Practice for Midterm Examination 1

ECE 302, Spring 2013

Instructor: Prof. Mimi Boutin

Instructions:

1. Wait for the "BEGIN" signal before opening this booklet. In the meantime, read the instructions below and fill out the requested info.
2. You have 50 minutes to complete this exam. **When the end of the exam is announced, you must stop writing immediately**. Anyone caught writing after the exam is over will get a grade of zero.
3. You will find some scratch paper at the end of this booklet. What you write on the scratch paper will not be graded. You may tear out the scratch paper pages **once the exam begins**. Make sure to hand in all your scratch paper when you turn in your exam.
4. You must keep your eyes on your desk at all times. Looking around is not allowed.
5. This is a closed book exam. The use of calculators is prohibited. Cell phones, iPods, and all other electronic communication devices are strictly forbidden. This means that they MUST BE TURNED OFF (not on vibrate mode) and stowed away (in your bag, not in your pocket) AT ALL TIMES.

Name:_____

Email:_____

Signature:_____

Itemized Scores
Problem 1:
Problem 2:
Problem 3:
Problem 4:
Problem 5:
Total:

(12 pts) **1.**
a) Does the following collection of signals form a set? Answer yes/no and briefly justify your answer.

$$\begin{aligned} x_1(t) &= \sin t \\ x_2(t) &= \cos t \\ x_3(t) &= \cos\left(\frac{t}{2}\right) \\ x_4(t) &= \sin\left(t + \frac{\pi}{2}\right) \end{aligned}$$

b) Let $A = \{\frac{1}{2}, 1, 2\}$ and $B = \{\frac{54}{27}, 0.\bar{9}, 3\}$. Write $A \cup B$ explicitly. Is $A \cup B$ a set? (Answer yes/no.)

(20 pts) **2.** Let A and B be two events.
a) Prove that if A is independent of B, then A is also independent of B^c.

b) Assume that $P(A) = 0.2$, that $P(B) = 0.3$, and that A is independent of B. Use what you proved in a) to compute the probability that only one event among A and B occurs (i.e., either A or B, but not both, occurs). You must fully justify your answer (esp. clearly indicate where you used a)) in order to get full credit.

(25 pts) **3.** You are given three boxes, each with one drawer on each of two sides. (So there are two drawers per box.) Each drawer contains exactly one coin. One box has a gold coin in each of its two drawers. Another box has a silver coin in each of its two drawers. The remaining box has a silver coin in one drawer, and a gold coin in the other drawer. A box is chosen at random, a random drawer is opened, and a gold coin is found inside it. What is the probability that the coin on the other side is gold? (Use conditional probability to justify your answer.)

(20 pts) **4.** A hunter has two hunting dogs. One day, on the trail of some animal, the hunter comes to a place where the road diverges into two paths. He knows that each dog, independent of the other, will choose the correct path with probability p. The hunter decides to let each dog choose a path, and if they agree, take that one, and if they disagree to randomly pick a path. Is this strategy better than just letting one of the two dogs decide on a path? Justify your answer.

(15 pts) **5.** Nine rooks are placed in distinct squares on a 9×9 chessboard, with all possible placements being equally likely. What is the probability that all the rooks are safe from one another, i.e., that there is no row or column with more than one rook. (Leave your answer in unsimplified numerical form.)

-SCRATCH -
(will not be graded)

-SCRATCH -
(will not be graded)