Name _____

Purdue student ID (10 digits) _____

1. The testing booklet contains 5 questions. Dr. Ward will grade them all, but will only use the highest 4 scores. These highest 4 scores will all be weighted evenly (i.e., each question is worth 1/4 of the midterm exam grade).

2. Permitted Texas Instruments calculators:
   BA-35
   BA II Plus*
   BA II Plus Professional Edition*
   TI-30XS MultiView*
   TI-30Xa
   TI-30XIIS*
   TI-30XIIB*
   TI-30XB MultiView*
   *The memory of the calculator should be cleared at the start of the exam.

3. **Circle your final answer in your booklet**; otherwise, no credit may be given.

4. There is no penalty for guessing or partial work.

5. Show all your work in the exam booklet. If the majority of questions are answered correctly, but insufficient work is given, the exam could be considered for academic misconduct.

6. Extra sheets of paper are available from the proctor.

1. Suppose that

$$F_X(x) = \begin{cases} 0 & \text{if } x \leq 3 \\ \frac{x-3}{4} & \text{if } 3 < x < 7 \\ 1 & \text{if } x \geq 7 \end{cases}$$

1a. Find $\mathbb{E}(X)$.

1b. Find $\text{Var}(X)$.

2. Starting on the first Sunday of the semester, Carlos randomly grabs a cookie as he exits the dining court at lunch. Assume that 40% of the cookies are chocolate, and that his picks are independent from day to day.

He does this all semester. Assume that, during the 16 weeks of the semester, he does this exactly 112 times.

Find a good approximation for the probability that he eats 50 or more chocolate cookies during the semester.

3. Suppose that X and Y have joint probability density function $f_{X,Y}(x,y) = 15e^{-5x-3y}$ for $x > 0$ and $y > 0$, and $f_{X,Y}(x,y) = 0$ otherwise. Find $P(Y > X/2)$.

4. Suppose X and Y have joint probability density function

$$f_{X,Y}(x,y) = 70e^{-3x-7y}$$

for $0 < x < y$; and $f_{X,Y}(x,y) = 0$ otherwise.

4a. For $x > 0$, find the density $f_X(x)$ of X.

4b. Find the conditional probability that $Y > 1/4$, given $X = 1/10$, i.e., $P(Y > 1/4 \mid X = 1/10)$.

5. Draw five cards from a deck, *without replacement.* Let X denote the number of cards with pictures of people (Jacks, Queens, and Kings) that appear. Let $X_i = 1$ if the ith card has a picture of a person (Jack, Queen, King), and $X_i = 0$ otherwise.

5a. Find $\mathrm{Cov}(X_1, X_2) = \mathbb{E}(X_1 X_2) - \mathbb{E}(X_1)\mathbb{E}(X_2)$.

5b. Calculate the correlation $\rho(X_1, X_2)$ between the two random variables X_1 and X_2.