2.5-1. An excellent free-throw shooter attempts several free throws until she misses.

(a) If $p = 0.9$ is her probability of making a free throw, what is the probability of having the first miss on the 13th attempt or later?

(b) If she continues shooting until she misses three, what is the probability that the third miss occurs on the 30th attempt?

2.5-3. Suppose that a basketball player different from the ones in Example 2.5-2 and in Exercise 2.5-1 can make a free throw 60% of the time. Let X equal the minimum number of free throws that this player must attempt to make a total of 10 shots.

(a) Give the mean, variance, and standard deviation of X.

(b) Find $P(X = 16)$.

2.1-14. Often in buying a product at a supermarket, there is a concern about the item being underweight. Suppose there are 20 "one-pound" packages of frozen ground turkey on display and 3 of them are underweight. A consumer group buys 5 of the 20 packages at random. What is the probability of at least one of the five being underweight?

3.2-12. Let X equal the number of alpha particle emissions of carbon-14 that are counted by a Geiger counter each second. Assume that the distribution of X is Poisson with mean 16. Let W equal the time in seconds before the seventh count is made.

(a) Give the distribution of W.

3.2-23. Some dental insurance policies cover the insurer only up to a certain amount, say, M. (This seems to us to be a dumb type of insurance policy because most people should want to protect themselves against large losses.) Say the dental expense X is a random variable with pdf $f(x) = (0.001)e^{-x/1000}$, $0 < x < \infty$. Find M so that $P(X < M) = 0.08$.

3.2-2. Telephone calls arrive at a doctor's office according to a Poisson process on the average of two every 3 minutes. Let X denote the waiting time until the first call that arrives after 10 A.M.

(a) What is the pdf of X?

(b) Find $P(X > 2)$.

3.3-5. If X is normally distributed with a mean of 6 and a variance of 25, find

(a) $P(6 \le X \le 12)$. **(b)** $P(0 \le X \le 8)$.

(c) $P(-2 < X \le 0)$. **(d)** $P(X > 21)$.

2.1-10. Suppose there are 3 defective items in a lot (collection) of 50 items. A sample of size 10 is taken at random and without replacement. Let X denote the number of defective items in the sample. Find the probability that the sample contains

(a) Exactly one defective item.

(b) At most one defective item.

2.4-9. Suppose that the percentage of American drivers who are multitaskers (e.g., talk on cell phones, eat a snack, or text message at the same time they are driving) is approximately 80%. In a random sample of $n = 20$ drivers, let X equal the number of multitaskers.

(a) How is X distributed?

(b) Give the values of the mean, variance, and standard deviation of X.

(c) Find the following probabilities: **(i)** $P(X = 15)$, **(ii)** $P(X > 15)$, and **(iii)** $P(X \le 15)$.

3.3-6. If the moment-generating function of X is $M(t) = \exp(166t + 200t^2)$, find

(a) The mean of X. **(b)** The variance of X.

(c) $P(170 < X < 200)$.

3.3-2. If Z is $N(0, 1)$, find

(a) $P(0 \le Z \le 0.87)$. **(b)** $P(-2.64 \le Z \le 0)$.

(c) $P(-2.13 \le Z \le -0.56)$. **(d)** $P(|Z| > 1.39)$.

(e) $P(Z < -1.62)$.

3.2-24. Let the random variable X be equal to the number of days that it takes a high-risk driver to have an accident. Assume that X has an exponential distribution. If $P(X < 50) = 0.25$, compute $P(X > 100 \mid X > 50)$.

2.4-20. **(i)** Give the name of the distribution of X (if it has a name), **(ii)** find the values of μ and σ^2, and **(iii)** calculate $P(1 \le X \le 2)$ when the moment-generating function of X is given by

(a) $M(t) = (0.3 + 0.7e^t)^5$.

(b) $M(t) = \dfrac{0.3e^t}{1 - 0.7e^t}, \qquad t < -\ln(0.7)$.

(c) $M(t) = 0.45 + 0.55e^t$.

(d) $M(t) = \sum_{x=1}^{10} (0.1)e^{tx}$.

2.3-13. For each question on a multiple-choice test, there are five possible answers, of which exactly one is correct. If a student selects answers at random, give the probability that the first question answered correctly is question 4.

2.6-5. Flaws in a certain type of drapery material appear on the average of one in 150 square feet. If we assume a Poisson distribution, find the probability of at most one flaw appearing in 225 square feet.

