Example 1:
Find the probability that 3 out of 8 plants will survive a frost, given that any such plant will survive a frost with probability of 0.30. Also, find the probability that at least one out of 8 will survive a frost. What is the expected value and standard deviation of the number of plants that survive the frost?

Example 2:
If the probabilities of having a male or female offspring are both 0.50, find the probabilities that a family’s fifth child is their first son.

Example 3:
A complex electronic system is built with a certain number of backup components in its subsystem. One subsystem has 4 identical components, each with probability of 0.20 of failing in less than 1000 hours. The subsystem will operate if at least 2 of the 4 components are operating. Assume the components operate independently.
   a. Find the probability that exactly 2 of the 4 components last longer than 1000 hours.
   b. Find the probability that the subsystem operates longer than 1000 hours.

Example 4:
Suppose that 30% of the applicants for a certain industrial job have advanced training in computer programming. Applicants are interviewed sequentially and are selected at random from the pool. Find the probability that the first applicant having advanced training in computer programming is found on the fifth interview.

Example 5:
Refer to the previous exercise: What is the expected number of applicants who need to be interviewed in order to find the first one with advanced training in computer programming?

Example 6:
A missile protection system consists of \( n \) radar sets operating independently, each with probability 0.90 of detecting a missile entering a zone.
   a. If \( n = 5 \) and a missile enters the zone what is the probability that exactly 4 radar sets detect the missile? At least one?
   b. How large must \( n \) be if we require that the probability of detecting a missile that enters the zone be 0.999?

Example 7:
Construct a probability histogram for the binomial probability distribution for each one of the following: \( n = 5, p = 0.1 \), \( n = 5, p = 0.5 \), \( n = 5, p = 0.9 \). What do you observe? Explain.

Example 8:
On a population of consumers, 60% prefer a certain brand of ice cream. If consumers are randomly selected,
   a. what is the probability that exactly 3 people have to be interviewed to encounter the first consumer who prefers this brand of ice cream?
   b. what is the probability that at least 3 people have to be interviewed to encounter the first consumer who prefers this brand of ice cream?
Example 9:
The *alpha* marketing research company employs consumer panels to explore preferences for new products. The current inquiry involves a taste test comparison between a standard brand *A* vanilla ice cream and a new one of reduced sugar. The company recruits panels of five consumers at a time and determines how many of the five prefer the new product. Their objective is to obtain a panel of five in which all five consumers prefer the new product. The actual probability that an individual will prefer the new product is 0.40.

a. What is the probability that all five consumers in a panel will prefer the new product?

b. What is the exact probability that *alpha* will go through 60 panels (each of five people) without finding a single panel of five which unanimously prefer the new product?

Example 10:
The *Southland* produce uses the following scheme to assign a quality ranking to incoming shipments of peaches.

Select four peaches at random.

- If all four peaches are unbruised, then the shipment is classified *A*.
- If three of the four peaches are unbruised, then select an additional four peaches.
  - If all of these additional four peaches are unbruised, then the shipment is classified *A*.
  - If two or more of these additional four peaches are unbruised, then the shipment is classified *B*.
  - If zero or one of these additional four peaches are unbruised, then the shipment is classified *C*.
- If two or fewer of the four peaches are unbruised, then the shipment is classified *C*.

a. If the proportion of unbruised peaches in a shipment is 0.90, find the probability that the shipment will be classified *A*? Assume that the shipment is very large so that the probability of selecting an unbruised peach practically remains constant.

b. What is the probability that the shipment will be classified *C*? Same assumption as in part (a).

Example 11:
A communication system consists of *n* components, each of which will, independently, function with probability 0.40. The total system will be able to operate effectively if at least one-half of its components function.

a. Would you choose a communication system that consists of *n* = 5 components, or a system that consists of *n* = 3 components?

b. Suppose that a complex communication system consists of *n* = 200 components. What is the mean and standard deviation of the number of components that will function?

Example 12:
A jury of 6 persons is to be selected at random from a group of 25 potential jurors, of whom 12 are black and 13 are white.

a. What is the probability that the majority of the 6 jurors selected will be black (at least 4 black jurors)?

b. What is the probability that among the 6 jurors selected exactly 3 are black?

c. What is the probability that among the 6 jurors selected no more than 3 will be white?

Example 13:
Use the California State Super Lotto Plus to compute the probability of:

a. Winning the 4th prize (match 4 of 5 but not the mega).

b. Winning the 7th prize (match 2 of 5 and the mega).