

**Instructions:** This exam is in two parts: Part I is to be completed partly at home using the materials posted on Blackboard for Part I and you will answer questions about that work in class below; Part II is to be completed entirely in class. You may not use cell phones, and you may only access internet resources you are specifically directed to use. You may access your data file for Part I of the exam in Blackboard. You may access the data files posted to Blackboard for the Exam part II. Be sure you are using the data file that matches the exam version you are given.

#### Part I: At Home

This part was completed at home. You can upload the Excel file for Part I to the Part I folder in Blackboard for use during the Exam period. However, this submission will not be graded in this location, it must be submitted to the “to be graded folder” to receive credit.

#### Part II: In Class

1. Use the work done at home to answer the Part I questions.
2. Open the file from the in-class portion of the final posted on Blackboard that corresponds to the version of the exam you have. This is Exam C.
3. Answer the questions corresponding to the data file, and any additional calculation in Excel required.
4. When you have finished answering questions on the exam, and all your answers have been recorded on the paper test for grading, upload **both** the take home Excel file **and** the in-class Excel file to the same in-class Exam folder in Blackboard for grading. Only those files submitted to the correct folder will be graded. (If in doubt, put all work in one Excel file.)
5. Turn in your paper copy of the exam to your instructor.
6. Enjoy your break!



Part I:

1. Using the NoTip Table data, write the objective function you are using to maximize profit in their production process for the original problem data. (6 points)
2. How many of each type of cut should be made to produce the maximum profit? (6 points)
3. How did the result of the model change when we adjusted the profit for each type of table to \$120 and \$300? (6 points)
4. For the data on employee's year-end performance, which variable had the highest P-value (at any stage of the regression analysis)? State the name of the variable and the P-value. (6 points)
5. Write the final regression equation you obtained, the  $R^2$  value, and explain your reasoning for choosing it. (9 points)



11. Write the best regression equation you found and state the  $R^2$  value. (6 points)
  
12. Interpret the meaning of the  $R^2$  value in the context of the problem. (8 points)
  
13. Are there any outliers in the data? Use the residuals and residual plots to determine which point is suspect. Redo your analysis without this point included and describe the results of this test. (10 points)
  
14. Using data on couples purchasing cars, determine if the two measurements are dependent or independent. Explain your reasoning. (8 points)
  
15. Conduct an appropriate  $t$ -test to determine if men are willing to pay more than their wives for a car. State the null and alternative hypotheses, test statistic, P-value and state the results in an English sentence understandable to a non-statistician. (12 points)

Calculations in Excel: (1) 30 points, (2) 35 points, (3) 20 points, (4) 20 points.

Part II:

16. A study shows that half of all Internet users in 2012 used Google for their preferred search engine. Before purchasing ads on Google, a company decides to conduct a survey to see if this is still true. They ask 1593 people and find the 791 respondents claim to use Google as their primary search engine. Conduct a hypothesis test of proportions to determine if this result has changed from previous results. State the hypotheses, test statistic, P-value and conclusion. Is this sufficient evidence to think use of Google has changed? (12 points)

17. Interpret a Type I and Type II error in the context of this problem. (6 points)

18. Construct a 92% confidence interval for the true proportion of Internet users that prefer Google as their primary search engine. Interpret the interval in context. (8 points)

19. Suppose that you wish to sample employees of a large company to determine factors that predict high inside sales commissions in order to prepare for a new training program. The company has 1300 employees in this position around the world. The company wants to select 8 of them for an initial study of best practices. Eligible employees are assigned numbers from 1 to 1300 based on their date of initial hire. Select a simple random sample and report the employee numbers you have selected below. (6 points)

**Standard errors:**  $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$   $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$   $S_{pooled} = \sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}}$

$$S_{x_1-x_2} = S_{pooled} \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

**Sample sizes:**  $n > \hat{p}(1-\hat{p}) \left(\frac{z_{\alpha/2}}{E}\right)^2$   $n > \left(\frac{z_{\alpha/2}\sigma}{E}\right)^2$   $m = n = \frac{4z_{\alpha/2}^2(\sigma_1^2 + \sigma_2^2)}{w^2}$

**Confidence intervals:**

One sample:  $\bar{x} \pm t_{\alpha/2, n-1} \frac{s}{\sqrt{n}}$   $\hat{p} \pm z_{\alpha/2} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

Two samples (independent):  $(\bar{x}_1 - \bar{x}_2) \pm t_{\alpha/2, n-1} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$   $(\hat{p}_1 - \hat{p}_2) \pm z_{\alpha/2} \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$

**Test statistics:**

One sample:  $z$  or  $t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$   $z = \frac{\hat{p} - p_0}{\sqrt{p_0(1-p_0)/n}}$

Two samples: dependent:  $z$  or  $t = \frac{\bar{d}_0 - \delta}{\frac{s_d}{\sqrt{n}}}$

Independent:  $z$  or  $t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$   $z = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\frac{p_1(1-p_1)}{n_1} + \frac{p_2(1-p_2)}{n_2}}}$

Degrees of freedom (two samples, unpooled)  $\nu = \frac{\left(\frac{s_1^2}{m} + \frac{s_2^2}{n}\right)^2}{\frac{\left(\frac{s_1^2}{m}\right)^2}{m-1} + \frac{\left(\frac{s_2^2}{n}\right)^2}{n-1}}$

$\chi^2$  Tests:  $\chi^2 = \sum_{all\ cells} \frac{(obs-exp)^2}{exp}$

ANOVA:  $MSE = \frac{(\sum_{j=1}^J n_j (\bar{Y}_j - \bar{Y})^2)}{J-1}$   $MSS = \sum_{j=1}^J \frac{(n_j-1)s_j^2}{n-j}$   $F = \frac{MSE}{MSS}$

Upload your completed Excel files to the Final Exam submission box in Blackboard, and submit your completed paper exam to your instructor. You may not modify anything once the exam is submitted.