Spring 2009 Final Exam

Closed book & notes; only a two-sided and handwritten A4 formula sheet and a calculator allowed; 90 minutes. No questions accepted!

Instructions: There are seven pages (one cover and six pages with questions) in this exam. Please inspect the exam and make sure you have all 6 pages. You may only use your calculator and your formula sheet. Do all your work on these pages. If you use the back of a page, make sure to indicate that. You may not exchange any kind of material with another student.

Remember: You must show all your work to get proper credit. Round your final answers to two decimal places.

Academic Honesty Code: Koç University Academic Honesty Code stipulates that “copying from others or providing answers or information, written or oral, to others is cheating.” By taking this exam, you are assuming full responsibility for observing the Academic Honesty Code.

NAME and SURNAME: ___________________  SIGNATURE: ___________________
INSTRUCTOR: ___________________  LECTURE TIME: ___________________

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(1) (14 points) Suppose a veterinarian selects ten pairs of puppies (köpek yavrusu) so that the two puppies in each pair are from the same litter (i.e., they are very similar genetically). These puppies are housetrained using two different methods: one puppy from each pair was paper-trained, with the paper gradually moved outside, and the other puppy was taken out every three hours and twenty minutes after each meal. The number of days until the puppies was considered “housetrained” were compared. The average difference in completing the training of the puppies by the two methods was equal to 4 days, with a standard deviation of the difference equal to 3 days. The differences are taken as “number of days with paper-trained” minus “number of days with taking out after the meal”.

(a) What is a 90% confidence interval on the difference in successful training? 
(b) Test the claim that paper-training the puppies is less effective (i.e., takes longer time to train) at $\alpha=0.05$. 

Two samples concerning retention (sınifta kalma) rates for first-year students at private and public institutions were obtained from the Department of Education’s data base to see if there was a significant difference in the two types of colleges. The number of students who fail the class is recorded for each college. The data is summarized as follows:

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<th>Private Colleges</th>
<th>Public Universities</th>
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<tr>
<td>n</td>
<td>71</td>
<td>32</td>
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<tr>
<td>Mean</td>
<td>78.17</td>
<td>84</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>9.55</td>
<td>9.88</td>
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<tr>
<td>Variance</td>
<td>91.17</td>
<td>97.64</td>
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</table>

(a) Calculate a 95% confidence interval for the differences in mean number of students on retention? What does the confidence interval tell us about retention rates?
(b) Test the hypothesis that there is no significant difference in retention at privates and publics. Use $\alpha=0.05$.
(c) Also calculate the $p$-value for the test in part (b). Would the decision be different if $\alpha$ was equal to 0.01?
(3) (14 points) Suppose photocopy machines print out on average 100,000 copies between paper jams (kağıt sıkışması). A salesman claims his photocopy machines are better, and offers to leave 5 units for testing. The average number of copies between paper jams is 100,987, with a standard deviation of 157.

(a) Does his claim seem believable (i.e., is the true average number of copies between paper jams larger than 100,000)? Use $\alpha=0.01$.

(b) Calculate a 90% confidence interval for the average number of copies between paper jams based on the data the salesman collected.
(4) (14 points) Rope (halat) designed for use in a theater must have a minimum breaking strength of 1400 kgs. The theater manager has to reject any shipment which cannot pass a 1% defect (hatalı, defolu) test.

(a) From a shipment of brand (marka) A ropes, 1500 are tested, and 20 pieces failed the test. At the $\alpha = 0.01$ level, should the shipment be rejected?

(b) From a shipment of brand B ropes, 2000 are tested and the shipment is rejected. What must be the minimum number of failed ropes for brand B?
(5) (16 points) In a factory producing cartons, it is believed that the number of acceptable cartons \((Y)\) has a positive linear relationship with the number of hours of line operation \((X)\). Suppose with 15 independent measurements, we have the following summary statistics:

\[
\begin{align*}
\sum X &= 1153 & \sum X^2 &= 104025 & \bar{X} &= 76.86666 \\
\sum Y &= 338 & \sum Y^2 &= 8430 & \bar{Y} &= 22.53333 \\
\sum XY &= 29277 & n &= 15
\end{align*}
\]

(a) Find the estimates of the slope and intercept.

(b) Interpret (yorumla) the estimates in part (a).

(c) Write the regression equation.

(d) Calculate and interpret the correlation coefficient.
(6) (14 points) The European Union (EU) regulations require that the length of cucumbers (salatalık) have to be more than 10 but less than 20 cm. The length of cucumbers grown in Turkey is known to have a normal distribution with mean 12.5 cm and standard deviation of 7.5 cm.

(a) A producer has 1000 cucumbers to sell. What is the probability that more than 460 of these cucumbers will satisfy the rules of EU?

(b) Maria bought 10 cucumbers which were produced in Turkey and which satisfy EU regulations. What is the probability that more than 3 of these cucumbers will be less than 12.5 cm?
(7) (14 points) Osman is invited to a barbecue party this Saturday. At the party only köfte and tavuk şiş are served and everyone is allowed to eat at most two dishes. There will be two rounds of food service. In the first round Osman might eat köfte with probability 0.6 and tavuk şiş with probability 0.4. If he eats köfte in the first round, in the second round he might eat köfte with probability 0.4 or tavuk şiş with probability 0.5. If he eats tavuk şiş in the first round, in the second round he might eat köfte with probability 0.6 or tavuk şiş with probability 0.3. Notice that it is possible that Osman might not eat anything in the second round.

(a) What is the probability that Osman will eat both köfte and tavuk şiş (order not important)?

(b) Given that Osman ate köfte at the party, what is the probability that he first ate tavuk şiş?