

Department of Computer Science, University of Karachi
BSCS: 306: Probability and Statistical Methods
Course Tutor: Dr Tahseen A. Jilani
Assignment-08: Hypothesis Testing - I

- Q.1.** An automobile manufacturer substitutes a different engine in cars that were known to have an average rating of 31.5 miles-per-gallon (mpg) on the highway. The manufacturer wants to test whether the new engine changes the mpg rating of the automobile model. A random sample of 100 trial runs gives mean = 29.8 mpg and $s = 6.6$ mpg. Using the 0.05 level of significance, is the average mpg rating on the highway for cars using the new engine different from the rating for cars using the old engine?
- Q.2.** Many recent changes have affected the real estate market. A study was undertaken to determine customer satisfaction from real estate deals. Suppose that before the changes, the average customer satisfaction rating, on a scale of 0 to 100, was 77. A survey questionnaire was sent to a random sample of 50 residents, who bought new plots after the changes in the market were instituted, and the average satisfaction rating for this sample was found to be 84 with the standard deviation 28. Determine whether statistical evidence indicates a change in customer satisfaction. If you determine that a change did occur, state whether you believe customer satisfaction has improved or deteriorated?
- Q.3.** According to *Money*®, the average appreciation, in percent, for stocks has been 4.3% for the five-year period ending in May 2017. An analyst tests this claim by looking at a random sample of 50 stocks and finds a sample mean of 3.8% and a sample standard deviation of 1.1%. Using $\alpha = 0.05$, does the analyst have statistical evidence to reject the claim made by the magazine?
- Q.4.** A certain commodity is known to have a price that is stable through time and does not change according to any known trend. Price, however, does change from day to day in a random fashion. If the price is at a certain level one day, it is as likely to be at any level the next day within some probability bounds approximately given by a normal distribution. The mean daily price is believed to be \$14.25. To test the hypothesis that the average price is \$14.25 versus the alternative hypothesis that it is not \$14.25, a random sample of 16 daily prices is collected. The results are mean = \$16.50 and $s = \$5.8$. Using $\alpha = 0.05$, can you reject the null hypothesis?
- Q.5.** A new chemical process is introduced by Duracell in the production of lithium-ion batteries. For batteries produced by the old process, the average life of a battery is 102.5 hours. To determine whether the new process affects the average life of the batteries, the manufacturer collects a random sample of 25 batteries produced by the new process and uses them until they run out. The sample mean life is found to be 107 hours, and the sample standard deviation is found to be 10 hours. Are these results significant at $\alpha = 0.05$ level? Are they significant at $\alpha = 0.01$ level? Explain. Draw your conclusion.
- Q.6.** According to *Money*, which not only looked at stocks but also compared them with real estate, the average appreciation for all real estate sold in the five years ending May 2007 was 12.4% per year. To test this claim, an analyst looks at a random sample of 100 real estate deals in the period in question and finds a sample mean of 14.1% and a sample standard deviation of 2.6%. Conduct a two tailed test using the 0.05 level of significance.
- Q.7.** (Test for Proportion- read the book) The manufacturer of electronic components needs to inform its buyers of the proportion of defective components in its shipments. The company has been stating that the percentage of defectives is 12%. The company wants to test whether the proportion of all components that are defective is as claimed. A random sample of 100 items indicates 17 defectives. Use $\alpha = 0.05$ to test the hypothesis that the percentage of defective components is 12%.
- Q.8.** According to *BusinessWeek*, the average market value of a biotech company is less than \$250 million. Suppose that this indeed is the alternative hypothesis you want to prove. A sample of 20 firms reveals an

average of \$235 million and a standard deviation of \$85 million. Conduct the test at $\alpha = 0.05$ and $\alpha = 0.01$. State your

- Q.9.** (Test for Proportion- read the book) A company's market share is very sensitive to both its level of advertising and the levels of its competitors' advertising. A firm known to have a 56% market share wants to test whether this value is still valid in view of recent advertising campaigns of its competitors and its own increased level of advertising. A random sample of 500 consumers reveals that 298 use the company's product. Is there evidence to conclude that the company's market share is no longer 56%, at the 0.01 level of significance?
- Q.10.** (Test for Proportion- read the book) According to a financial planner, individuals should in theory save 7% to 10% of their income over their working life, if they desire a reasonably comfortable retirement. An agency wants to test whether this actually happens with people in the United States, suspecting the overall savings rate may be lower than this range. A random sample of 41 individuals revealed the following savings rates per year: 4, 0, 1.5, 6, 3.1, 10, 7.2, 1.2, 0, 1.9, 0, 1.0, 0.5, 1.7, 8.5, 0, 0, 0.4, 0, 1.6, 0.9, 10.5, 0, 1.2, 2.8, 0, 2.3, 3.9, 5.6, 3.2, 0, 1, 2.6, 2.2, 0.1, 0.6, 6.1, 0, 0.2, 0, 6.8 Conduct the test and state your conclusions. Use the lower value, 7%, in the null hypothesis. Use $\alpha = 0.01$. Interpret.
- Q.11.** The theory of finance allows for the computation of "excess" returns, either above or below the current stock market average. An analyst wants to determine whether stocks in a certain industry group earn either above or below the market average at a certain time period. The null hypothesis is that there are no excess returns, on the average, in the industry in question. "No average excess returns" means that the population excess return for the industry is zero. A random sample of 24 stocks in the industry reveals a sample average excess return of 0.12 and sample standard deviation of 0.2. State the null and alternative hypotheses, and carry out the test at the $\alpha = 0.05$ level of significance.
- Q.12.** (Test for Proportion- read the book) In a taste comparison test, it was found that 58 of 100 persons preferred the chunky version of a peanut butter over the creamy type. An interested observer would like to determine whether this proportion (0.58) is significantly greater than the (0.50) proportion that would tend to result from chance. Using the 0.05 level of significance, what conclusion will be reached?
- Q.13.** An exterminator claims that no more than 10% of the homes he treats have termite problems within 1 year after treatment. In a sample of 100 homes, local officials find that 14 had termites less than 1 year after being treated. At the 0.05 level of significance, evaluate the credibility of the exterminator's statement.
- Q.14.** (Test for Proportion- read the book) The administrator of a local hospital has told the governing board that 30% of its emergency room patients are not really in need of emergency treatment (i.e., the problems could just as easily have been handled by an appointment with their family physician). In checking a random sample of 400 emergency room patients, a board member finds that 35% of those treated were not true emergency cases. Using an appropriate hypothesis test and the 0.05 level, evaluate the administrator's statement.
- Q.15.** (Test for Proportion- read the book) During 2006, 3.0% of all U.S. households were burglary victims. For a simple random sample of 300 households from a certain region, suppose that 18 households were victimized by burglary during that year. Apply an appropriate hypothesis test and the 0.05 level of significance in determining whether the region should be considered as having a burglary problem greater than that for the nation as a whole.
- Q.16.** A consumer agency suspects that a pet food company may be underfilling packages for one of its brands. The package label states "1600 grams net weight," and the president of the company claims the average weight is at least 1600 grams. For a simple random sample of 35 boxes collected by the consumer agency, the mean and standard deviation were 1591.7 grams and 18.5 grams, respectively. (a). At the 0.05 level of significance, what conclusion should be reached by the consumer agency? Would the president of the company prefer to use a different level of significance in reaching a conclusion? Explain. (b). Use the decision rule associated with part (a) and a range of selected assumed values for β in constructing the power curve for the test.