Z-test of a single mean

1. Statistics Canada says that their census figures show that the mean height of Canadians is 69.85 inches. A recent study of people who purchase clothes from the expensive shops on Robson Street in Vancouver found that the mean height of a sample of 139 people was 67.52 inches. The standard deviation of the sample was 15.0. I am wondering if the people who purchase clothes from the expensive shops on Robson Street in Vancouver are systematically unlike Canadians surveyed by the census or if their lower height was probably just a coincidence.

    a.   What is the null hypothesis? Make reference to the relevant mean(s) in your hypothesis.

    b.   What is the alternate hypothesis? Make reference to the relevant mean(s) in your hypothesis.

    c.   Using the appropriate test that you learned in this course, determine whether the people who purchase clothes from the expensive shops on Robson Street in Vancouver are systematically unlike Canadians surveyed by the census, using the 95%confidence level.

2. The Universal Anti-Smoking Institute (UASI) runs a highly regarded program that claims to be more effective at convincing young people to stop smoking than all other similar programs. They claim that the average graduate of their program smokes fewer than 11.28 cigarettes per week. You have been asked by the Federal Truth In Advertising Commission to test the accuracy of the claims of the UASI. You begin your assessment by administering a test to a sample of 74 graduates of the UASI program. Your results show that the mean number of cigarettes smoked per week is 14.73 with a standard deviation of 15.47 cigarettes. You want to know if you could get a sample with a mean smoking rate of 14.73 cigarettes per week from a population with a mean smoking rate of 11.28 cigarettes per week?

    a.   What is your null hypothesis?

    b.   What is the alternate hypothesis?

    c.   Use the 95% confidence level and determine the answer to this question.

    d.   For the following question, assume the claims of the UASI are truthful and accurate:

        What are the chances of getting a sample of 74 graduates of their program with a mean smoking rate of 14.73 cigarettes per week and a standard deviation of 11.28 cigarettes?

3. A recently reported national study found that when you are sick, your recovery time will be significantly shorter if someone prays for you than if that doesn't happen — even if you don't know that someone is praying for you and if you have never met know the person who is praying for you. The report said that the mean recovery time for people who were prayed for was 8.19 days. I thought that was interesting, and decided to do my own study. I collected data from a random sample of 36 people who were prayed for by the Society for Spiritual Aid for the Ill, and found that their mean recovery time was 9.32 days with a standard deviation of 4.50. I am wondering how to interpret the difference between my

sample mean and the published national mean. Is it because the people in my sample are unlike other people who were prayed for (i.e. people in Vancouver stay sick longer than Canadians in general), or could their longer recovery times be just a coincidence?

    a.   What is the null hypothesis? Make reference to the relevant mean(s) in your hypothesis.

    b.   What is the alternate hypothesis? Make reference to the relevant mean(s) in your hypothesis.

    c.   Using an inferential statistical test that you learned in this course, determine whether the people in my sample are unlike other people who were prayed for, using the 95% confidence level.

4. Statistics Canada says that their census figures show that the mean height of Canadians is 65.52 inches. A recent study of people who purchase clothes from the expensive shops on Robson Street in Vancouver found that the mean height of a sample of 136 people was 67.86 inches. The standard deviation of the sample was 15.0. I am wondering if the people who purchase clothes from the expensive shops on Robson Street in Vancouver are systematically unlike Canadians surveyed by the census or if the difference in height was probably just a coincidence.

    a.   What is the null hypothesis? Make reference to the relevant mean(s) in your hypothesis.

    b.   What is the alternate hypothesis? Make reference to the relevant mean(s) in your hypothesis.

    c.   Using an inferential statistical test that you learned in this course, determine whether the people who purchase clothes from the expensive shops on Robson Street in Vancouver are systematically unlike Canadians surveyed by the census, using the 95% confidence level. Show all your work.

