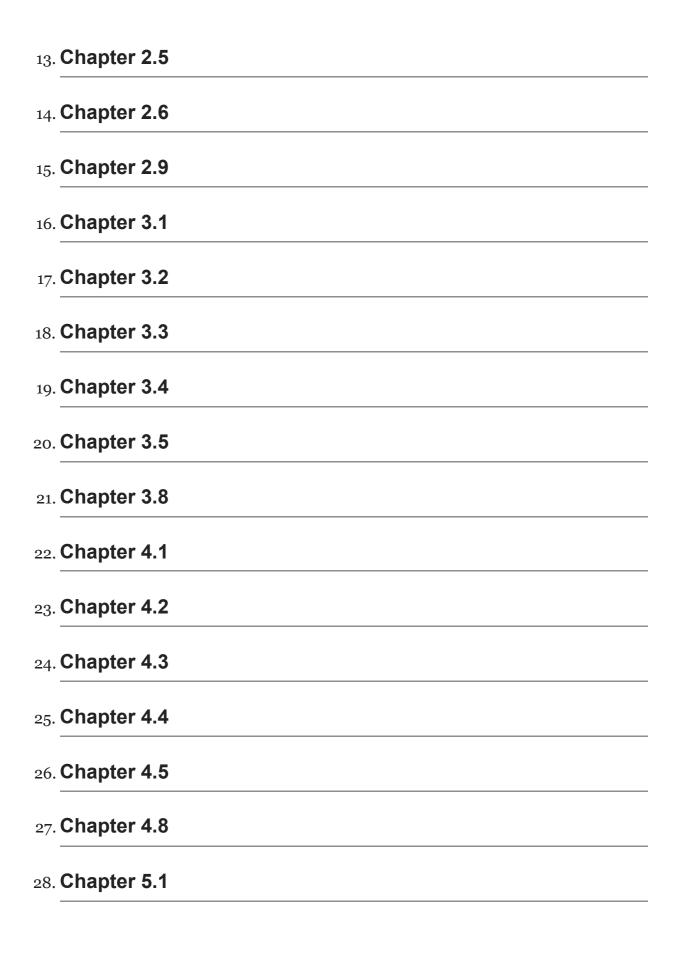
# **Probability And Statistics for Engineers And Scientists** (4th Edition)

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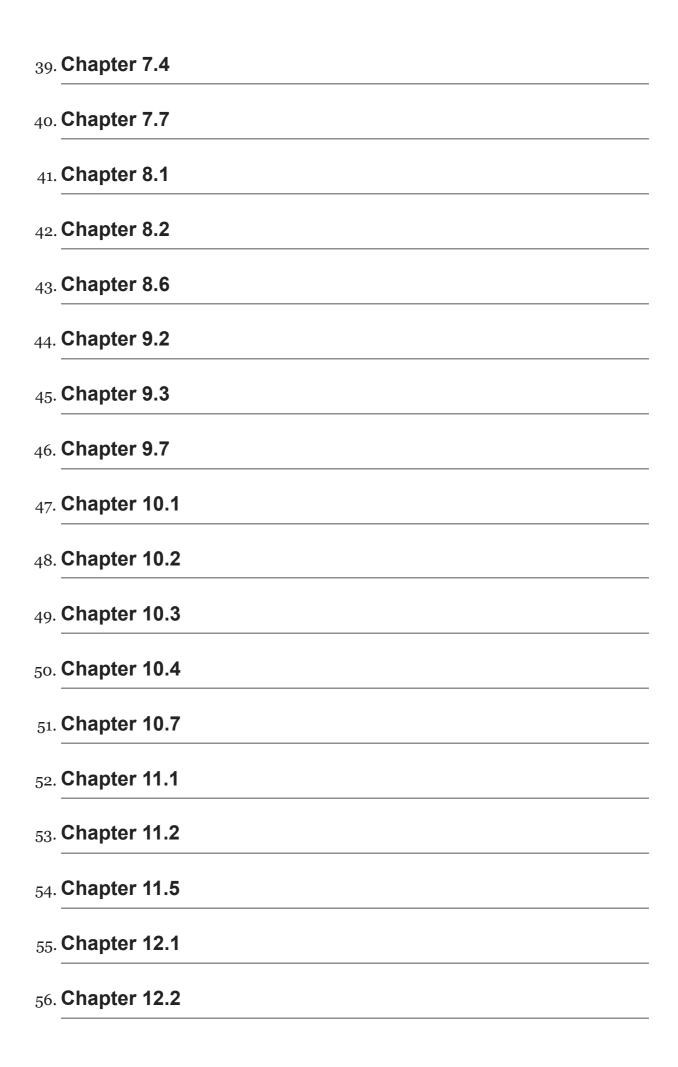
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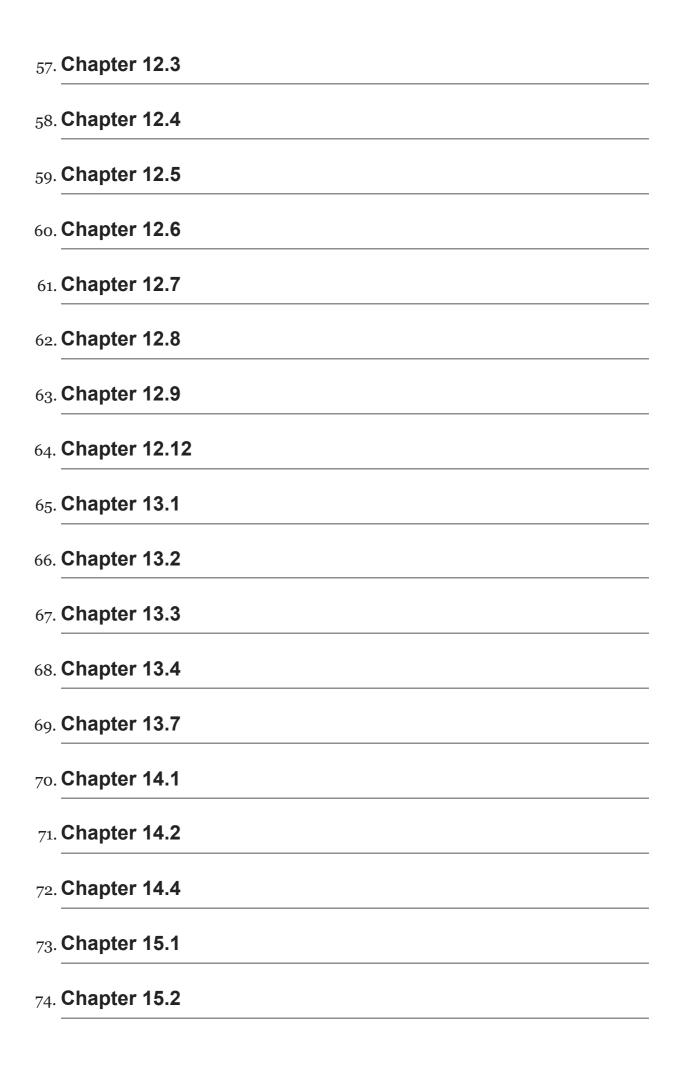
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#### **Problem**

