

1. Suppose that the probability that a duck hunter will successfully hit a duck is 0.40 on any given shot. Suppose also that the outcome of each shot is independent from the others.
 - a) What is the probability that the first successful hit would be on the fourth shot?
 - b) What is the probability that it would take at least six shots to hit a duck for the first time?
 - c) What is the probability that the first successful hit would happen during an even-numbered shot?
 - d) What is the probability that the third successful hit would be on the ninth shot?
 - e) What is the probability that the hunter would have three successful hits in nine shots?
 - f) What is the probability that the hunter would have at least six successful hits in nine shots?

2. According to a *CNN/USA Today* poll, approximately 70% of Americans believe the IRS abuses its power. Let X denote the number of people who believe the IRS abuses its power in a random sample of $n = 50$ Americans. Assuming that the poll results are still valid, use a computer to find the probability that ...
 - a) X is at most 32.
 - b) X is equal to 34.
 - c) X is at least 36.

Hint: EXCEL: =BINOMDIST($k, n, p, 0$) =BINOMDIST($k, n, p, 1$)
 R: > dbinom(k, n, p) > pbinom(k, n, p)
 gives P($X = k$) P($X \leq k$)

3. **2.4-11** **2.4-11** 2.4-13

A random variable X has a binomial distribution with mean 6 and variance 3.6.
Find $P(X = 4)$.

4. Alex sells “*Exciting World of Statistics*” videos over the phone to earn some extra cash during the economic crisis. Only 10% of all calls result in a sale. Assume that the outcome of each call is independent of the others.

- a) What is the probability that Alex makes his first sale on the fifth call?
- b) What is the probability that Alex makes his first sale on an odd-numbered call?
- c) What is the probability that it takes Alex at least 10 calls to make his first sale?
- d) What is the probability that it takes Alex at most 6 calls to make his first sale?
- e) What is the probability that Alex makes his second sale on the ninth call?
- f)* What is the probability that Alex makes his second sale on an odd-numbered call?

Hint: Consider $[\text{Answer}] - 0.9^2 \times [\text{Answer}]$.
On one side, you will have $0.19 \times [\text{Answer}]$.
On the other side, you will have a geometric series.

- g) What is the probability that Alex makes his third sale on the 13th call?
- h) If Alex makes 15 calls, what is the probability that he makes exactly 3 sales?
- i) If Alex makes 15 calls, what is the probability that he makes at least 2 sales?
- j) If Alex makes 15 calls, what is the probability that he makes at most 2 sales?

5. A grocery store has 10 loaves of bread on its shelves, of which 7 are fresh and 3 are stale. Customers buy 4 loaves selecting them at random.

- a) Find the probability that 3 are fresh and 1 is stale.
- b) Find the probability that 2 are fresh and 2 are stale.
- c) Find the probability that at least 2 loaves are fresh.

6. According to news reports in early 1995, among the first Pentium chips Intel made, some had a peculiar defect, which rendered some rarely carried-out arithmetic operations incorrect. Any chip could therefore be classified into one of three categories: Good, Broken (useless), or Defective (operable except for the peculiar defect described above). Suppose that 70% of the chips made were good, 25% had a peculiar defect, and 5% were broken. If a random sample of 20 chips was selected, what is the probability that 15 were good, 3 defective, and 2 broken?

7. a) **2.6-2** **2.6-2** ~~2.6-2~~

Let X have a Poisson distribution with variance of 3. Find $P(X = 2)$.

b) **2.6-4** **2.6-4** ~~2.6-4~~

If X has a Poisson distribution such that $3P(X = 1) = P(X = 2)$, find $P(X = 4)$.

8. Suppose the number of air bubbles in window glass has Poisson distribution, with an average of 0.3 air bubbles per square foot. Find the probability of finding in a 4' by 3' window ...

a) ... exactly 5 air bubbles.

b) ... at least 5 air bubbles.

9. **2.6-8** **2.6-8** ~~2.6-8~~

Suppose that the probability of suffering a side effect from a certain flu vaccine is 0.005. If 1000 persons are inoculated, find the approximate probability that

a) At most 1 person suffers.

(use Poisson approximation)

b) 4, 5, or 6 persons suffer.

- 10.** Urbana-Champaign Academics (UCV) is a semi-professional hockey team. Suppose that score goals according to a Poisson process with the average rate of 1 goal per 8 minutes. A hockey game consists of 3 periods, each lasting 20 minutes.
- a) Find the probability that UCV would score exactly 6 goals in one game.
 - b) Find the probability that UCV would score exactly 2 goals in each period in one game.
 - c) Find the probability that UCV would score exactly 2 goals in exactly 2 periods in one game.
 - d) Find the probability that UCV would score at least 1 goal in each period in one game.
 - e) Find the probability that UCV would fail to score a goal in exactly 1 period in one game.
 - f) Find the probability that UCV would score at most 4 goals in one game.
- 11.** The number of typos made by a student follows Poisson distribution with the rate of 1.5 typos per page. Assume that the numbers of typos on different pages are independent.
- a) Find the probability that there are at most 2 typos on a page.
 - b) Find the probability that there are exactly 10 typos in a 5-page paper.
 - c) Find the probability that there are exactly 2 typos on each page in a 5-page paper.
 - d) Find the probability that there is at least one page with no typos in a 5-page paper.
 - e) Find the probability that there are exactly two pages with no typos in a 5-page paper.