MATH 10B
Section 211
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Quiz 8

Student:
SID:
Tue 3/19/19

True/False - No explanation needed. (For each: 1 point if correct, 0 points if not answered, -1 points if incorrect)

1. The law of large numbers implies that for a Geometric distribution X with $p > 0$, the probability $P(X = \infty) = 0$. True/False

   False. The law of large numbers only deals with averages, not individual distributions.

2. $E(XY) = E(X)E(Y)$ does not necessarily imply that X and Y are independent. True/False

   True. The converse implication is true but not this direction. For example, take X to be uniformly either -1 or 1. Then take $P(Y|X = 1)$ as 3 with probability 1/3 and 0 otherwise. Then take $P(Y|X = -1) = 1$ with probability 1. Then X and Y satisfy the equation but are not independent.

Problems - Needs justification.

1. I flip a biased coin until I get a heads. If the standard error is 2/3, what is the expected number of tails I receive before I flip a heads? (10 points)

   We have

$$\begin{aligned} \frac{\sqrt{1-p}}{p} &= \frac{2}{3} \\ \frac{1-p}{p^2} &= \frac{4}{9} \\ 4p^2 &= 9 - 9p \\ 4p^2 + 9p - 9 &= 0 \\ p = \frac{-9 \pm \sqrt{81+144}}{2 \cdot 4} &= \frac{3}{4} \text{ or } -13/4 \end{aligned}$$

   so the only reasonable solution is $p = \frac{3}{4}$. The expectation is then

$$E(X) = \frac{1-p}{p} = \frac{\frac{1}{4}}{\frac{3}{4}} = \frac{1}{3}$$