2.4-4. It is claimed that 15% of the ducks in a particular region have patent schistosome infection. Suppose that seven ducks are selected at random. Let X equal the number of ducks that are infected.

(a) Assuming independence, how is X distributed?

(b) Find **(i)** $P(X \ge 2)$, **(ii)** $P(X = 1)$, and **(iii)** $P(X \le 3)$.

2.3-15. Apples are packaged automatically in 3-pound bags. Suppose that 4% of the time the bag of apples weighs less than 3 pounds. If you select bags randomly and weigh them in order to discover one underweight bag of apples, find the probability that the number of bags that must be selected is

(a) At least 20.

(b) At most 20.

(c) Exactly 20.

2.6-1. Let X have a Poisson distribution with a mean of 4. Find

(a) $P(2 \le X \le 5)$.

(b) $P(X \ge 3)$.

(c) $P(X \le 3)$.

3.1-3. Customers arrive randomly at a bank teller's window. Given that one customer arrived during a particular 10-minute period, let X equal the time within the 10 minutes that the customer arrived. If X is $U(0, 10)$, find

(a) The pdf of X.

(b) $P(X \ge 8)$.

(c) $P(2 \le X < 8)$.

(d) $E(X)$.

(e) $\mathrm{Var}(X)$.

3.2-16. Cars arrive at a toll booth at a mean rate of 5 cars every 50 minutes. Find the following probabilities of waiting for the first customer to arrive.

(a) P(T < 28 min)

(b) P(T > 20 min)

(c) P(15 < T < 22 min)

(d) Now suppose the toll collector is waiting for the 60th customer. Approximate the probability the total weight time is less than 8 hours and 20 min (totals 500 min)

3.3-10. Let $X \sim Normal(\mu = 0.75\ \sigma = 0.25)$ and $Y = e^X$.

(a) Find P(Y < 2.2)

(b) Find P(Y > 2)

(c) Find E(Y) and V(Y)

(d) Find E(X²)

3.3-15. Let $X \sim Beta(\alpha = 2, \beta = 4)$

(a) Find E(X) and V(X)

(b) Find P(X < 0.5)

select **Answers**

** note all normal probabilities s were found with normalcdf()
so z-table answers will be close

2.5-1) a) Prob ≈ 0.2824
b) Prob ≈ 0.0236

2.5-3) a) E(X) ≈ 16.67, V(X) ≈ 11.11
b) Prob ≈ 0.1240

2.1-14) Prob ≈ 0.60

3.2-23) M ≈ 83.38

3.2-2) b) Prob ≈ 0.2636

3.3-5) a) Prob ≈ 0.3849
b) Prob ≈ 0.5404
c) Prob ≈ 0.0603
d) Prob ≈ 0.0013

2.1-10) a) Prob ≈ 0.3980
b) Prob ≈ 0.9020

2.4-9) b) E(X) =16 , V(X) = 3.2
c) i) Prob ≈ 0.1746
ii) Prob ≈ 0.6296
iii) Prob ≈ 0.3704

3.3-2) a) Prob ≈ 0.3078
b) Prob ≈ 0.4959
c) Prob ≈ 0.2712
d) Prob ≈ 0.1645
e) Prob ≈ 0.0526

3.2-24) Prob = 0.75

2.4-20) a) Prob ≈ 0.1607
b) Prob = 0.51
c) Prob ≈ 0.55
d) Prob ≈ 0.2

2.3-13) Prob = 0.1024

2.6-5) Prob ≈ 0.5578

3.2-16) a) Prob ≈ 0.9392
b) Prob ≈ 0.1353
c) Prob ≈ 0.1123
d) Prob ≈ 0.0984

2.4-4) b) i) Prob ≈ 0.2834
ii) Prob ≈ 0.3960
iii) Prob ≈ 0.9879

2.3-15) a) Prob ≈ 0.4604
b) Prob ≈ 0.5580
c) Prob ≈ 0.0184

2.6-1) a) Prob ≈ 0.6936
b) Prob ≈ 0.7619
c) Prob ≈ 0.4335

3.3-10) a) Prob ≈ 0.5611
b) Prob ≈ 0.5899
c) E(X) ≈ 2.1842, V(X) ≈ 0.3077
d) $E(X^2) \approx 5.0784$

3.3-15) a) E(X) ≈ 0.3333, V(X) ≈ 0.0317
b) Prob = 0.8125