1. An urn holds 5 red, 6 blue, and 7 green marbles.
   (a) Let $X$ be the number of blue marbles that result if 3 marbles are drawn one at a time at random without replacement from the urn. Find a formula for $f_X(k)$.
   (b) Let $Y$ be the number of blue marbles that result if 3 marbles are drawn one at a time at random with replacement from the urn. Find a formula for $f_X(k)$.

2. Kitty generates random numbers between 1 and 6 by tossing a fair cubical die.
   Caleb generates random numbers between 1 and 6 by tossing a fair coin five times, counting the heads, and adding 1 to the result.
   Ursula generates random numbers between 1 and 6 by tossing a fair coin three times to generate a binary number with 3 bits ($H = 1, T = 0$). If she gets 000 or 111 she discards the result and tosses the coin 3 more times. Otherwise, she accepts the binary number resulting from the 3 tosses.
   Let $K$, $C$, and $U$ be the random variables describing the outcomes of these 3 random number generators.
   Describe the three probability functions $f_K$, $f_C$, and $f_U$.

3. Let $X$ be a uniform continuous random variable on the interval $[2, 8]$.
   (a) What is $P(X = 4)$?
   (b) What is $P(X \leq 4)$?
   (c) What is $P(4 \leq X \leq 7)$?
   (d) Find a formula for $f_X(x)$.

4. A point $v = (x, y)$ is chosen uniformly at random from the triangular region with vertices at the points $(0, 0)$, $(2, 0)$, and $(2, 5)$. Let $X$ denote the $x$-coordinate of the point $v$. Let $Y$ denote the $y$-coordinate of the point $v$.
   (a) Find a formula for $F_X(x)$.
   (b) Find a formula for $F_X(x)$.
   (c) What is $P(X \geq 1)$?
   (d) What is $P(X \geq Y)$?
   Hint: Draw a picture of the triangle and the regions inside described by each of these events.

Answers:

$\frac{x}{2} = (x \leq \chi_X (p))$

$\frac{y}{5} = (1 \leq \chi_X (q))$

$\frac{x}{7} = (y \leq \chi_Y (q))$

$\frac{x}{7} = (1 \leq x \leq y \mid (y \leq \chi_Y (q))$

$\frac{x}{7} = (y \leq \chi_Y (q))$

$\frac{x}{7} = (p = \chi_x (q))$

$\{0 = (\emptyset) \text{ or otherwise}\}$

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\left\{ \begin{array}{ll}
\frac{x}{7} = (1 \leq \chi_Y (q))
\end{array} \right.
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$a \geq 0, b \geq 0, c \geq 0 \mid \text{ otherwise}\}$