
UC Berkeley EECS Department

Midterm 1

Fall 2004

EE 126
Probability and Random Processes

Instructor: Pr. Avidesh Zakhor
Date: Wednesday, October 27
Exam Time: 12:35pm-1:30pm
Total Points: 100

Question 1 (20 Points)

A box contains N items, K of which are defective. A sample of M items is drawn from the box at random. What is the probability that the sample includes at least one defective item if the sample is taken

- 1.1 (10 points) with replacement
- 1.2 (10 points) without replacement

Question 2 (40 Points)

Random variables X and Y are independent and are described by the probability density functions $f_X(x) = 1$ if $0 \leq x \leq 1$ and $f_Y(y) = 1$ if $0 \leq y \leq 1$. The unit of x and y is in hours.

Stations A and B are connected by two parallel message channels. A message from A to B is sent over both channels at the same time. Random variables X and Y represent the message delays over parallel channels I and II, respectively.

A message is considered "received" as soon as it arrives on any one channel, and it is considered "verified" as soon as it has arrived over both channels.

Questions 1, 2 and 3 can be solved independently.

- 2.1 (13 points) Determine the probability that a message is received within 15 minutes after it is sent.
- 2.2 (12 points) Determine the probability that the message is received but not verified within 15 minutes after it is sent.
- 2.3 (10 points) Let Z represent the time (in hours) between transmission at A and verification at B. Determine the cumulative distribution function of Z and the probability density function of Z .
- 2.4 (5 points) If the attendant at B goes home 15 minutes after the message is received, what is the probability that he is present when the message should be verified?

Question 3 (40 Points)

Oscar has lost his dog in either forest A (with a priori probability 0.4) or in forest B (with a priori probability 0.6).

If the dog is in A and Oscar searches for it in A, the conditional probability that he will find the dog is 0.25. Similarly, if the dog is in B and Oscar searches for it in B, the conditional probability that he will find the dog is 0.15.

Questions 1, 2 and 3 can be solved independently.

- 3.1 (10 points) In which forest should Oscar look to maximize the probability he finds his dog?
- 3.2 (15 points) Given that Oscar looked in A but didn't find his dog, what is the probability that the dog is in A?
- 3.3 (15 points) If Oscar flips a fair coin to determine in which forest he should look and finds the dog, what is the probability that he looked in A?