

CHAPTER 3 HW

7. For each random variable defined here, describe the set of possible values for the variable, and state whether the variable is discrete.
- X=the number of unbroken eggs in a randomly chosen standard egg carton
 - Y= the number of students on a class list for a particular course who are absent on the first day of classes
 - U=the number of times a duffer has to swing at a golf ball before hitting it
 - X=the length of a randomly selected rattlesnake
 - Z= the sales tax percentage for a randomly selected amazon.com purchase.
 - Y= the pH of a randomly chosen soil sample
 - X= the tension (psi) at which a randomly selected tennis racket has been strung
 - X=the total number of times three tennis players must spin their rackets to obtain something other than UUU or DDD (to determine which two play next)

13. A mail-order computer business has six telephone lines. Let X denote the number of lines in use at a specified time. Suppose the pmf of X is as given in the accompanying table.

x	0	1	2	3	4	5	6
p(x)	0.10	0.15	0.20	0.25	0.20	0.06	0.04

Calculate the probability of each of the following events.

- {at most three lines are in use}
 - {fewer than three lines are in use}
 - {at least three lines are in use}
 - {between two and five lines, inclusive, are in use}
 - {between two and four lines, inclusive, are not in use}
 - {at least four lines are not in use}
23. A branch of a certain bank in New York City has six ATMs. Let X represent the number of machines in use at a particular time of day. The cdf of X is as follows:

$$F(x) = \begin{cases} 0 & x < 0 \\ 0.06 & 0 \leq x < 1 \\ 0.19 & 1 \leq x < 2 \\ 0.39 & 2 \leq x < 3 \\ 0.67 & 3 \leq x < 4 \\ 0.92 & 4 \leq x < 5 \\ 0.97 & 5 \leq x < 6 \\ 1 & 6 \leq x \end{cases}$$

Calculate the following probabilities directly from the cdf:

- P(2), that is, P(x=2)
 - P(X>3)
 - P(2≤X≤5)
 - P(2<X<5)
24. An insurance company offers its policyholders a number of different premium payment options. For a randomly selected policyholder, let of months between successive payments. The cdf of X is as follows:

$$F(x) = \begin{cases} 0 & x < 1 \\ 0.30 & 1 \leq x < 3 \\ 0.40 & 3 \leq x < 4 \\ 0.45 & 4 \leq x < 6 \\ 0.60 & 6 \leq x < 12 \\ 1 & 12 \leq x \end{cases}$$

- a. What is the pmf of X ?
- b. Using just the cdf, compute $P(3 \leq X \leq 6)$ and $P(4 \leq X)$.

29. The pmf of the amount of memory X (GB) in a purchased flash drive was given in Example 3.13 as

x	1	2	4	8	16
$p(x)$	0.05	0.10	0.35	0.40	0.10

Compute the following:

- a. $E(X)$
 - b. $V(X)$ directly from the definition
 - c. The standard deviation of X
 - d. $V(X)$ using the shortcut formula
32. A certain brand of upright freezer is available in three different rated capacities: 16 ft², 18 ft², and 20 ft². Let X =the rated capacity of a freezer of this brand sold at a certain store. Suppose that X has pmf

x	16	18	20
$p(x)$.2	.5	.3

- a. Compute $E(X)$, $E(X^2)$, and $V(X)$
 - b. If the price of a freezer having capacity X is $70X-650$, what is the expected price paid by the next customer to buy a freezer?
 - c. What is the variance of the price paid by the next customer?
 - d. Suppose that although the rated capacity of a freezer is X , the actual capacity is $h(X) = X - 0.008X^2$. What is the expected actual capacity of the freezer purchased by the next customer?
39. A chemical supply company currently has in stock 100 lb of a certain chemical, which it sells to customers in 5-lb batches. Let X =the number of batches ordered by a randomly chosen customer, and suppose that X has pmf

x	1	2	3	4
$p(x)$	0.2	0.4	0.3	0.1

Compute $E(X)$ and $V(X)$. Then compute the expected number of pounds left after the next customer's order is shipped and the variance of the number of pounds left. [Hint: The number of pounds left is a linear function of X .]

47. The article "Should You Report That Fender-Bender?" (Consumer Reports, Sept. 2013:15) reported that 7 in 10 auto accidents involve a single vehicle (the article recommended always reporting to the insurance company an accident involving multiple vehicles). Suppose 15 accidents are randomly selected. Answer the each of the following questions.

- a. What is the probability that at most 4 involve a single vehicle?
- b. What is the probability that exactly 4 involve a single vehicle?
- c. What is the probability that exactly 6 involve multiple vehicles?
- d. What is the probability that between 2 and 4, including, involve a single vehicle?
- e. What is the probability that at least 2 involve a single vehicle?
- f. What is the probability that exactly 4 involve a single vehicle and the other 11 involve multiple vehicles?

49. A company that produces fine crystal knows from experience that 10% of its goblets have cosmetic flaws and must be classified as "seconds."

- a. Among six randomly selected goblets, how likely is it that only one is a second?
- b. Among six randomly selected goblets, what is the probability that at least two are seconds?
- c. If goblets are examined one by one, what is the probability that at most five must be selected to find four that are not seconds?

55. Twenty percent of all telephones of a certain type are submitted for service while under warranty. Of these, 60% can be repaired, whereas the other 40% must be replaced with new units. If a company purchases ten of these telephones, what is the probability that exactly two will end up being replaced under warranty?
69. Each of 12 refrigerators of a certain type has been returned to a distributor because of an audible, high-pitched, oscillating noise when the refrigerators are running. Suppose that 7 of these refrigerators have a defective compressor and the other 5 have less serious problems. If the refrigerators are examined in random order, let X be the number among the first 6 examined that have a defective compressor.
- Calculate $P(X=4)$ and $P(X \leq 4)$
 - Determine the probability that X exceeds its mean value by more than 1 standard deviation.
 - Consider a large shipment of 400 refrigerators, of which 40 have defective compressors. If X is the number among 15 randomly selected refrigerators that have defective compressors, describe a less tedious way to calculate (at least approximately) $P(X \leq 5)$ than to use the hypergeometric pmf.
71. A geologist has collected 10 specimens of basaltic rock and 10 specimens of granite. The geologist instructs a laboratory assistant to randomly select 15 of the specimens for analysis.
- What is the pmf of the number of granite specimens selected for analysis?
 - What is the probability that all specimens of one of the two types of rock are selected for analysis?
 - What is the probability that the number of granite specimens selected for analysis is within 1 standard deviation of its mean value?
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81. Suppose that the number of drivers who travel between a particular origin and destination during a designated time period has a Poisson distribution with parameter $\mu = 20$ (as suggested in the article "Dynamic Ride Sharing: Theory and Practice," J. of Transp. Engr., 1997: 308–312). What is the probability that the number of drivers will
- Be at most 10?
 - Exceed 20?
 - Be between 10 and 20, inclusive? Be strictly between 10 and 20?
 - Be within 2 standard deviations of the mean value?
83. An article in the Los Angeles Times (Dec. 3, 1993) reports that 1 in 200 people carry the defective gene that causes inherited colon cancer. In a sample of 1000 individuals, what is the approximate distribution of the number who carry this gene? Use this distribution to calculate the approximate probability that
- Between 5 and 8 (inclusive) carry the gene.
 - At least 8 carry the gene.
87. The number of requests for assistance received by a towing service is a Poisson process with rate $\alpha=4$ per hour.
- Compute the probability that exactly ten requests are received during a particular 2-hour period.
 - If the operators of the towing service take a 30-min break for lunch, what is the probability that they do not miss any calls for assistance?
 - How many calls would you expect during their break?