1. *Problem 4.12* The cdf of the random variable X is given by:

$$F_x(x) = \begin{cases} 0 & x < -1 \\ 0.5 & -1 \le x \le 0 \\ (1+x)/2 & 0 \le x \le 1 \\ 1 & x > 1 \end{cases}$$

   (a) Plot the cdf and identify the type of random variable.

   (b) Find $P[X \le -1], P[X = -1], P[X < 0.5], P[-0.5 < X < 0.5], P[x > -1], P[x \le 2], P[x > 3]$.

2. *Problem 4.13* A random variable X has cdf,

$$F_x(x) = \begin{cases} 0 & x < 0 \\ 1 - \frac{1}{4}e^{-2x} & x \ge 0 \end{cases}$$

   (a) Plot the cdf and identify the type of random variable.

   (b) Find $P[X \le 2], P[X = 0], P[X < 0], P[2 < X < 6], P[x > 10]$.

3. *Problem 4.16* A random variable X has cdf,

$$F_x(x) = \begin{cases} 0 & x < 0 \\ 0.5 + c\sin^2(\pi x/2) & 0 \le x \le 1 \\ 1 & x > 1 \end{cases}$$

   (a) What values can c assume?

   (b) Plot the cdf.

   (c) Find $P[X > 0]$.

4. *Problem 4.17* A random variable X has cdf,

$$F_x(x) = \begin{cases} c(1 - x^2) & -1 \le x \le 1 \\ 0 & elsewhere. \end{cases}$$

   (a) Find c and plot the pdf.

   (b) Plot the cdf of X.

   (c) Find $P[X = 0], P[0 < X < 0.5], P[|\, X - 0.5 \,| < 0.25]$.

5. *Problem 4.38* A binary transmission system sends a 0 bit using a -1 voltage signal and a 1 bit by transmitting a $+1$, The received signal is corrupted by noise N that has a Laplacian distribution with parameter α. Assume that 0 bits and 1 bits are equiprobable.

   (a) Find the pdf of the received signal $Y = X + N$, where X is the transmitted signal, given that a 0 was transmitted; that a 1 was transmitted.

   (b) Suppose that the receiver decides a 0 was sent if $Y < 0$, and a 1 was sent if $Y \geq 0$. What is the probability that the receiver makes an error given that a $+1$ was transmitted? a -1 was transmitted?

   (c) What is the overall probability of error?

6. *Problem 4.66* Let X be a Gaussian random variable with mean m and variance σ^2.

   (a) Find $P[X \leq m]$.

   (b) Find $P[|X - m| < k\sigma]$, for $k = 1, 2, \cdots, 6$.

   (c) Find the value of k for which $Q(k) = P[X > m+k\sigma] = 10^{-j}$, for $j = 1, 2, \cdots, 6$.