3.2.3

First experiment is Male or Female, second is whether disease is inherited (Yes or No). Four outcomes:
MY has probability 0.513(0.5)=0.2565
MN has probability 0.513(0.5)=0.2565
FY has probability 0.487(0.0)=0.0
FN has probability 0.487(1.0)=0.487

The probability that a randomly chosen child will inherit the disease is Pr{Y}=Pr{MY or FY}=0.2565+0.0=0.2565.

3.2.4

First experiment is whether she knows the answer to a question (Y or N), second experiment is whether she gets the problem right (R or W). Four outcomes:
YR has probability 0.4(1.0)=0.4
YW has probability 0.4(0.0)=0.0
NR has probability 0.6(0.2)=0.12
NW has probability 0.6(0.8)=0.48

The probability of getting the problem right is Pr{R}=Pr{YR or NR}=0.4+0.12=0.52.

3.2.5(a)

Let P or N be whether a woman is pregnant and + and - be test positive and test negative. Four outcomes:
P+ with prob. 0.1(0.98)=0.098
P- with prob. 0.1(0.02)=0.002
N+ with prob. 0.9(0.01)=0.009
N- with prob. 0.9(0.99)=0.891

Probability of testing positive is PR{+}=Pr{P+ or N+}=0.098+0.009=0.107.

3.2.7

Let D or N be diseased or not and + and – be the result of the test
D+ has probability 0.1(0.92)=0.092
D- has probability 0.1(0.08)=0.008
N+ has probability 0.9(0.06)=0.054
N- has probability 0.9(0.94)=0.846

Pr{+}=Pr{D+ or N+}=0.092+0.054=0.146
Pr{D|+}=Pr{D+}/Pr{+}=0.092/0.146=0.63 (this uses definition of conditional probability)

3.3.1

(a) Pr{smoke}=1213/6549=0.185
(b) Pr{smoke|high income}=247/2115=0.117
(c) Smoking and income are not independent. Knowing someone's income changes their probability of smoking, 0.185 not equal to 0.117.

3.3.2

(a) Pr{low income and smokes}=634/6549=0.097
(b) Pr{not low income}=(1954+2115)/6549=0.621
(c) Pr{medium income}=1954/6549=0.298
(d) Pr={low or medium income}=(2480+1954)/6549=0.677

3.4.2

(a) $\Pr\{D<10\}=1-0.07=0.93$
(b) $\Pr\{D>4\}=0.33+0.25+0.12+0.07=0.77$
(c) $\Pr\{2<D<8\}=0.20+0.33+0.25=0.78$

Interesting question: what is the median tree diameter? It is between 4 and 6, but we don't know for sure.

3.5.4

(a) $\Pr\{Y\geq 2\}=\Pr\{Y=2\}+\Pr\{Y=3\}=0.189+0.027=0.216$
(b) $\Pr\{Y\leq 2\}=0.189+0.441+0.343=0.973$

3.5.5

0(0.343)+1(0.441)+2(0.189)+3(0.027)=0.9 flies. That is, μ_Y=0.9 flies.

3.6.1

3 yellow to 1 green mans that the probability of yellow is 0.75. Let Y ~ binomial(4, 0.75).

(a) Pr{Y=3}=0.422 from dbinom(3,4,0.75)
(b) Pr{Y=4}=0.316 from dbinom(4,4,0.75)
(c) Pr{Y=0 or Y=4}=PrY=0}+Pr{Y=4}=0.320 from dbinom(0,4,0.75)+dbinom(4,4,0.75)

3.6.2

Let Y ~ binomial(4,0.42)

(a) Pr{Y=0}=0.113 from dbinom(0,4,0.42)
(b) Pr{Y=1}=0.328 from dbinom(1,4,0.42)
(c) Pr{Y=2}=0.356 from dbinom(2,4,0.42)
(d) $\Pr\{0\leq Y\leq 2\}=\Pr\{Y=0\}+\Pr\{Y=1\}+\Pr\{Y=2\}=0.113+0.328+0.356=0.797$
(e) $\Pr\{0<Y\leq 2\}=\Pr\{Y=1\}+\Pr\{Y=2\}=0.328+0.356=0.684$