

Concordia University
Department of Electrical and Computer Engineering
ENGR 371 - Probability and Statistics

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Final Examination

April 29, 2010

- 1) **(10 Marks)** In a particular area, there are just three makes of cars available: Ford (60% of the total), Renault (30%) and Honda (10%). The carburetors on Fords have a 0.09 probability of failure, those on Renaults have a 0.05 chance and those on Hondas have a 0.02 chance of failure. If a car with a failed carburetor is selected at random, what is the probability that it is a Ford?
- 2) **(10 Marks)** A multiple-choice quiz has 200 questions each with 4 possible answers of which only 1 is the correct answer. What is the probability that sheer guesswork yields from 25 to 30 correct answers for 80 of the 200 problems about which the student has no knowledge? **[HINT: approximation may be helpful here]**

- 3) **(10 Marks)** Let X and Y represent two random variables whose joint density function is

$$f_{XY}(x, y) = \begin{cases} 24xy, & 0 \leq x \leq 1, 0 \leq y \leq 1, x + y \leq 1 \\ 0, & \text{elsewhere} \end{cases}$$

- a) Find $f_Y(y)$.
- b) Are X and Y independent? Explain.
- c) Find $P(Y < \frac{1}{8} | X = \frac{3}{4})$.
- 4) **(10 Marks)** Two independent experiments are being run in which two different types of paints are compared. Eighteen specimens are painted using type A and the drying time, in hours, is recorded on each. The same is done with type B.
- a) Suppose that the population standard deviations are both known to be 1.0. Assuming that the mean drying time is equal for the two types of paint, find $P(\bar{X}_A - \bar{X}_B > 1.0)$, where \bar{X}_A and \bar{X}_B are average drying times for samples of size $n_A = n_B = 18$.
- b) Repeat Part (a) when the population standard deviations are unknown, but they are still equal and estimated to be $s = 0.96$.
- 5) **(10 Marks)** A random sample of 100 automobile owners shows that, in the province of Quebec, an automobile is driven on the average 23,500 kilometers per year with a standard deviation of 3900 kilometers.
- a) Construct a 99% confidence interval for the average number of kilometers an automobile is driven annually in Quebec.
- b) What can we assert with 99% confidence about the possible size of our error if we estimate the average number of kilometers driven by car in Quebec to be 23,500 kilometers per year?
- 6) **(10 Marks)** The life in hours for a battery is known to be normally distributed with standard deviation $\sigma = 1$ hours. A random sample of 16 batteries has a mean life of $\bar{x} = 20.3$ hours.
- a) Test $H_0 : \mu = 20$ versus $H_1 : \mu > 20$ for $\alpha = 0.05$.
- b) What is the P-value of the test in part (a)?
- c) What is the β error for the test in part (a) if the true mean is 20.75 hours?