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ISyE 2027 B
Test 2

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

1. (30 points) What would be a reasonable guess for the distribution of the following quantities?

   (a) The number of train derailments in the U.S. during December 2018.

   (b) The number of cars that enter an intersection until a car turns left.

   (c) The number of eggs that exceed 60 grams in a carton of a dozen eggs.

2. (30 points)

   Suppose we roll a pair of fair dice—one red and one green. Let R be the event that the red die is a 2 and G be the event that the green die is a 2. Let $A = R \cup G$.

   (a) Compute $\mathbb{P}(A)$.

   (b) Compute the probability that both dice are twos given that there is at least one two.

   (c) Compute $\mathbb{P}(R^c A)$.

3. (30 points) Let X have p.d.f. $f(t) = |t|$ for $-1 < t < 1$. Let $F(t)$ be the c.d.f. of X.

   (a) Compute $F(1/2)$.

   (b) Compute $\mathrm{Var}(X)$.

   (c) Compute $\mathbb{P}\{X \leqslant 0 \mid X \leqslant 1/2\}$.

4. (30 points) Tomorrow's demand D for a particular product has a Poisson distribution with mean 3. The product sells for $10.

   (a) What is the probability that tomorrow's demand is 0?

   (b) What is the variance of 10D?

   (c) There are only 2 items in stock. Compute the expected number of items sold. (At most half credit if your answer has an infinite summation.)

5. (30 points) A picker is at the end of an aisle that is 40 meters in length. The picker needs to walk down the aisle to a random location L, pick the item, and return to the starting point. The picker walks at a speed of 2.5 meters per second and takes 4 seconds to pick the item. The high turnover items are stored in the first 10 meters of the aisle; the low turnover items are stored in the rest of the aisle. The high turnover items cause 90% of the activity. Assume that the p.d.f. of L is constant over the region $(0, 10)$ and a possibly different constant over the region $(10, 40)$.

   (a) Let R denote the round trip travel time. Express R as a function of L, the walking speed, and the time needed to pick the item.

   (b) Compute $\mathbb{P}\{L \leqslant 20\}$.

   (c) Compute $\mathbb{E}[L]$.

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