## Massachusetts Institute of Technology

## Department of Electrical Engineering & Computer Science

## **6.041/6.431:** Probabilistic Systems Analysis (Fall 2010)

## Tutorial 3 September 30/October 1, 2010

- 1. Let X and Y be independent random variables. Random variable X has mean  $\mu_X$  and variance  $\sigma_X^2$ , and random variable Y has mean  $\mu_Y$  and variance  $\sigma_Y^2$ . Let Z = 2X 3Y. Find the mean and variance of Z in terms of the means and variances of X and Y.
- 2. Problem 2.40, page 133 in the text.

  A particular professor is known for his arbitrary grading policies. Each paper receives a grade from the set {A, A-, B+, B, B-, C+}, with equal probability, independently of other papers. How many papers do you expect to hand in before you receive each possible grade at least once?
- 3. The joint PMF of the random variables X and Y is given by the following table:

y = 3	c	c	2c
y = 2	2c	0	4c
y = 1	3c	$\overline{c}$	6c
	x = 1	x = 2	x = 3

- (a) Find the value of the constant c.
- (b) Find  $p_Y(2)$ .
- (c) Consider the random variable  $Z = YX^2$ . Find  $\mathbf{E}[Z \mid Y = 2]$ .
- (d) Conditioned on the event that  $X \neq 2$ , are X and Y independent? Give a one-line justification.
- (e) Find the conditional variance of Y given that X = 2.

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6.041SC Probabilistic Systems Analysis and Applied Probability Fall 2013

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