



Statistics for Business

Fall Semester 2015–2016

Assignment 3

Answer the following questions and hand in your answers by Monday, September 21, 2015. These should either be typed and sent electronically (via e-mail at pkonstantinou@aueb.gr) or should be left with Mrs Sakellariou.

Confidence Intervals

1. *Playbill* magazine reported that the mean annual household income of its readers is \$119,155 (*Playbill*, January 2012). Assume this estimate of the mean annual household income is based on a sample of 80 households, and based on past studies, the population standard deviation is known to be $\sigma = \$30,000$.

 - (a) Develop a 90% confidence interval estimate of the population mean.
 - (b) Develop a 95% confidence interval estimate of the population mean.
 - (c) Develop a 99% confidence interval estimate of the population mean.
 - (d) Discuss what happens to the width of the confidence interval as the confidence level is increased. Does this result seem reasonable? Explain.
2. The following sample data are from a normal population: 10, 8, 12, 15, 13, 11, 6, 5.

 - (a) What is the point estimate of the population mean?
 - (b) What is the point estimate of the population standard deviation?
 - (c) With 95% confidence, what is the margin of error for the estimation of the population mean?
 - (d) What is the 95% confidence interval for the population mean?
3. The average cost per night of a hotel room in New York City is \$273 (*SmartMoney*, March 2009). Assume this estimate is based on a sample of 45 hotels and that the sample standard deviation is \$65.

 - (a) With 95% confidence, what is the margin of error?
 - (b) What is the 95% confidence interval estimate of the population mean?
 - (c) Two years ago the average cost of a hotel room in New York City was \$229. Discuss the change in cost over the two-year period.

4. According to statistics reported on CNBC a surprising number of motor vehicles are not covered by insurance (CNBC February 23, 2006). Sample results consistent with the CNBC report showed 46 of 200 vehicles were not covered by insurance.

- (a) What is the point estimate of the proportion of vehicles not covered by insurance?
- (b) Develop a 95% confidence interval for the population proportion.

5. America's young people are heavy internet users: 87% of Americans ages 12 to 17 are internet users (The Cincinnati Enquirer, February 7, 2006). MySpace was voted the most popular website by 9% in a sample survey of Internet users in this age group. Suppose 1400 youths participated in the survey. What is the margin of error and what is the interval estimate of the population proportion for which MySpace is the most popular website? Use a 95% confidence level.

6. The average expenditure on Valentine's Day was expected to be \$100.89 (USA Today, February 13, 2013). Do male and female consumers differ in the amounts they spend? The average expenditure in a sample survey of 40 male consumers was \$135.67 and the average expenditure in a sample survey of 30 female consumers was \$68.64. Based on past surveys the standard deviation for male consumers is assumed to be \$35 and the standard deviation for female consumers is assumed to be \$20.

- (a) What is the point estimate of the difference between the population mean expenditure for males and the population mean expenditure for females?
- (b) At 99% confidence, what is the margin of error?
- (c) Develop a 99% confidence interval for the difference between the two population means.

7. Consider the following data for two independent random samples taken from two normal populations:

Sample 1	10	7	13	7	9	8
Sample 2	8	7	8	4	6	9

- (a) Compute the two sample means and the two sample standard deviations.
- (b) What is the point estimate of the difference between the two population means?
- (c) What is the 90% confidence interval estimate of the difference between the two population means?

Population	1	2	3	4	5
X:	1.3	1.6	1.1	1.4	1.7
Y:	1.2	1.5	1.1	1.2	1.8

Hypothesis Tests

8. A 2003 New York Times/CBS News poll sampled 523 adults who were planning a vacation during the next six months and found that 141 were expecting to travel by airplane (New York Times News Service, March 2, 2003). A similar survey question in a May 1993 New York Times/CBS News poll found that of 477 adults who were planning a vacation in the next six months, 81 were expecting to travel by airplane.

- State the hypotheses that can be used to determine whether a significant change has occurred in the population proportion planning to travel by airplane over the 10-year period.
- What is the sample proportion expecting to travel by airplane in 2003? In 1993?
- Use $\alpha = 0.01$ and test for a significant difference. What is your conclusion?
- Discuss reasons that might provide an explanation for this conclusion.

9. The following results are from independent samples taken from two populations

$$\begin{aligned} n_1 &= 35 & n_2 &= 40 \\ \bar{x}_1 &= 13.6 & \bar{x}_2 &= 10.1 \\ s_1 &= 5.2 & s_2 &= 8.5 \end{aligned}$$

Perform a test of the hypothesis that the two population means are equal. Explain the distribution the test statistic follows and report the p -value for the statistic. At $\alpha = 0.05$ what is your conclusion

10. A paired-difference experiment was conducted to compare the means of two populations:

- Do the data provide sufficient evidence to indicate that μ_1 differs from μ_2 ? Test using $\alpha = .05$.
- Find the approximate p -value for the test and interpret its value.
- Find a 95% confidence interval for $(\mu_1 - \mu_2)$.
- Compare your interpretation of the confidence interval with your test results in part (a).

11. Two independent random samples of sizes $n_1 = 4$ and $n_2 = 5$ are selected from each of two normal populations:

Population					
X:	12	3	8	5	
Y:	14	7	7	9	6

- (a) Calculate s_p^2 , the pooled estimator of σ^2 .
- (b) Find a 90% confidence interval for $(\mu_1 - \mu_2)$, the difference between the two population means.
- (c) Test $H_0 : (\mu_1 - \mu_2) \leq 0$ against $H_1 : (\mu_1 - \mu_2) > 0$ for $\alpha = .05$. State your conclusions.
12. Independent random samples of $n_1 = 16$ and $n_2 = 13$ observations were selected from two normal populations with equal variances:

	X	Y
Sample Size:	16	13
Sample mean:	34.6	32.2
Sample std. dev.:	4.8	5.9

- (a) Suppose you wish to detect a difference between the population means. State the null and alternative hypotheses for the test.
- (b) Find the rejection region for the test in part (a) for $\alpha = .01$.
- (c) Find the value of the test statistic.
- (d) Find the approximate p -value for the test.
- (e) Conduct the test and state your conclusions.
13. The SAT subject tests in chemistry and physics for two groups of students each electing to take these tests are given below.

	Chemistry	Physics
Sample Size:	16	14
Sample mean:	644	658
Sample std. dev.:	114	103

To use the two-sample t -test with a pooled estimate of σ^2 , you must assume that the two population variances are equal. Test this assumption using the F -test for equality of variances. What is the approximate p -value for the test?