

Exam 3 Review

Covers Sections: 6.6 – 6.7, 7.1 – 7.5, 9.1 – 9.2

While every effort has been made to ensure the accuracy of the questions and solutions below, mistakes do sometimes occur. If you discover an error please let me know, either in class, or by email to jreitz@citytech.cuny.edu. Use full accuracy (all available decimals) until the final step of each problem. Give two decimal places of accuracy (when calculating probabilities, give four decimal places).

1. The finishing times for a long-distance race are normally distributed, with an average finishing time of 3.25 hours and a standard deviation of 0.5 hours. If Bob is running this race, what time does he need to finish in order to beat 75% of the other participants?
2. The average time it takes to get a pizza delivered from Pete's Pizza is 22 minutes. Pete is creating a giveaway – any pizza delivered after the guaranteed delivery time is free. Assuming the delivery time is normally distributed with a standard deviation of 2 minutes, what should the guaranteed delivery time be if Pete does not want to give away more than 8% of his pizzas?
3. Seven percent of the cell phones produced by a large factory have minor defects. What is the probability that the number of phones with minor defects from a random sample of 200 taken from the factory assembly line is between 10 and 20?
4. Suppose 64% of all small businesses offer two weeks of paid vacation time per year. In a random sample of 80 small businesses, what is the probability that at least sixty of them offer two weeks of paid vacation per year?
5. There is an 80% chance that it will rain on any given day in Seattle. What is the probability that, of 118 randomly selected days, there will be rain on at most 90 of them?
6. For subway commuters leaving Brooklyn, the wait time for the F train at the Jay Street/Borough Hall station is normally distributed with a mean of 10 minutes and a standard deviation of 3 minutes. Find the probability that the mean wait time for a random sample of 20 commuters will be between 9.1 and 10.5 minutes.
7. The scores on the final exam in a introductory statistics course at a major university are not normally distributed, but the mean is 73 and the standard deviation is 12. What is the probability that the mean score of a random sample of 100 students is at least 75? What is the shape of the sampling distribution?
8. A random variable x is approximately normally distributed with $\mu = 143$ and $\sigma = 27.45$. Find $\mu_{\bar{x}}$ and $\sigma_{\bar{x}}$ for a random sample with $n = 48$. What is the probability that \bar{x} is less than 149?
9. A study claims that all adults spend an average of 14 hours or more on chores during a weekend. A researcher wanted to check if this claim is true. A random sample of 200 adults taken by this researcher showed that these adults spend an average of 13.52 hours on chores during a weekend. The population standard deviation is known to be 3.0 hours.
 - a. State the null and alternative hypotheses.
 - b. Using $\alpha = 0.01$, find the critical value(s).
 - c. Calculate the test statistic. Do you accept or reject the null hypothesis?

10. A 2003 study led by Reid Ewing, research professor at the National Center for Smart Growth at the University of Maryland, examined data on over 200,000 Americans living in 448 well-populated counties in the United States. The study showed that people living in the more densely-populated counties tended to weigh less than those living in less densely-populated counties, perhaps because residents of high-density counties were less dependent on vehicles and tended to walk more. In fact, in the 25 most densely-populated counties included in the study, people walked an average of 254 minutes per month, compared to an average of 191 minutes per month in the 25 least densely-populated counties (Time, June 7, 2004). Suppose a recent random sample of 400 people from these 25 most densely-populated counties found that they walked an average of 246 minutes per month. The population standard deviation is known to be 64 minutes. Using a significance level of 5%, do you accept or reject the hypothesis that the mean walking time in these 25 counties is 254 minutes? (Be sure to state the null and alternative hypotheses, find the critical value(s), and calculate the test statistic before giving your conclusion).
11. A study conducted a few years ago claims that adult men spend an average of 11 hours a week watching sports on television. A recent sample of 100 adult men showed that the mean time they spend per week watching sports on television is 9 hours. The population standard deviation is given to be 2.2 hours. Test at the 1% significance level whether currently all adult men spend less than 11 hours a week watching sports on television.

Answer Key

1. Bob needs a time of 2.92 hours to beat 75% of the participants.
2. The guaranteed delivery time should be 24.82 minutes (Pete would probably make it an even 25 minutes, just to be sure).
3. Note that both np and nq are >5 , so the normal distribution can be used. The probability is 0.8585.
4. Note that both np and nq are >5 , so the normal distribution can be used. The probability is 0.0268.
5. Note that both np and nq are >5 , so the normal distribution can be used. The probability is 0.1841.
6. The probability is 0.6833.
7. The probability is 0.0475. The sampling distribution is approximately normal.
8. The probability is 0.9345.
9. Null hypothesis $H_0 : \mu \geq 14$, alternative hypothesis $H_1 : \mu < 14$. This is a left-tailed test, and the critical value is $z = -2.33$. The test statistic is $z = -2.26$. Since this lies within the acceptance region, we **accept** the null hypothesis. Our test indicates that the claim is correct.
10. Null hypothesis $H_0 : \mu = 254$, alternative hypothesis $H_1 : \mu \neq 254$. This is a two-tailed test, with critical values $z = -1.96$ and $z = 1.96$. The test statistic is $z = -2.5$. Since this lies outside the acceptance region, we **reject** the null hypothesis. Our test indicates that the claim is not correct.
11. Null hypothesis $H_0 : \mu < 11$, alternative hypothesis $H_1 : \mu \geq 11$. This is a right-tailed test, with critical value $z = 2.33$. The test statistic is $z = -9.09$. Since this lies within the acceptance region, we **accept** the hypothesis that currently all adult men spend less than 11 hours a week watching sports on television.