10. How many 5-digit numbers can be formed from the integers $1, 2, \ldots, 9$ if no digit can appear more than twice? (For instance, 41434 is not allowed.)

3. A deck of cards is dealt out. What is the probability that the 14th card dealt is an ace? What is the probability that the first ace occurs on the 14th card?

3.11. A type C battery is in working condition with probability .7, whereas a type D battery is in working condition with probability .4. A battery is randomly chosen from a bin consisting of 8 type C and 6 type D batteries.

(a) What is the probability that the battery works?

(b) Given that the battery does not work, what is the conditional probability that it was a type C battery?

4.19. When three friends go for coffee, they decide who will pay the check by each flipping a coin and then letting the "odd person" pay. If all three flips produce the same result (so that there is no odd person), then they make a second round of flips, and they continue to do so until there is an odd person. What is the probability that

(a) exactly 3 rounds of flips are made?

(b) more than 4 rounds are needed?

5.4. The random variable X has the probability density function

$$f(x) = \begin{cases} ax + bx^2 & 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$$

If $E[X] = .6$, find (a) $P\{X < \frac{1}{2}\}$ and (b) $\mathrm{Var}(X)$.

6.8. Consider two components and three types of shocks. A type 1 shock causes component 1 to fail, a type 2 shock causes component 2 to fail, and a type 3 shock causes both components 1 and 2 to fail. The times until shocks 1, 2, and 3 occur are independent exponential random variables with respective rates λ_1, λ_2, and λ_3. Let X_i denote the time at which component i fails, $i = 1, 2$. The random variables X_1, X_2 are said to have a joint bivariate exponential distribution. Find $P\{X_1 > s, X_2 > t\}$.

7.4. If a die is to be rolled until all sides have appeared at least once, find the expected number of times that outcome 1 appears.

8.7. The servicing of a machine requires two separate steps, with the time needed for the first step being an exponential random variable with mean .2 hour and the time for the second step being an independent exponential random variable with mean .3 hour. If a repair person has 20 machines to service, approximate the probability that all the work can be completed in 8 hours.