

Name: _____

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ISyE 2027
Test 1

Calculators, notes, and books are not allowed. Put your name on back and front of this sheet. Please stop working when time is up. You may leave terms like $\binom{52}{5}$ and e^{-2} in your answers.

- (30 points) A tick is a small insect. A lone star tick is a particular type of tick. Tick bites sometimes transmit various diseases including Lyme disease and Erlichiosis. What would be a reasonable guess for the distribution of each of the following: (a) The number of tick bites that you receive during May 2012. (b) The number of tick bites that you receive until being bitten by a lone star tick. (c) Out of the next 5 ticks that bite you, whether any of those 5 ticks were infected with Erlichiosis or not.
- (30 points) Suppose the event A has probability $6/10$, the event B has probability $8/10$, and the event AB has probability $5/10$. What is the probability of (a) A^c ? (b) A given B ? (c) AC where $C = A^c$?
- (30 points) Suppose Z has p.m.f.

$$\mathbb{P}\{Z = k\} = \begin{cases} 4/7 & \text{for } k = 0, \\ 3/7 & \text{for } k = 7, \\ 0 & \text{otherwise.} \end{cases}$$

Compute (a) the mean, (b) the variance, and (c) a median of Z .

- (30 points) Suppose X has mean 4 and variance 9. Let $Y = -3X + 6$. (a) What is the mean of Y ? (b) What is the variance of Y ? (c) What is a good (that is, least) upper bound for $\mathbb{P}\{|X - 4| \geq 15\}$?
- (30 points) Suppose X has p.m.f. $\mathbb{P}\{X = k\} = e^{-\lambda}\lambda^k/k!$ for $k = 0, 1, 2, \dots$. What is (a) $\mathbb{E}[X]$, (b) $\mathbb{P}\{X = 0 \mid X \leq 1\}$, (c) $\mathbb{E}[X(X - 1)(X - 2)]$.
- (30 points) Suppose I am tossing markers at the basket. Assume that the results of the tosses are independent and that I am successful on each toss with probability p . Let Y be the number of tosses until the SECOND success, so $Y \geq 2$. Compute (a) $\mathbb{P}\{Y = 2\}$, (b) $\mathbb{P}\{Y = 50\}$, and (c) $\mathbb{E}[Y \mid A]$ where A is the event that I am successful on the first toss.