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1.010 Uncertainty in Engineering  
Fall 2008

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1.010 Fall 2008  
Homework Set #6  
Due October 28, 2008 (in class)

1. A chain has 10 links. The strengths of the links,  $X_1, \dots, X_{10}$  are independent and identically distributed random variables with exponential PDF

$$f_X(x) = e^{-x}, x \geq 0$$

Find and plot the PDF of the strength of the chain  $S = \min\{X_1, X_2, \dots, X_{10}\}$ . Is the distribution of  $S$  also exponential?

2. At a certain location storms arrive as a Poisson point process with rate  $\lambda=70$  storms/year. The rainfall intensity  $I$  of each storm has CDF

$$P[I \leq i] = F_I(i) = 1 - e^{-0.067i}, i \geq 0$$

where  $i$  is in mm/hour. Assuming independence among the storm intensities, find the probability that the yearly maximum rainfall intensity exceeds 100mm/hour. [Read application example 11.]

3.  $U_1$  and  $U_2$  are independent random variables with uniform distribution in  $[0,1]$ . Find the CDF of  $Y = U_1 + U_2$ . Then differentiate  $F_Y(y)$  to find the PDF,  $f_Y(y)$ . [Hint: To find  $F_Y(y)$ , sketch the region  $\Omega_y$  on the  $(U_1, U_2)$  plane where  $Y \leq y$ .]