16 people are combined. What is the probability that the combined sample tests positive for gonorrhea? Is it unlikely for such a combined sample to test positive?

Acceptance Sampling. ***Exercises 43 and 44 involve the method of acceptance sampling, whereby a shipment of a large number of items is accepted if tests of a sample of those items result in only one or none that are defective.***

43. Aspirin The Medassist Pharmaceutical Company receives large shipments of aspirin tablets and uses this acceptance sampling plan: Randomly select and test 40 tablets, then accept the whole batch if there is only one or none that doesn't meet the required specifications. If one shipment of 5000 aspirin tablets actually has a 3% rate of defects, what is the probability that this whole shipment will be accepted? Will almost all such shipments be accepted, or will many be rejected?

44. Chocolate Chip Cookies The Killington Market chain uses this acceptance sampling plan for large shipments of packages of its generic chocolate chip cookies: Randomly select 30 packages and determine whether each is within specifications (not too many broken cookies, acceptable taste, distribution of chocolate chips, and so on). The entire shipment is accepted if at most 2 packages do not meet specifications. A shipment contains 1200 packages of chocolate chips, and 2% of those packages do not meet specifications. What is the probability that this whole shipment will be accepted? Will almost all such shipments be accepted, or will many be rejected?

5-3 Beyond the Basics

45. Geometric Distribution If a procedure meets all the conditions of a binomial distribution except that the number of trials is not fixed, then the **geometric distribution** can be used. The probability of getting the first success on the xth trial is given by $P(x) = p(1 - p)^{x-1}$, where p is the probability of success on any one trial. Subjects are randomly selected for the National Health and Nutrition Examination Survey conducted by the National Center for Health Statistics, Centers for Disease Control. Find the probability that the first subject to be a universal blood donor (with group O and type Rh^- blood) is the fifth person selected. The probability that someone is a universal donor is 0.06.

46. Multinomial Distribution The binomial distribution applies only to cases involving two types of outcomes, whereas the **multinomial distribution** involves more than two categories. Suppose we have three types of mutually exclusive outcomes denoted by A, B, and C. Let $P(\text{A}) = p_1$, $P(\text{B}) = p_2$, and $P(\text{C}) = p_3$. In n independent trials, the probability of x_1 outcomes of type A, x_2 outcomes of type B, and x_3 outcomes of type C is given by

$$\frac{n!}{(x_1)!(x_2)!(x_3)!} \cdot p_1^{x_1} \cdot p_2^{x_2} \cdot p_3^{x_3}$$

A roulette wheel in the Hard Rock casino in Las Vegas has 18 red slots, 18 black slots, and 2 green slots. If roulette is played 12 times, find the probability of getting 5 red outcomes, 4 black outcomes, and 3 green outcomes.

47. Hypergeometric Distribution If we sample from a small finite population without replacement, the binomial distribution should not be used because the events are not independent. If sampling is done without replacement and the outcomes belong to one of two types, we can use the **hypergeometric distribution.** If a population has A objects of one type (such as lottery numbers matching the ones you selected), while the remaining B objects are of the other type (such as lottery numbers different from the ones you selected), and if n objects are sampled without replacement (such as six drawn lottery numbers), then the probability of getting x objects of type A and $n - x$ objects of type B is

$$P(x) = \frac{A!}{(A - x)!x!} \cdot \frac{B!}{(B - n + x)!(n - x)!} \div \frac{(A + B)!}{(A + B - n)!n!}$$