# Problem 2.1.7

A machine produces photo detectors in pairs. Tests show that the first photo detector is acceptable with probability 3/5. When the first photo detector is acceptable, the second photo detector is acceptable with probability 4/5. If the first photo detector is defective, the second photo detector is acceptable with probability 2/5.

(a) Find the probability that exactly one photo detector of a pair is acceptable.

(b) Find the probability that both photo detectors in a pair are defective.

# Problem 2.1.10

Suppose Dagwood (Blondie's husband) wants to eat a sandwich but needs to go on a diet. Dagwood decides to let the flip of a coin determine whether he eats. Using an unbiased coin, Dagwood will postpone the diet (and go directly to the refrigerator) if either (a) he flips heads on his first flip or (b) he flips tails on the first flip but then proceeds to get two heads out of the next three flips. Note that the first flip is *not* counted in the attempt to win two of three and that Dagwood never performs any unnecessary flips. Let $H_i$ be the event that Dagwood flips heads on try $i$. Let $T_i$ be the event that tails occurs on flip $i$.

(a) Draw the tree for this experiment. Label the probabilities of all outcomes.

(b) What are $\mathrm{P}[H_3]$ and $\mathrm{P}[T_3]$?

(c) Let $D$ be the event that Dagwood must diet. What is $\mathrm{P}[D]$? What is $\mathrm{P}[H_1|D]$?

(d) Are $H_3$ and $H_2$ independent events?

# Problem 2.2.12

An instant lottery ticket consists of a collection of boxes covered with gray wax. For a subset of the boxes, the gray wax hides a special mark. If a player scratches off the correct number of the marked boxes (and no boxes without the mark), then that ticket is a winner. Design an instant lottery game in which a player scratches five boxes and the probability that a ticket is a winner is approximately 0.01.

# Problem 2.3.3

Suppose each day that you drive to work a traffic light that you encounter is either green with probability 7/16, red with probability 7/16, or yellow with probability 1/8, independent of the status of the light on any other day. If over the course of five days, $G$, $Y$, and $R$ denote the number of times the light is found to be green, yellow, or red, respectively, what is the probability that $\mathrm{P}[G = 2, Y = 1, R = 2]$? Also, what is the probability $\mathrm{P}[G = R]$?

# Problem 2.3.5

A collection of field goal kickers are divided into groups 1 and 2. Group $i$ has $3i$ kickers. On any kick, a kicker from group $i$ will kick a field goal with probability $1/(i+1)$, independent of the outcome of any other kicks.

(a) A kicker is selected at random from among all the kickers and attempts one field goal. Let $K$ be the event that a field goal is kicked. Find $\mathrm{P}[K]$.

(b) Two kickers are selected at random; $K_j$ is the event that kicker $j$ kicks a field goal. Are $K_1$ and $K_2$ independent?

(c) A kicker is selected at random and attempts 10 field goals. Let $M$ be the number of misses. Find $\mathrm{P}[M = 5]$.