Homework 8

MATH 262

due 5:00pm on Wednesday, March 18

Write your solutions to the following problems clearly and neatly. Make sure to explain your reasoning and provide mathematical details that support your answers. For a few tips on writing solutions, see this helpful guide for mathematical writing.

You may write or type your solutions electronically, or write them on paper and scan or photograph them. Either way, make sure your solutions are easy to read, in order, and clearly labeled. Upload a single PDF file containing your solutions to the Homework 8 assignment on Moodle.

Book Problems

- Section 2.6 #102, 105 (pages 122–123)
- Section 2.7 #107, 109, 113, 114, 117, 120 (pages 129–131)

Additional Problems

1. For a certain section of forest, the number X of diseased trees per acre has a Poisson distribution with mean $\mu = 10$. To treat the trees, spraying equipment is rented for \$150. The diseased trees are sprayed with insecticide at a cost of \$5 per tree. Let C be total cost of spraying a randomly selected acre of forest.

   (a) Find the moment generating function of C.

   (b) Find the expected value and standard deviation for C.

   (c) Use Chebyshev's inequality to find an interval that contains C with probability of at least 0.8.

   (d) Using your knowledge about the Poisson distribution, find a smaller interval than what you found in part (c) that still contains C with a probability of at least 0.8. (Note that X has a Poisson distribution, but C does not.)

2. Find the distributions of the random variables that have each of the following moment-generating functions. (*Hint*: refer to Section 2.7.3 in the textbook.) Be sure to state the values of any parameters necessary to specify each distribution.

   (a) $M_X(t) = \left[\frac{1}{3}e^t + \frac{2}{3}\right]^5$

   (b) $M_Y(t) = \frac{2e^t}{3-e^t}$

   (c) $M_Z(t) = e^{3(e^t-1)}$