Chapter, section and problem numbers refer to the 3rd edition of the Ghahramani textbook.

1. Let $X$ be a random variable with $E[X] = a$ and $E[X(X-1)] = a(a-1)$, for some constant $a > 0$. Show that $X = a$ with probability 1.

2. We have two biased coins. When coin 1 is flipped, it lands on heads with probability 0.4, when coin 2 is flipped it lands on heads with probability 0.7. One of these coins is randomly picked and flipped 10 times.

   (a) What is the probability that exactly 7 of the 10 flips land on heads?
   (b) Given that the first of these 10 flips lands heads, what is the conditional probability that exactly 7 of the 10 flips land on heads?

3. Suppose that 100 numbers are picked at random, with replacement, from the two-element set $\{−1, 1\}$. Assume that the numbers are picked independently of each other.

   (a) What is the probability that the sum of the 100 numbers is zero?
   (b) Find the expected value and standard deviation of the sum of the 100 numbers. 
      [Hint: let $S$ be the sum of the 100 numbers, and let $X$ be the number of 1’s picked. 
       Express $S$ in terms of $X$, and then find its expected value and standard deviation.]

4. Section 5.3, # 4

5. Section 5.3, # 20

6. Section 5.2, #12

7. Section 5.2, #15