1. (2.85) The probability that a doctor correctly diagnoses a particular illness is $0.7 = P(C)$. Given that the doctor makes an incorrect diagnosis, the probability that the patient files a lawsuit is $0.9 = P(L \mid C')$. What is the probability that the doctor makes an incorrect diagnosis and the patient sues $P(S)$?

$$P(S) = P(C' \cap L) = P(L \mid C')P(C') = (0.9)(0.3) = \boxed{0.27}$$

2. (2.89) A town has two fire engines operating independently. The probability that a specific engine is available when needed is 0.96.

   (a) What is the probability that neither is available when needed?

$$P(U) = P(A' \cap B') = (0.04)(0.04) = \boxed{0.0016}$$

   (b) What is the probability that a fire engine is available when needed?

$$P(U') = 1 - 0.0016 = \boxed{0.9984}$$

3. (2.109) A large industrial firm uses three local motels to provide overnight accommodations for its clients. From past experience it is known that 20% of the clients are assigned rooms at the Ramada Inn, 50% at the Sheraton, and 30% at the Lakeview Motor Lodge. If the plumbing is faulty in 5% of the rooms at the Ramada Inn, in 4% of the rooms at the Sheraton, and in 8% of the rooms at the Lakeview Motor Lodge, what is the probability that

$$P(R) = 0.2, P(F_r) = 0.05, P(F_r \cap R) = 0.01$$
$$P(S) = 0.5, P(F_s) = 0.04, P(F_s \cap S) = 0.02$$
$$P(L) = 0.3, P(F_l) = 0.08, P(F_l \cap L) = 0.024$$

   (a) a client will be assigned a room with faulty plumbing?

$$P(F) = 0.01 + 0.02 + 0.024 = \boxed{0.054}$$

   (b) a person with a room having faulty plumbing was assigned accommodations at the Lakeview Motor Lodge?

$$P(L \mid F) = \frac{P(F_l \cap L)}{P(F)} = \frac{0.024}{0.54} = \boxed{\frac{4}{9}}$$

4. (2.113) From a box containing 6 black balls and 4 green balls, 3 balls are drawn in succession, each ball being replaced in the box before the next draw is made. What is the probability that

$$P(B_i) = \frac{6}{10}, \quad P(G_i) = \frac{4}{10}$$

   (a) all 3 are the same color?

$$P(A) = P\left((B_1 \cap B_2 \cap B_3) \cup (G_1 \cap G_2 \cap G_3)\right) = 0.6^3 + 0.4^3 = \boxed{0.28}$$

   (b) each color is represented?

$$P(A') = 1 - 0.28 = \boxed{0.72}$$

5. (3.1) Classify the following random variables as discrete or continuous:

   X: the number of automobile accidents per year in Virginia.

   - **discrete**

   Y: the length of time to play 18 holes of golf.

   - **continuous**

   M: the amount of milk produced yearly by a particular cow.

   - **continuous**

   N: the number of eggs laid each month by a hen.

   - **discrete**

   P: the number of building permits issued each month in a certain city.

   - **discrete**

   Q: the weight of grain produced per acre.

   - **continuous**

6. (3.3) Let W be a random variable giving the number of heads minus the number of tails in three tosses of a coin. List the elements of the sample space S for the three tosses of the coin and to each sample point assign a value w of W.

$$S = \{HHH, HHT, HTH, THH, TTH, THT, TTH, TTT\}$$
$$W = [3, 1, 1, 1, -1, -1, -1, -3]$$
$$S_i \to W_i$$

7. (3.35) Suppose it is known from large amounts of historical data that X, the number of cars that arrive at a specific intersection during a 20 second time period, is characterized by the following discrete probability function:

$$f(x) = e^{-6}\frac{6^x}{x!}, \forall x \geq 0 \in \mathbb{Z}$$

(a) Find the probability that in a specific 20 second time period, more than 8 cars arrive at the intersection.

$$P(x \leq 8) = \sum_{x=0}^{8} e^{-6}\frac{6^x}{x!} = 0.847$$
$$P(x > 8) = 1 - P(x \leq 8) = \boxed{0.153}$$

(b) Find the probability that only 2 cars arrive.

$$f(2) = e^{-6}\frac{6^2}{2!} = \boxed{0.045}$$