

EE302 Homework #5

Assigned 10/26/09, Due 11/06/09 (by 4:30 in dropbox in MSEE 330)..

1. A communications satellite is designed to have a mean time to failure of 5 years starting from when it becomes operational. One satellite is in operation at any time. When a satellite fails a new one becomes operational. *For each part below*, answer the question for the two cases where (i) failures occur randomly at continuous times according to a Poisson process; (ii) failures occur randomly at positive integer number of years according to a Bernoulli process.
 - (a) Find the probability that a satellite will last at least 5 years
 - (b) Find the probability that two satellites will last at least 10 years
 - (c) Find the probability that one satellite will last at least 10 years given it lasts at least 5 years.
 - (d) Find the probability that two satellites will last at least 20 years given they last at least 10 years.
 - (e) Find the conditional mean lifetime of one satellite given it lasts at least 5 years.
 - (f) Find the conditional mean lifetime of two satellites given they last at least 10 years.

2. At even time instants, a robot moves either $+\Delta$ cm or $-\Delta$ cm in the x -direction according to the outcome of a coin flip; at odd time instants, the robot moves similarly according to another coin flip in the y -direction. All coin flips are independent and fair. Assuming that the robot begins at the origin, let X and Y denote the coordinates of the location of the robot after $2n$ time instants.
 - (a) Find the marginal pmfs for X and for Y .
 - (b) Find the joint pmf for X and Y
 - (c) Find the probability that the robot is within distance $\sqrt{2}\Delta$ of the origin after $2n$ time instants. *Note:* the cases of n even and odd have different answers.

3. Text, chapter 5, problem 5.9. Also find $p_{Y|X}(y|x)$
4. Text, chapter 5, problem 5.26. Also find $f_{Y|X}(y|x)$
5. Text, chapter 5, problem 5.11
6. Text, chapter 5, problem 5.61
7. Text, chapter 5, problem 5.28
8. Text, chapter 5, problem 5.81
9. Text, chapter 5, problem 5.68