

STAT1302 – Statistical Analysis II
Assignment #2
Winter 2018
Due Wednesday, March 14, 2018, in class

Instructions:

- Use appropriate notations in your answers.
- Show all steps of your work. Otherwise, part marks will not be given.
- Write neat and clear (e.g., big enough and less cramped up).
- Answer the questions in order AND staple their pages in order.
- Make a photocopy of your assignment for your record.
- There are 11 questions but only 6 (determined after submission) will be marked.
- Solutions will be posted on Nexus after the due date.
- There will be no extension to the due date and late assignments will receive a zero mark.

Q1. The management at New Century Bank claims that the mean waiting time for all customers at its branches is less than that at the Public Bank, which is its main competitor. A business consulting firm took a sample of 200 customers from the New Century Bank and found that they waited an average of 4.5 minutes before being served. Another sample of 300 customers taken from the Public Bank showed that these customers waited an average of 4.75 minutes before being served. Assume that the standard deviations for the two populations are 1.2 and 1.5 minutes, respectively.

- a) Make a 97% confidence interval for the difference between the two population means.
- b) Test at a 2.5% significance level whether the claim of the management of the New Century Bank is true. Use the critical value approach.
- c) Calculate the p -value for the test of part (b). Based on this p -value, would you reject the null hypothesis if $\alpha = 0.01$? What if $\alpha = 0.05$?

Q2. A company sent seven of its employees to attend a course in building self-confidence. These employees were evaluated for their self-confidence before and after attending this course. The following table gives the scores (on a scale of 1 to 15, 1 being the lowest and 15 being the highest score) of these employees before and after they attended the course.

Before	8	5	4	9	6	9	5
After	10	8	5	11	6	7	9

Construct a 95% confidence interval for the difference between the mean of the scores of these employees before and the mean after they attended the course. State the underlying assumption(s).

Q3. Quadro Corporation has two supermarket stores in a city. The company's quality control department wanted to check if the customers are equally satisfied with the service provided at these two stores. A sample of 380 customers selected from Supermarket I produced a mean satisfaction index of 7.6 (on a scale of 1 to 10, 1 being the lowest and 10 being the highest) with a variance of 0.5625. Another sample of 370 customers selected from Supermarket II produced a mean satisfaction index of 8.1 with a variance of 0.3481. Assume that the customer satisfaction index for each supermarket has unknown but same population standard deviation.

- a) Construct a 98% confidence interval for the difference between the mean satisfaction indexes for all customers for the two supermarkets.
- b) Test at a 1% significance level whether the mean satisfaction indexes for all customers for the two supermarkets are different. Use either the p -value approach or the critical value approach.

Q4. In a random sample of 800 men aged 25 to 35 years, 24% said they live with one or both parents. In another sample of 850 women of the same age group, 18% said that they live with one or both parents. Construct a 95% confidence interval for the difference between the proportions of all men and all women aged 25 to 35 years who live with one or both parents.

Q5. The owner of a mosquito-infested fishing camp in Alaska wants to test the effectiveness of two rival brands of mosquito repellents, X and Y. During the first month of the season, eight people are chosen at random from those guests who agree to take part in the experiment. For each of these guests, Brand X is randomly applied to one arm and Brand Y is applied to the other arm. These guests fish for 4 hours, then the owner counts the number of bites on each arm. The table below shows the number of bites on the arm with Brand X and those on the arm with Brand Y for each guest.

Guest	A	B	C	D	E	F	G	H
Brand X	12	23	18	36	8	27	22	32
Brand Y	9	20	21	27	6	18	15	25

- a) Test at a 5% significance level whether the effectiveness of Brand X is different from the effectiveness of Brand Y. State the underlying assumption(s). Use the critical value approach.
- b) What would your decision in part (a) be if the probability of making a type I error were zero? Explain.

Q6. A mail-order company has two warehouses, one on the East Coast and the second on the West Coast. The company's policy is to mail all orders placed with it within 72 hours. The company's quality control department checks quite often whether or not this policy is maintained at the two warehouses. A recently taken sample of 300 orders placed with the warehouse on the East Coast showed that 279 of them were mailed within 72 hours. Another sample of 400 orders placed with the warehouse on the West Coast showed that 364 of them were mailed within 72 hours.

- a) Using a 2.5% significance level, can you conclude that the proportion of all orders placed at the warehouse on the West Coast that are mailed within 72 hours is lower than the corresponding proportion for the warehouse on the East Coast? Use the critical value approach.
- b) What is the type I error in (a)? Explain. What is the probability of making such an error
- c) Find the p -value for the test in part (a).

Q7.

- a) Determine the value of χ^2 for 23 degrees of freedom and an area of 0.990 in the left tail of the chi-square distribution curve.
- b) Find the value of χ^2 for 4 degrees of freedom and 0.005 area in the right tail of the chi-square distribution curve.
- c) Find the value of χ^2 for 6 degrees of freedom and 0.05 area in the left tail of the chi-square distribution curve.

Q8. Chance Corporation produces beauty products. Two years ago the quality control department at the company conducted a survey of users of one of the company's products. The survey revealed that 53% of the users said the product was excellent, 31% said it was satisfactory, 7% said it was unsatisfactory, and 9% had no opinion. Assume that these percentages were true for the population of all users of this product at that time. After this survey was conducted, the company redesigned this product. A recent survey of 800 users of the redesigned product conducted by the quality control department at the company showed that 495 of the users think the product is excellent, 255 think it is satisfactory, 35 think it is unsatisfactory, and 15 have no opinion. Is the percentage distribution of the opinions of users of the redesigned product different from the percentage distribution of users of this product before it was redesigned? Use $\alpha = 0.025$.

Q9. Four hundred people were selected from each of the four geographic regions (Midwest, Northeast, South, West) of the United States, and they were asked which form of camping they prefer. The choices were pop-up camper/trailer, family style (tenting with sanitary facilities), rustic (tenting, no sanitary facilities), or none. The results of the survey are shown in the following table.

	Midwest	Northeast	South	West
Camper/trailer	132	129	129	135
Family style	180	175	168	146
Rustic	46	50	59	68
None	42	46	44	51

Based on the evidence from these samples, can you conclude that the distributions of favorite forms of camping are different for at least two of the regions? Use $\alpha = 0.01$.

Q10. Many students graduate from college deeply in debt from student loans, credit card debts, and so on. A sociologist took a random sample of 401 single persons, classified them by gender, and asked, “Would you consider marrying someone who was \$25,000 or more in debt?” The results of this survey are shown in the following table. Test at a 1% significance level whether gender and response are related.

	Yes	No	Uncertain
Women	125	59	21
Men	101	79	16

Q11. In 2014, the variance of the ages of all workers at a large company that has more than 30,000 workers was 133. A recent random sample of 25 workers selected from this company showed that the variance of their ages is 112.

- a) Using a 2.5% significance level, can you conclude that the current variance of the ages of workers at this company is lower than 133? Assume that the ages of all current workers at this company are (approximately) normally distributed.
- b) Construct a 98% confidence intervals for the variance of the ages of all current workers at this company.