

1016-345-01
Probability and Statistics for Engineers

Problem Set 3

Assigned 2012 September 18
Due 2012 September 25

Show your work on all problems! If you use a computer to assist with numerical computations, turn in your source code as well.

- 1 Devore Chapter 3, Problem 86**
- 2 Devore Chapter 3, Problem 88**
- 3 Devore Chapter 4, Problem 8**
- 4 Devore Chapter 4, Problem 20**
- 5 Computational Exercise (Extra Credit)**

In this problem you simulate an approximate Poisson process and verify that it agrees with the pmf for the Poisson distribution. The scenario is the “beetle problem” described in the notes: a $1000' \times 1000'$ field contains 4.5 million beetles, each located randomly and independent of the others. We divide the field into a million square-foot patches, so that the average number of beetles per patch is $\mu = 4.5$, and randomly distribute the beetles as follows:

- a. Using a random number generator, assign each of the 4.5 million beetles to one of the million patches. (I.e., generate a vector of 4.5 million integers, each randomly and independently chosen to lie between 1 and 1 million.)
- b. Count the number of beetles in each of the 1 million patches, which will give you a vector of 1 million integers. (It’s convenient to use a histogram function if you have one available.)
- c. Now take the vector from part b) and make a histogram from that, giving you a vector containing the number of patches with 0 beetles, 1 beetle, 2 beetles, etc.
- d. Divide the values in the vector from part c) by 1 million to obtain a vector of the relative frequency of x -beetle patches, and plot it on the same set of axes as the Poisson pmf $p(x, 4.5) = \frac{(4.5)^x}{x!} e^{-4.5}$.