Recall Problem where metal plate thicknesses are normally distributed with a mean of 4.3 mm and a standard deviation of 0.12 mm.

- (a) If one metal plate is placed on top of another, what is the distribution of their combined thickness?
- (b) What is the distribution of the average thickness of 12 metal plates?
- (c) What is the smallest number of metal plates required in order for their average thickness to be between 4.25 and 4.35 mm with a probability of at least 99.7%?

#### Problem

The thicknesses of metal plates made by a particular machine are normally distributed with a mean of 4.3 mm and a standard deviation of 0.12 mm.

- (a) What are the upper and lower quartiles of the metal plate thicknesses?
- (b) What is the value of c for which there is 80% probability that a metal plate has a thickness within the interval [4.3 c, 4.3 + c]?

### **Step-by-step solution**

#### 1. Step 1 of 4

Given information is related to thicknesses of a metal plate.

Let *X* a random variable related to thicknesses of a metal plate.

Given that the random variable X follows normal distribution with mean  $\mu = 4.3$  mm and standard deviation  $\sigma = 0.12$  mm .

#### Comment

#### 2. Step 2 of 4

(a)

Let the random variable X be the distribution of their combined thickness, it is given by

Therefore, the distribution of their combined thickness is.

$$X \sim N\left(\mu_1 + \mu_2, \sigma_1^2 + \sigma_2^2\right)$$
$$X \sim N\left(4.3 + 4.3, 0.12^2 + 0.12^2\right)$$
$$X \sim N\left(8.6, 0.0288\right)$$

**Comment** 

$$X \sim N(8.6, 0.0288)$$

#### 3. Step 3 of 4

(b)

The distribution of the individual thicknesses of metal plate is.

Consequently the average thicknesses of 12 metal plates is distributed as follows:

$$X \sim N(4.3, 0.12^2)$$

Therefore, the distribution of the average thicknesses of 12 metal plates is

#### **Comment**

$$\overline{X} \sim N\left(\mu, \frac{\sigma^2}{n}\right)$$

$$\overline{X} \sim N\left(4.3, \frac{0.12^2}{12}\right)$$

$$\overline{X} \sim N\left(4.3, 0.0012\right)$$

$$\bar{X} \sim N(4.3, 0.0012)$$

#### 4. Step 4 of 4

(c)

Let n be the smallest number of metal plates.

Calculate the value of *n* by using the following notation:

 $n \ge 51$ 

Therefore, the minimum number of metal plates required should be  $n \ge 51$ .

Comments (4)

$$P(4.25 \le \overline{X} \le 4.35) \ge .997$$
  
 $2(Z_{0.0015} \times \sigma) \le 1 - 0.99$   
 $2.9677 \times \frac{0.12}{\sqrt{n}} \le 0.05$   
 $\sqrt{n} \ge \frac{2.9677 \times 0.12}{0.05}$ 

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Recall Problem where metal plate thicknesses are normally distributed with a mean of 4.3 mm and a standard deviation of 0.12...

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### Chapter 5.2, Problem 6P

(a) Suppose that  $X_1 \sim N(\mu_1, \mu_1)$  and  $X_2 \sim N(\mu_2, \mu_2)$  are independently distributed. What is the variance...

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# Chapter 5.2, Problem 7P

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# Chapter 5.2, Problem 5P

A machine part is assembled by fastening two components of type A and three components of type B end to end. The lengths of...

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