

- (a) Fit a binomial distribution to the data. (Round the expected frequencies to one decimal place.)
- (b) Two students, Fran and Bob, were talking before class. All of Fran's seeds had germinated by the seventh day, whereas none of Bob's had. Bob wondered whether he had done something wrong. With the perspective gained from seeing all 280 students' results, what would you say to Bob? (*Hint*: Can the variation among the students be explained by the hypothesis that some

of the seeds were good and some were poor, with each student receiving a randomly chosen five seeds?)

- (c) Invent a fictitious set of data for 280 students, with the same overall percentage germination as the observed data given in the table, but with all the students getting either Fran's results (perfect) or Bob's results (nothing). How would your answer to Bob differ if the actual data had looked like this fictitious data set?

Supplementary Exercises 3.S.1–3.S.12

3.S.1 In the United States, 10% of adolescent girls have iron deficiency.²⁷ Suppose two adolescent girls are chosen at random. Find the probability that

- (a) both girls have iron deficiency.
 (b) one girl has iron deficiency and the other does not.

3.S.2 In preparation for an ecological study of centipedes, the floor of a beech woods is divided into a large number of 1-foot squares.²⁸ At a certain moment, the distribution of centipedes in the squares is as shown in the table.

Number of centipedes	Percent frequency (% of squares)
0	45
1	36
2	14
3	4
4	1
Total	100

Suppose that a square is chosen at random, and let Y be the number of centipedes in the chosen square. Find

- (a) $\Pr\{Y = 1\}$
 (b) $\Pr\{Y \geq 2\}$

3.S.3 Refer to the distribution of centipedes given in Exercise 3.S.2. Suppose five squares are chosen at random. Find the probability that three of the squares contain centipedes and two do not.

3.S.4 Refer to the distribution of centipedes given in Exercise 3.S.2. Suppose five squares are chosen at random. Find the expected value (i.e., the mean) of the number of squares that contain at least one centipede.

3.S.5 Wavy hair in mice is a recessive genetic trait. If mice with wavy hair are mated with straight-haired (heterozygous) mice, each offspring has probability $\frac{1}{2}$ of having wavy hair.²⁹ Consider a large number of such matings, each producing a litter of five offspring. What percentage of the litters will consist of

- (a) two wavy-haired and three straight-haired offspring?

- (b) three or more straight-haired offspring?

- (c) all the same type (either all wavy- or all straight-haired) offspring?

3.S.6 A certain drug causes kidney damage in 1% of patients. Suppose the drug is to be tested on 50 patients. Find the probability that

- (a) none of the patients will experience kidney damage.
 (b) one or more of the patients will experience kidney damage. [*Hint*: Use part (a) to answer part (b).]

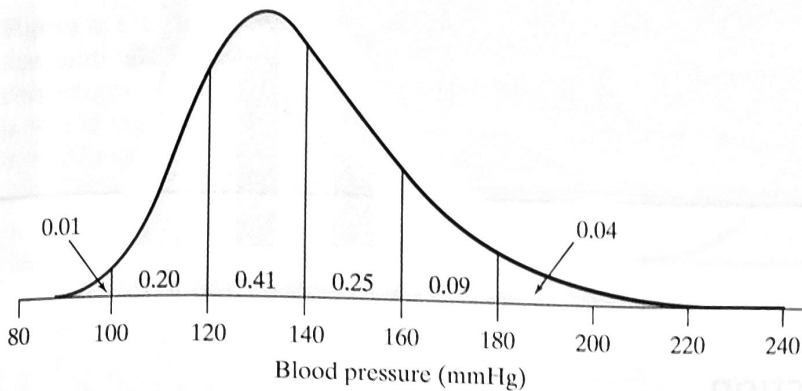
3.S.7 Refer to Exercise 3.S.6. Suppose now that the drug is to be tested on n patients, and let E represent the event that kidney damage occurs in one or more of the patients. The probability $\Pr\{E\}$ is useful in establishing criteria for drug safety.

- (a) Find $\Pr\{E\}$ for $n = 100$.
 (b) How large must n be in order for $\Pr\{E\}$ to exceed 0.95?

3.S.8 To study people's ability to deceive lie detectors, researchers sometimes use the "guilty knowledge" technique.³⁰ Certain subjects memorize six common words; other subjects memorize no words. Each subject is then tested on a polygraph machine (lie detector), as follows. The experimenter reads, in random order, 24 words: the six "critical" words (the memorized list) and, for each critical word, three "control" words with similar or related meanings. If the subject has memorized the six words, he or she tries to conceal that fact. The subject is scored a "failure" on a critical word if his or her electrodermal response is higher on the critical word than on any of the three control words. Thus, on each of the six critical words, even an innocent subject would have a 25% chance of failing. Suppose a subject is labeled "guilty" if the subject fails on four or more of the six critical words. If an innocent subject is tested, what is the probability that he or she will be labeled "guilty"?

3.S.9 The density curve shown here represents the distribution of systolic blood pressures in a population of middle-aged men.³¹ Areas under the curve are shown in the figure. Suppose a man is selected at random from the population, and let Y be his blood pressure. Find

- (a) $\Pr\{120 < Y < 160\}$.
 (b) $\Pr\{Y < 120\}$.
 (c) $\Pr\{Y > 140\}$.



3.5.10 Refer to the blood pressure distribution of Exercise 3.5.9. Suppose four men are selected at random from the population. Find the probability that

- (a) all four have blood pressures higher than 140 mm Hg.
 (b) three have blood pressures higher than 140, and one has blood pressure 140 or less.

3.5.11 In the United States 9% of all people are left-handed.³² If we take a random sample of five Americans what is the probability that

- (a) exactly four are left-handed?

- (b) all five are left-handed?
 (c) at most four are left-handed?

3.5.12 Refer to the information about left-handedness in Exercise 3.5.11. Consider taking repeated samples of 50 Americans.

- (a) What is the mean number of left-handed persons?
 (b) What is the standard deviation of the number of left-handed persons?

