

Show all of your work. Please staple. Problems denoted with (a.i.b.) mean the answers are in the back of the book: be sure to show your work for full credit.

1. Baron 4.24. (a.i.b.) note: It may help to first translate the total time of 20 minutes into an average time per file, and then ask the probability the sample mean time is less than this average.
2. Baron 4.23.
3. Baron 4.28.
4. based on Baron 5.7(a):

In this problem we will estimate the probability that a Geometric($p = .2$) random variable is greater than or equal to a Geometric($p = .1$) random variable.

Let $X \sim \text{Geometric}(p = .2)$ and $Y \sim \text{Geometric}(p = .1)$.

- (a) Get an estimate for $P(X \geq Y)$ to three decimals using a simulation study. See the R code posted (**hw6prob4.R**) with this assignment for information how to run this simulation in R and for general tutorial information. R is a free statistical computing software, and you should install R first by visiting <http://cran.r-project.org/>. R is also available at most university terminal computers.
- (b) Get an exact answer for $P(X \geq Y)$ by using the law of total probability and the cumulative probability function for the geometric distribution. Hint:

$$P(X \geq Y) = \sum_{k=1}^{\infty} P(X \geq Y | Y = k)P(Y = k) \equiv \sum_{k=1}^{\infty} P(X \geq k)P_Y(k),$$

using the positive integers as a partition for Y .

5. This problem is an extension of what we did in class Friday.

Suppose that a rabbit is trying to get to its home in the field. There are three places the rabbit can be: the field, the park, or the road. The rabbit starts in the park. Estimate the probability that the rabbit finds home before finding a car's tire.

A rabbit in the field will find its home with probability .40, and will otherwise return to the park.

A rabbit in the park will find its way to the field with probability .80, and will go on the road with probability .20.

A rabbit on the road will successfully get back to the park with probability .50. Otherwise, ...not a good ending for the bunny.

Using the provided code **hw6prob5.R** (you must insert the correct probabilities), run a simulation of 1,000 rabbits. How many will find their way to their home?

(We will learn how to solve this problem in Chapter 6.)

6. Draw 100,000 random values from the sum of 12 Uniform(0,1) values minus 6.

That is, let $U_i \sim \text{Uniform}(0,1)$ random variables, for $i = 1, 2, \dots, 12$, and let $X = U_1 + U_2 + \dots + U_{12} - 6$ such that $E(X) = 0$ and $\text{Var}(X) = 1$ and the shape of X is approximately normal.

What proportion were less than ...

- (a) -3 ?
- (b) -2 ?
- (c) -1 ?

(d) 0?

(e) 1?

(f) 2?

(g) 3?

How do these differ from the true probabilities $P(Z < z)$ for each of these cases?

See the posted R code (`hw6prob6.R`) with the assignment for assistance in doing this simulation.