

University of Waterloo
Department of Electrical and Computer Engineering

E&CE-316 – Probability Theory and Random Processes
Midterm Examination

February 16, 2001, 4:30pm to 6:30pm, MC 2038, 2054, 1085

Instructor: G. Gong and A. K. Khandani

Time allowed: 1.5 hours.

Closed book examination. One $8\frac{1}{2} \times 11$ review sheet allowed.

Answer all the questions. Questions of equal mark. [40] constitutes full mark.

Question 1: Let E, F and G be three events. Suppose that $P(E) = .4$, $P(F) = .5$ and $P(G) = 0.6$. We also assume that E and F are independent and E and G are mutually exclusive. Compute,

(2.5/40) a: $P(E \cup F^c)$

(2.5/40) b: $P[E \cap (F \cup G)]$

(2.5/40) c: $P(E|F^c)$

(2.5/40) d: $P(F \cap G)$.

Question 2: Solve the following problem.

(10/40): Two hunters shoot at a deer which is hit by exactly one bullet. If the first hunter hits his target with probability 0.3 and the second with probability 0.6, what is the probability the second hunter killed the deer?

Question 3: A communication system consists of n components, each of which will, independently, function with probability p . Let X be the number of the components that function.

(5/40) a: What is the probability mass function of X ? Compute $E(X)$, $Var(X)$, $E(2X+3)$ and $Var(2X+3)$.

(5/40) b: Suppose that the system will be functional if more than one-half of its components function. We denote Y a random variable which takes value 1 if the system functions and value 0 if it does not function. What is the probability mass function of Y if $n = 6$ and $p = 2/3$?

Question 4: Solve the following problems:

(5/40) a: The average number of database queries processed by a computer in any 10-second interval is 5 (hint: use Poisson distribution). What is the probability that there will be no queries processed in a 10-second interval? What is the probability that at least two queries are processed during this time?

(5/40) b: Ten people enter an elevator on the ground floor and get off, at random, at one of eight floors above ground. Find the probability that exactly one person gets off on the fifth floor.