Spring 2006 Final Exam
Closed book & notes; only an A4-size formula sheet and a calculator allowed;
2 hrs 15 mins. No questions accepted!

Instructions: There are nine pages (one cover, six pages with questions and two pages with
density tables) in this exam. Please inspect the exam and make sure you have all 9 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.

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: ___________________________ SIGNATURE: ___________________________

LECTURE TIME : ____________________

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<td>Total:</td>
<td>104</td>
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1. A manager wants to conduct a test to determine if there is a difference in the average amount of time in minutes that individuals wait in line at the Ceyhan Shop&Save compared to those at the T&A Food Factory. He took a random sample of 13 customers at Ceyhan’s and determined that the mean time in line was 5.2 minutes with a standard deviation of 1.2 minutes, while a sample of 12 customers at T&A’s yielded a sample mean of 4.8 minutes with a standard deviation of 1.5 minutes.

(a) Do the test using $\alpha = 0.05$ and interpret your result. (8 points)

(b) Construct a 95% CI for the mean difference in the average amount of time in minutes that individuals wait in line. (6 points)

(c) Can you use the interval in part (b) when doing the test in part (a)? If so, what do you conclude? If not, explain why not? (4 points)
2. A sample of 15 children from Manisa (group 1) showed that the mean time they spend playing computer games is 35 hours per week with a standard deviation of 6 hours. A sample of 21 children from İzmir (group 2) showed that the mean time spent by them playing computer games is 33 hours per week with a standard deviation of 10 hours.

(a) Find a 95% CI for the mean time children from Manisa spent on computers. (5 points)
(b) Using the CI in part (a), test whether the mean time children from Manisa spent on computers is different from 33 (use α=0.05). (5 points)
(c) Construct a 95% CI for the mean time children from İzmir spent on computers. (5 points)
(d) Compare the CI’s in parts (a) and (c) (do they intersect or not?). What do you conclude about the mean time spent on computers by Manisa and İzmir children? (5 points)
3. A tax reform group wants to compare the average annual property tax on houses in an urban setting with equally valued houses in a rural setting. 15 houses were randomly sampled from the urban tax role and 15 houses were randomly sampled from the rural tax role. The average annual tax observed for urban and rural settings are given below along with the variance of each of the samples.

<table>
<thead>
<tr>
<th>URBAN (group 1)</th>
<th>RURAL (group 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\bar{X} = 242.50$</td>
<td>$\bar{Y} = 235.00$</td>
</tr>
<tr>
<td>$s^2_1 = 85.00$</td>
<td>$s^2_2 = 50.00$</td>
</tr>
</tbody>
</table>

(a) Do the data indicate that the average annual property tax for houses in an urban setting is more than the average annual property tax for houses in a rural setting. Use $\alpha=0.025$. Do a hypothesis test. (10 points)

(b) What type of error might you have made in part (a)? (2 points)

(c) (Bonus) Find the range of p-value for this test. (4 points)
4. A researcher wanted to know if attending a course on “how to sell a product” can increase the average sales of its employees. The company sent six salespersons to attend this course. The following table gives the one-week sales of these salespersons before and after they attended this course:

<table>
<thead>
<tr>
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<th>18</th>
<th>24</th>
<th>24</th>
<th>14</th>
<th>19</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>14</td>
<td>20</td>
<td>35</td>
<td>10</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>Difference</td>
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</tbody>
</table>

(a) Fill in the difference (after-before) cells in the above table, and estimate the standard error term for this sample.(6 points)

(b) Construct a 90% CI on the mean difference of one-week sales of these salespersons before and after they attended the course. (6 points)

(c) Is there substantial evidence that attending the course increased average sales? Test at \( \alpha = 0.05 \) level. (8 points)
5. Mark Speller, IT Manager at ABC, Inc., is studying employee use of ABC e-mail for non-business communications.

(a) A random sample of 200 e-mail messages was selected. 42 of the messages were not business related. Calculate the 90% confidence interval for the population proportion of non-business email usage. (6 points)

(b) Mr. Speller plans to use a 95% confidence interval estimate of the proportion of e-mail messages that are non-business; and he will accept at most 0.05 error of estimation. Previous studies indicate that approximately 25% of employee e-mail is not business related. How many e-mail messages should be sampled? (6 points)

(c) Mr. Speller suspects that less than 25% of e-mail messages sent by ABC employees are not business related. A new random sample of 300 e-mail messages was selected to test this hypothesis at the 0.01 level of significance. 60 of the messages were not business related. Conduct the test using p-value and interpret your result. (6 points)
6. American First Banks' policy requires consistent, uniform training of employees at all banks. Consequently, David Moneye, VP of Human Resources, orders a survey of mean employee training time in the Southeast region (group 1) and the Southwest region (group 2). His staff randomly selected personnel records of 14 employees from each region, and reported the following: group 1: $\bar{X} = 30$ hours, $s_1 = 12$
   group 2: $\bar{Y} = 25$ hours, $s_2 = 4$.

(a) Do these data indicate that employee training time is less in the Southwest region? Test with $\alpha=0.05$. (6 points)
(b) Compute a 98% confidence interval for the difference in population means, $\mu_1 - \mu_2$. (6 points)