Chapter 4
Continuous Random Variables and Probability Distributions

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Example 1

Suppose the reaction temperature X (in $^\circ$C) in a certain chemical process has a uniform distribution with $A = -5$ and $B = 5$.

- Compute $P(X < 0)$.
- Compute $P(-2.5 < X < 2.5)$.
- Compute $P(-2 \leq X \leq 3)$.

Example 2

A college professor never finishes his lecture before the end of the hour and always finishes his lectures within two minutes after the hour. Let X be the time that elapses between the end of the hour and the end of the lecture. Suppose that the pdf of X is

$$f(x) = \begin{cases} kx^2 & \text{if } 0 \leq x \leq 2 \\ 0 & \text{otherwise} \end{cases}$$

- Find the value of k that makes $f(x)$ a valid pdf.
- What is the probability that the lecture ends within one minute after the end of the hour?

Example 3

The error involved in making a certain measurement is a continuous rv X with pdf

$$f(x) = \begin{cases} 0.09375(4 - x^2) & \text{if } -2 \leq x \leq 2 \\ 0 & \text{otherwise} \end{cases}$$

- Compute $P(X > 0)$.
- Compute $P(-1 < X < 1)$.
- Compute $P(X < -0.5 \text{ or } X > 0.5)$.

Example 4

Let X denote the amount of time a book on two-hour reserve is actually checked out at the library. Suppose the cdf is

$$F(x) = \begin{cases} 0 & \text{if } x < 0 \\ \frac{x^2}{4} & \text{if } 0 \leq x < 2 \\ 1 & \text{if } 2 \leq x \end{cases}$$

Use the cdf to obtain the following:

- $P(X \leq 1)$
- $P(0.5 \leq X \leq 1)$
- $P(X > 1.5)$
- The median checkout duration
- The density function $f(x)$
- $E(X)$
- If the borrower is charged an amount $h(X) = X^2$ when checkout duration is X, compute the expected charge amount.
- $V(X)$ and σ_X