5. The Universal Anti-Smoking Institute (UASI) runs a highly regarded program that claims to be more effective at convincing young people to stop smoking than all other similar programs. They claim that the average graduate of their program smokes fewer than 11.28 cigarettes per week. You have been asked by the Federal Truth In Advertising Commission to test the accuracy of the claims of the UASI. You begin your assessment by administering a test to a sample of 74 graduates of the UASI program. For your sample, the mean number of cigarettes smoked per week is 14.73 with a standard deviation of 15.47 cigarettes.

    a.   What is the name of the test that is appropriate to determine whether the UASI is telling the truth?

    b.   What is your null hypothesis?

    c.   What is the alternate hypothesis?

    d.   Use the 95% confidence level and determine whether or not the UASI could be telling the truth. At the end of your answer, in one sentence, tell what you would say to the Federal Truth Commission about the claims of the UASI. [show all of your calculations]

Z-test of difference between means

1. There is growing public concern about men committing violent attacks on women. You have been studying this issue and have reason to believe that viewing a lot of violent television programs and movies leads to an increase in subsequent acts of violent aggression against women. You are conducting some research on this issue, and have collected data on viewing habits and assault records of men. Assume your variables are "amount of violent programming viewed" and "number of instances of violent aggression against women."

    a. State the null and research hypotheses you would use for this test with these variables
       – $H_\emptyset$:

       – H_{ALT}:

    b. Is this a 1-tailed test or a 2-tailed test? Why?

    c. Determine the critical value for a **99%** level of confidence (**p<0.01**) for the appropriate z-test.

2. *Sony* wants to focus its marketing for a new compact disc player on university students in the Vancouver area (the most competitive market for CDs in North America). Their marketing department has chosen SFU and UBC students as their target population. On the basis of its sales figures, A&B Sound has told Sony that SFU students buy **more expensive** stereo equipment than UBC students. The mean amount spent by the sample of 42 SFU students was $838, s=85.75. The mean for a sample of 41 UBC students was $834, s=76.52. Formulate a pair of research and null hypotheses to test this claim. Formulate a pair of research and null hypotheses to test this claim.

    a. State the null and research hypotheses you would use for this test with these variables
       – $H_\emptyset$:

       – H_{ALT}:

    b. Is this a 1-tailed test or a 2-tailed test? Why?

    c. Determine the critical value for a **95%** level of confidence (**p<0.05**) for the appropriate z-test.

    d. Perform the test. At the end of your answer, state, in a sentence, your conclusion about whether or not SFU students buy more expensive stereo equipment than UBC students. [Show all of your calculations.]

3. *Sony* wants to verify the research done by A&B, whom they do not trust. Once again, their marketing department has chosen SFU and UBC students as their target population. On the basis of its sales figures, the Future Shop has told Sony that UBC students buy **more expensive** stereo equipment than SFU

students. The mean amount spent by the sample of 75 SFU students was $852, s=57.55. The mean for a sample of 68 UBC students was $839, s=58.52. Formulate a pair of research and null hypotheses to test this claim.

    a. State the null and research hypotheses you would use for this test with these variables
        – $H_{\emptyset}$:

        – H_{ALT}:

    b. Is this a 1-tailed test or a 2-tailed test? Why?

    c. Determine the critical value for a **95%** level of confidence (**p<0.05**) for the appropriate z-test.

    d. Perform the test. At the end of your answer, state, in a sentence, your conclusion about whether or not UBC students buy more expensive stereo equipment than SFU students.

4. You have been doing research on the effects violent video games have on children and have reason to believe that spending a lot of time playing these games leads to an increase in subsequent acts of violent aggression against other children and in later years, against other people. You have collected data from a sample of 120 children. You have sorted them into two groups. 55 of them spend ten or more hours a week playing these video games; 65 of them spend less than one hour a week playing them. All 120 children were given the Miller Aggressive Personality (MAP) test in which scores range from 0.0 to 10.0 and higher scores indicate that the person is more likely to be violent or aggressive with others and lower scores indicates that the person is less likely to be violent or aggressive. The mean MAP score for the low playing group was 4.86, s=6.97; the mean MAP score for the high playing group was 7.13, s=7.83.

    a. Is this a one-tailed test or a two-tailed test? Why?

    b. State the null and research hypotheses you would use for this test with these variables
        – $H_{\emptyset}$:

        – H_{ALT}:

    c. At the **95%** level, what is the critical value you would use for this test?

    d. Perform the test.

    e. At the end of your answer, state, in a sentence, your conclusion about the relation between playing these games and violent aggressive behaviour.