Name:_____

Student Number:_____

Statistics for Final Year Engineering Students
Final Class Test, Thursday May 26, 2011.
Lecturer: Dr. Yoni Nazarathy.

Duration: 40 Minutes.

Allowed: Non-Communicating calculators, double sided A4 reference sheet.

Not Allowed: Any other material, talking of any sort, looking side to side, passing items.
Students who violate this will be asked to leave immediately.

Write your answers CLEARLY in the answer boxes only. You may use spare paper supplied during the test – write your name on this sheet and hand it in along with the test.

A single sheet containing both a normal and an F distribution table is supplied.

The test is composed of 15 items. 7 points per item (Maximal grade: 105).

Good Luck.

1) An engineer is conducting an experiment to compare the durability of two tire types: Type X and type Y. 4 tires of each type are put to a test and a unit of measure indicating the level of durability is determined for each of the tested tires. The engineer decides to conduct an ANOVA test and obtains a value of 5.42 for the F statistic. The engineer uses a confidence level of 95%.

For each statement, indicate if true or false. And supply a **brief** explanation.

a) The engineer rejects H_0 and concludes that there is no difference between tire types.

True / False. Explanation:

b) The engineer rejects H_0 and concludes that the tire types have different durability levels with complete certainty.

True / False. Explanation:

c) Knowing the value of the F statistic is not enough for deciding if to reject/not reject H_0 since the correlation coefficient between tires of type X and Y needs to also be computed.

True / False. Explanation:

d) The engineer rejects H_0 and concludes the tire types differ in durability yet there is a 5% chance that the tire types do not have different durability levels.

True / False. Explanation:

e) The engineer does not reject H_0 .

True / False. Explanation:

2) Weights of items (measured in Kg) are denoted by $W_1, W_2, \ldots, W_n$ and are assumed to be independent and follow the same distribution with,

$$P(W_i > x) = \begin{cases} 2e^{-x} & a \leq x \\ 1 & x < a \end{cases}.$$

a) Find the constant a.

a =
Explanation:

b) Write (do not draw) the CDF of W_i, make sure you specify the value of the CDF for every x. (If you did not manage to solve the item above, leave your answer to this item and the next in terms of the constant a.)

$F(x) =$

c) Write (do not draw) the PDF of W_i.

$f(x) =$

d) An item is said to be "overweight" if it weighs more than 5 Kg. Assume $n = 100$. Write an expression (may involve a summation) for the probability of having less than 20 overweight items.

$Probability\ of\ less\ than\ 20\ overweight =$

Explanation:

e) Let $\widetilde{W}_i$ denote the weight measured in **grams**. Write the PDF of $\widetilde{W}_i$ (if you did not answer (c), assume your result for (c) is $f(x)$ and try to write the result in terms of it).

$\tilde{f}(x) =$

3) A shipping company is conducting a survey regarding container contents. 100 containers are picked at random and for each container the following quantities are recorded:
x_i- The weight of the container.
y_i- The value of the container contents.
I_i- Equals 1 if the container is privately owned and gets the value 0 if the container is owned by a company.

The following statistics are calculated: $\overline{x}$, $\overline{y}$ (sample means) S_x^2, S_y^2 (sample variances), $\hat{p}$ (sample proportion of privately owned containers) and $\sum_{i=1}^{100} x_i y_i$.

For each statement, indicate if true or false. And supply a **brief** explanation.

a) S_x^2 is an unbiased estimator of the variance of container weights.

True / False. Explanation:

b) The sample correlation coefficient of container weights and container values can be calculated based on the above statistics (without using any other information from the data).

True / False. Explanation:

c) The sample correlation coefficient of container weights and container values is 0 because the sample is random and containers are assumed to be independent.

True / False. Explanation (no need for an exact formula if true):

d) A confidence interval for the proportion of privately owned containers with confidence level $1-\alpha$ can span a range (lowest value to upper value) of at most $\frac{z_{1-\frac{\alpha}{2}}}{10}$.

True / False. Explanation:

e) $P(\hat{p}=1)$=$100p^{100}$, where p is the population proportion of privately owned containers.

True / False. Explanation: