Concordia
UNIVERSITY

Course		Number	Section
ENGR 371/CC	August 23, 2006	19:00-22:00pm	5
Examination	**Date**	**Time**	**# of pages**
Final Examination			

Instructor(s)

Dr. Don Davis

Materials allowed: [ ] No [X] Yes (Please specify)

Calculators allowed: [ ] No [X] Yes

Students are allowed to use silent, non-programmable electronic calculators without text display.

Special Instructions:

Closed book, one single page crib sheet, answer all questions

Question 1) A town has *six* police cars and one garage. When a police car breaks down it is sent to the garage. The garage can *work* on up to 2 cars at a time. If there are more than 2 cars sent to the garage, the remaining cars are put in a *storage lot*. From experience there is a 20% chance that a given police car will break down.

a) Write out a table with two columns. The first column is the number of police cars that have broken down and the second column is the probability of that event. Give numerical values for all constants.
b) Compute the average (expected value) of the number of police cars that are broken down.
c) Compute the average (expected value) of the number of police cars that are being worked on.
d) Compute the average (expected value) of the number of cars in the garage storage lot.

Question 2) Two random variables, X and Y have a joint probability distribution $f(x,y)=\begin{cases} c & x,y \in A \\ 0 & elsewhere \end{cases}$ where A is the triangular region shown in figure 1.

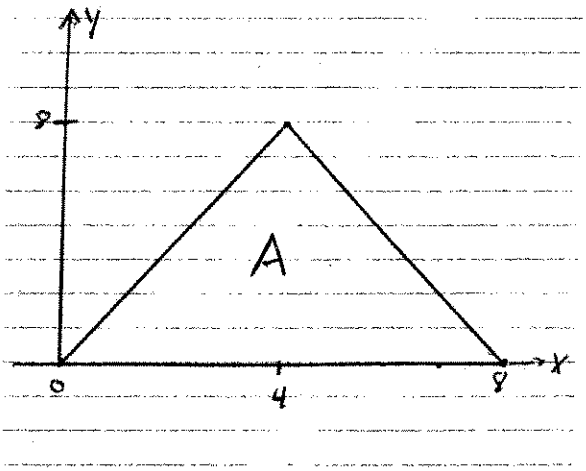

Figure 1 Region of coverage for joint distribution $f(x,y)$ in question 2.

a) Compute the value of c for the joint distribution.
b) Compute the probability $P(Y+2X \geq 8)$
c) Are the random variables X and Y independent? Prove your answer.

Question 3) A resistor manufacturer produces chip resistors for cellular phones. The process for manufacturing the chip resistors can be approximated by the normal distribution with a mean value of 100 ohms and a standard deviation of 10. The chip resistors must have a resistance (R) between $80.4 < R < 119.6$ ohms or they are rejected.

a) What is the probability that a given chip resistor is rejected?
b) If the company produced 150 chip resistors a day, what is the average rejection rate per day?
c) Compute the probability that the number of rejected resistors per day, (N_R), is within the range $7 \leq N_R \leq 9$.

Question 4) The wireless network in the library has four independent communication nodes (A, B, C, and D) for an entire floor. Each node handles a portion of the total internet communication and for each node there is a chance of getting a "drop", (lost the connection), over the wireless link. The coverage (the percentage of the total internet communications) and probability of getting a drop for each node is found in table 1.

Table 1
Node coverage and Node Drop risk for a wireless transmission

Node	Coverage	Drop
A	20%	3%
B	25%	2%
C	30%	1%
D	25%	4%

a) Compute the probability of getting a drop in the library.
b) If you have a drop in your internet connection, compute the most likely node that sent the transmission and the least likely node that handled the transmission.

Question 5) Two brands (brand A and Brand B) of field coils are being tested. It has been previously determined that both of the coils have normally distributed lifetimes and the same standard deviation of 10. If the population mean lifetimes are within 35 hours the products are considered equal. If the population mean of coil A (μ_A) is greater than the population mean of product B (μ_B) by more than 35 hours, it will be decided that coil A is superior to coil B. If the population mean of coil B (μ_B) is greater than the population mean of product A (μ_A) by more than 35 hours, it will be decided that coil B is superior to coil A.
In order to compare the quality of the two products, 30 units of field coil A and 25 units of field coil B are tested. The sample mean of coil A was 500 hours. The sample mean of coil B was 550 hours.

a) Using a 95% confidence interval, determine if either coil is superior. Justify your answer.
b) How accurate is this determination? Explain how you could improve the estimate.
c) What product would you recommend, justify your answer.

Question 6) A single roll of a die produces a discrete random variable with a uniform probability distribution. $f(X) = 1/6$ *for* $1 \le X \le 6$.

a) Use this distribution to obtain the moment generating function for this random variable.
b) Compute the mean using the moment generating function. Compare this value with the mean obtained directly from the distribution. Comment on any similarities or differences.