Department of Electrical and Computer Engineering

ENGR 371 Probability and Statistics in Engineering
Midterm Exam – February 12, 2014

You can only use the faculty approved calculator with sticker.
Pens, pencils, erasers, and straight edges only. No crib sheets. NO CELL PHONES.
If you have a difficulty you may try making REASONABLE assumptions. State the assumption and how that assumption limits your answer. Justify your responses.

1. A jar contains 4 red and 7 yellow balls. You randomly take out exactly three balls. What is the probability that all the balls are yellow, if
   a) You remove all 3 balls simultaneously. (2 marks)
   b) You remove all 3 balls sequentially. (2 marks)
   c) What is the relationship between the answers for a) and b)? (2 marks)
   d) You now have a second jar, which contains 6 red and 4 yellow balls. You toss a coin to select the jar. You pick the first jar on tails and the second on heads. Using the law of total probability, show all steps for calculating the probability of selecting a red ball. (3 marks)

2. Seventy percent of the aircraft light that disappear while in flight in a certain country are subsequently discovered. Of the aircrafts that are discovered, 60% have an emergency locator, whereas 90% of the aircrafts that are not discovered do not have such a locator. Suppose an aircraft light has disappeared.
   a) If it has an emergency locator, what is the probability that it will not be discovered? (3 marks)
   b) If it does not have an emergency locator, what is the probability that it will be discovered? (3 marks)

3. Let X be a random variable with the following probability distribution

X	-2	-1	1	3	5
f(x)	1/A	2/A	3/A	4/A	5/A

add all up
Must = 1, A = 15

   a) Determine A. (2 marks)
   b) Find the mean E(X) of the random variable X. (2 marks)
   c) Find the variance of the random variable X. (2 marks)

4. A tetrahedron is a three dimensional object with four sides each made up of a plane. Each side is a triangle. If one throws this object into the air, one side will land face down. The sides are marked 1, 2, 3, and 4. Assume further that the tetrahedron is "regular" i.e. each side is identical to the others, so that when we throw the tetrahedron in the air the chances that we land on any one of the four sides are equal. Assume that we have two such tetrahedron. We throw both in the air. We then examine the side that landed face down for each of them, and add together the two numbers that we find. Call that sum X. Give the probability mass function for X. If you make any assumptions, state them. (4 marks)

5. The service center of a company is open 7 days a week. The average number of service calls received per day is estimated to be 12. Find the probability that fewer than 7 service calls are received
   a) On a given day. (2.5 marks)
   b) On two of the next three days. (2.5 marks)