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

1. Section 3.1, # 2.

2. Which of the following statements is true? If a statement is true, prove it. If it is false, give a counterexample.
   
   (a) If $B$ is an event such that $P(B) > 0$, then $P(A|B) + P(A^c|B) = 1$ for any event $A$.
   
   (b) If $A$ and $B$ are events such that $P(A) = P(B)$, then $P(A|C) = P(B|C)$ for any event $C$ with $P(C) > 0$.
   
   (c) If $A$, $B$ and $C$ are events such that $P(A|C) = P(B|C)$, then $P(A) = P(B)$.

3. A number $x$ is selected at random from the interval $[-1, 1]$. Let $B$ be the event $\{|x - 0.5| < 1\}$ and let $C$ be the event $\{x > 0.75\}$. Find $P(B|C)$ and $P(C|B)$.

4. If two fair dice are rolled, what is the conditional probability that the first one lands on 6 given that the sum of the dice is $i$? Compute for all the possible values of $i$.

5. An urn initially contains 5 white and 7 black balls. Each time a ball is selected at random, its color is noted and it is replaced into the urn along with 2 other balls of the same color. Compute the probability that the first 2 balls selected are black and the next 2 are white.

6. In a town, 7/9th of the adult men and 3/5th of the adult women are married. We know that all married adults are the residents of the town. Use the law of total probability to calculate the probability that a randomly chosen adult is married.

7. A student applied for a teaching assistant (TA) job for which she needs a letter of recommendation from her department head. She estimates that there is an 80% chance that she gets the job if the letter is very strong, a 40% chance if the letter is good, and a 10% chance if the letter is weak. She estimates that the chances of getting a strong, good, or weak letter are 70%, 20%, and 10%, respectively.
   
   (a) What is the student’s best estimate of the probability that she will get the TA job?
   
   (b) Assuming she does receive the job, how likely it is (in her estimate) that the letter was strong? How likely is it that the letter was weak?