to suggest a decrease in the average calorie intake of a diners at this restaurant?

(d) Based on the performance of those who took the GRE exam between July 1, 2004 and June 30, 2007, the average Verbal Reasoning score was calculated to be 462. In 2011 the average verbal score was slightly higher. Do these data provide convincing evidence that the average GRE Verbal Reasoning score has changed since 2004?
2. Last week we saw the results of a survey showing that the mean price of a house in Topanga, CA is $1.3 million. A prospective homeowner believes that this figure is an overestimation and decides to collect his own data for a hypothesis test. Below is how he set up his hypotheses. Indicate any errors you see.

\[ H_0 : \bar{x} = 1.3 \text{ million} \]
\[ H_A : \bar{x} > 1.3 \text{ million} \]

3. A recent review of the efficiency of the ER at a local hospital calculated a 95% confidence interval for the mean waiting time of (128 minutes, 147 minutes).

(a) A local newspaper claims that the average waiting time at this ER exceeds 3 hours. What do you think of their claim?

(b) The Dean of Medicine at this hospital claims the average wait time is 2.2 hours. What do you think of her claim?

(c) Determine if the claim of the Dean from part (b) would be considered reasonable based on a 99% confidence interval without actually calculating the interval?

4. The hospital administrator mentioned in the previous exercise randomly selected 64 patients and measures the time (in minutes) between when they checked in to the ER and the time they were first seen by a doctor. The average time is 137.5 minutes and the standard deviation is 39 minutes. She is getting grief from her supervisor on the basis that the wait times in the ER has increased greatly from last year’s average of 128 minutes. However, she claims that the increase is probably just due to chance.

(a) Are assumptions and conditions for inference met?

(b) Using a significance level of \( \alpha = 0.05 \), is the increase in wait times statistically significant?

(c) Would the conclusion of the hypothesis test change if the significance level was changed to \( \alpha = 0.01 \)?
5. A 2000 study showed that college students spent an average of 25% of their internet time on coursework. A decade later in 2010 a new survey was given to 238 randomly sampled college students. The responses showed that on average 10% of the time college students spent on the Internet was for coursework with a standard deviation of 30%. Do these data provide convincing evidence that the percentage of time college students spend on the Internet for coursework has changed over the last decade?

(a) Are assumptions and conditions for inference met?

(b) Perform an appropriate hypothesis test and state your conclusion.

(c) Interpret the p-value in context.

6. You are given the following hypotheses:

\[ H_0 : \mu = 34 \quad H_A : \mu > 34 \]

We know that the sample standard deviation is 10 and the sample size is 65. For what sample mean would the p-value be equal to 0.05? Assume that all assumptions and conditions necessary for inference are satisfied.

7. Suppose that 8% of college students are vegetarians. Determine if the following statements are true or false, and explain your reasoning.

(a) The distribution of the sample proportions of vegetarians in random samples of size 60 is nearly normal since \( n \geq 50 \).

(b) The distribution of the sample proportions of vegetarian college students in random samples of size 50 is right skewed.

(c) A random sample of 125 college students where 12% are vegetarians would be considered unusual.

(d) A random sample of 250 college students where 12% are vegetarians would be considered unusual.

(e) The standard error would be reduced by one-half if we increased the sample size from 125 to 250.
8. We are interested in estimating the proportion of graduates at a mid-sized university who found a job within one year of completing their undergraduate degree. We conduct a survey and find out that 348 of the 400 randomly sampled graduates found jobs. The graduating class under consideration included approximately 4500 students.

(a) Describe the population parameter of interest. What is the value of the point estimate of this parameter?

(b) Construct a 95% confidence interval for the proportion of graduates who found a job within one year of completing their undergraduate degree at this university. (Reminder: check assumptions and conditions.)

(c) Explain what this interval means in the context of this question.

(d) What does “95% confidence” mean?

(e) Without doing any calculations, describe what would happen to the confidence interval if we decided to use a higher confidence level.

(f) Without doing any calculations, describe what would happen to the confidence interval if we used a larger sample.

9. After implementing a study abroad program, a university conducted a study to find out what percent of students had already traveled to another country. The survey showed that 42 out of 100 sampled students had previously visited abroad.

(a) Describe the population parameter of interest. What is the value of the point estimate of this parameter?

(b) Construct a 90% confidence interval for the proportion of students at this university who have traveled abroad. (Reminder: check assumptions and conditions.)

(c) Interpret this interval in context.

(d) What does “90% confidence” mean?