Massachusetts Institute of Technology

Department of Electrical Engineering & Computer Science

6.041/6.431: Probabilistic Systems Analysis (Fall 2010)

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- 1. See the textbook, Example 1.20, page 37.
- 2. (a) In order to wind up in the same place after two steps, the tightrope walker can either step forwards, then backwards, or vice versa. Therefore the required probability is:

$$2 \cdot p \cdot (1-p)$$
.

(b) The probability that after three steps he will be one step ahead of his starting point is the probability that out of 3 steps in total, 2 of them are forwards, and one is backwards. This equals:

$$3 \cdot p^2 \cdot (1-p).$$

(c) Given that out of his three steps only one is backwards, the sample space for the experiment is:

$$\{(F, F, B); (F, B, F); (B, F, F)\}$$

where F denotes a step forwards, and B a step backwards. Each of these sample points is equally likely, therefore the probability that his first step is a step forward is $\frac{2}{3}$.

- 3. See the textbook, Problem 1.31, page 60.
- 4. (a) A is independent of itself if and only if $\mathbf{P}(A \cap A) = \mathbf{P}(A)\mathbf{P}(A)$. Since $A \cap A = A$ then A must satisfy $\mathbf{P}(A) = (\mathbf{P}(A))^2$. Therefore, A is independent of itself if and only if $\mathbf{P}(A) = 1$ or $\mathbf{P}(A) = 0$.
 - (b) See solution to Problem 1.43(a) in text on pages 63-64.
 - (c) See solution to Problem 1.44 in text on page 64.

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