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1.010 Uncertainty in Engineering  
Fall 2008

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Homework Set #1

1. If the occurrences of earthquakes and high winds are unrelated, and if, at a particular location, the probability of a “high” wind occurring throughout any single minute is  $10^{-5}$  and the probability of a “moderate” earthquake during any single minute is  $10^{-8}$ :

- (a) Find the probability of the joint occurrence of the two events during any minute. Building codes do not require the engineer to design the building for the combined effects of these loads. Is this reasonable?
- (b) Find the probability of the occurrence of one or the other or both during any minute. For rare events, i.e., events with small probabilities of occurrence, the engineer frequently assumes:  $P(A \cup B) \sim P(A) + P(B)$ . Give a comment.
- (c) If the events in successive minutes are mutually independent, what is the probability that there will be no moderate earthquakes in a year near this location? In 10 years?

2. When tossing a fair dice, the probability of each outcome 1,2,3,4,5,6 is the same, and therefore, is  $1/6$ . Let A, B, and C be the events

A: outcome is 1 or 4  
B: outcome is 1,2, or 3  
C: outcome is an even number

Calculate

- (a)  $P[A]$ ,  $P[B]$ ,  $P[C]$
- (b)  $P[A|B]$ ,  $P[A|C]$ ,  $P[C|B]$
- (c)  $P[A|(B \cap C)]$

Are the following statements true or false?

- (d) A is independent of B.
- (e) A is independent of C.
- (f) B is independent of C.
- (g) A is independent of  $(B \cap C)$ .
- (h) (A, B, C) are mutually independent.

3. Read *Application Example 1* – Section 1, and do Problem 1.1.

4. Read *Application Example 2*, and do Problem 2.2.