(1) In a gambling game a person draws a single card from an ordinary 52-card playing deck. A person is paid \$15 for drawing a jack or a queen and \$5 for drawing a king or an ace. A person who draws any other card pays \$4. If a person plays this game, what is the expected gain?

(2) Approximately 10% of the glass bottles coming off a production line have serious flaws in the glass. If two bottles are randomly selected, find the mean and variance of the number of bottles that have serious flaws.

(3) Suppose that we survey 20 individuals working for a large company and ask each whether they favor implementation of a new policy regarding retirement funding.

  (a) If, in our sample, 6 favored the new policy, find an estimate for $p$, the true but unknown proportion of employees that favor the new policy.

  (b) We stop interviewing when we find the first person who likes the policy. If the fifth person interviewed is the first one who favors the new policy, find an estimate for $p$, the true but unknown proportion of employees who favor the new policy.

(4) A jury of 6 persons was selected from a group of 20 potential jurors, of whom 8 were African American and 12 were white. The jury was supposedly randomly selected, but it contained only 1 African American member. Do you have any reason to doubt the randomness of the selection? If the selection process were really random, what would be the mean and variance of the number of African American members selected for the jury?

(5) Suppose that 30% of the applicants for a certain industrial job possess advanced training in computer programming. Applicants are interviewed sequentially and are selected at random from the pool. Find the probability that the first applicant with advanced training in programming is found on the fifth interview. What is the expected number of applicants who need to be interviewed in order to find the first one with advanced training?

(6) Given that we have already tossed a balanced coin ten times and obtained zero heads, what is the probability that we must toss it at least two more times to obtain the first head?

(7) A certified public accountant (CPA) has found that nine of ten company audits contain substantial errors. If the CPA audits a series of company accounts, what is the probability that the first account containing substantial errors

  (a) is the third one to be audited?
  (b) will occur on or after the third audited account?
  (c) What are the mean and standard deviation of the number of accounts that must be examined to find the first one with substantial errors?

(8) How many times would you expect to toss a balanced coin in order to obtain the first head?

(9) An oil prospector drills holes until he finds a productive well. The probability that he is successful on a given trial is .2. How many holes would the prospector expect to drill? Interpret your answer intuitively.

(10) A new secretary has been given $n$ computer passwords. Exactly one of the passwords permits access to a computer file. Suppose now that the secretary selects a password, tries it, and – if it does not work – puts it back in with the other passwords before randomly selecting the next password to try (not a very clever secretary!). What is the probability that the correct password is found on the sixth try? Find the mean and the variance of $Y$, the number of the trial on which the correct password is first identified.

(11) A large stockpile of used pumps contains 20% that are in need of repair. A maintenance worker is sent to the stockpile with three repair kits. She selects pumps at random and tests them one at a time. If the pump works, she sets it aside for future use. However, if the pump does not work, she uses one of her repair kits on it. Suppose that it takes 10 minutes to test a pump that is in working condition and 30 minutes to test and repair a pump that does not work. Find the mean and variance of the total time it takes the maintenance worker to use her three repair kits.

(12) Ten percent of the engines manufactured on an assembly line are defective. If engines are randomly selected one at a time and tested, what is the probability that the first non-defective engine will be found on the second trial? What is the probability that the third non-defective engine will be found

  (a) on the fifth trial?
  (b) on or before the fifth trial?

  Find the mean and variance of the number of the trial on which

  (a) the first non-defective engine is found.
  (b) the third non-defective engine is found.