1. **a.** $\Pr(E) = 0.3 + 0.2 = 0.5$

b. $\Pr(F) = 0.2 + 0.4 = 0.6$

c. $\Pr(E|F) = \dfrac{0.2}{0.6} = 0.3333$

d. $\Pr(F|E) = \dfrac{0.2}{0.5} = 0.4$

2. **a.** $\Pr(E) = \frac{1}{3} + \frac{1}{6} = \frac{1}{2}$

b. $\Pr(F) = \frac{1}{6} + \frac{1}{2} = \frac{2}{3}$

c. $\Pr(E|F)=\frac{\frac{1}{6}}{\frac{2}{3}}=\frac{1}{4}$

d. $\Pr(F|E)=\frac{\frac{1}{6}}{\frac{1}{2}}=\frac{1}{3}$

3. a. $\Pr(E|F)=\frac{0.1}{0.4}=\frac{1}{4}$

b. $\Pr(F|E)=\frac{0.1}{0.5}=\frac{1}{5}$

c. $\Pr(E|F')=\frac{0.4}{0.6}=\frac{2}{3}$

d. $\Pr(E'|F')=\frac{0.2}{0.6}=\frac{1}{3}$

4. a. $\Pr(E|F)=\frac{0.2}{0.3}=\frac{2}{3}$

b. $\Pr(F|E)=\frac{0.2}{0.6}=\frac{1}{3}$

c. $\Pr(E|F')=\frac{0.4}{0.7}=\frac{4}{7}$

d. $\Pr(E'|F')=\frac{0.3}{0.7}=\frac{3}{7}$

5. a. $\Pr(E\cap F)=\frac{1}{3}+\frac{5}{12}-\frac{2}{3}=\frac{1}{12}$

b. $\Pr(E|F)=\frac{\frac{1}{12}}{\frac{5}{12}}=\frac{1}{5}$

c. $\Pr(F|E)=\frac{\frac{1}{12}}{\frac{1}{3}}=\frac{1}{4}$

6. a. $\Pr(E\cap F)=\frac{1}{2}+\frac{1}{3}-\frac{7}{12}=\frac{3}{12}=\frac{1}{4}$

b. $\Pr(E|F)=\frac{\frac{1}{4}}{\frac{1}{3}}=\frac{3}{4}$

c. $\Pr(F|E)=\frac{\frac{1}{4}}{\frac{1}{2}}=\frac{1}{2}$

7. a. $\Pr(F\mid E)=\frac{\Pr(E\cap F)}{\Pr(E)}$

$0.25=\frac{\Pr(E\cap F)}{0.4}$

$\Pr(E\cap F)=0.1$

b. $\Pr(E\cup F)=0.4+0.3-0.1=0.6$

c. $\Pr(E|F)=\frac{0.1}{0.3}=\frac{1}{3}$

d. $\Pr(E'\cap F)=0.3-0.1=0.2$

8. a. $\Pr(F\mid E)=\frac{\Pr(E\cap F)}{\Pr(E)}$

$0.4=\frac{\Pr(E\cap F)}{0.5}$

$\Pr(E\cap F)=0.2$

b. $\Pr(E\cup F)=0.5+0.3-0.2=0.6$

c. $\Pr(E|F)=\frac{0.2}{0.3}=\frac{2}{3}$

d. $\Pr(E\cap F')=0.5-0.2=0.3$

9. $\Pr(8\mid \text{not } 7)=\frac{\Pr(8\cap \text{not } 7)}{\Pr(\text{not } 7)}$

$\Pr(8\mid \text{not } 7)=\frac{\frac{5}{36}}{\frac{30}{36}}$

$\Pr(8\mid \text{not } 7)=\frac{5}{30}=\frac{1}{6}$

10. $\Pr(8\mid \text{one } 3)=\frac{2}{5+5}=\frac{2}{10}=\frac{1}{5}=0.2$

11. 0; because exactly one coin shows heads therefore there are two tails.

12. 0; because exactly one coin shows tails

13. $\frac{\text{[number of outcomes that four are white]}}{\text{[number of outcomes that at least 1 is white]}}$

$$\frac{C(7,4)}{C(12,4)-C(5,4)}=\frac{35}{495-5}$$
$$=\frac{35}{490}$$
$$=\frac{1}{14}\approx 0.0714$$

14. $$\frac{[\text{number of outcomes that two are white}]}{[\text{number of outcomes that at least 1 is white}]}$$
$$=\frac{C(2,\ 2)}{C(5,\ 2)-C(3,2)}$$
$$=\frac{1}{10-3}$$
$$=\frac{1}{7}\approx 0.1429$$

15. $\Pr(\text{both girls}|\text{first girl})=\frac{1}{2}$

16. $\Pr(\text{both girls}|\text{at least one girl})=\frac{1}{3}$

17. $$\Pr(\text{grad}\,|\,\text{more \$45,000})=\frac{\Pr(\text{grad and }>45000)}{\Pr(>45000)}$$
$$=\frac{0.10}{0.25}$$
$$=\frac{2}{5}=0.4$$

18. $$\Pr(\text{masters}\,|\,\text{female})=\frac{\Pr(\text{masters and female})}{\Pr(\text{female})}$$
$$=\frac{.40}{.60}$$
$$=\frac{2}{3}$$

19. **a.** $\Pr(\text{Masters})=\frac{851}{2898}\approx 0.2937$

b. $\Pr(\text{Male})=\frac{1201}{2898}\approx 0.4144$

c. $\Pr(\text{Female}|\text{Masters})=\frac{522}{851}\approx 0.6134$

d. $\Pr(\text{Doctors}|\text{Female})=\frac{93}{1697}\approx 0.0548$

20. **a.** $\Pr(\text{Voted})=\frac{92.2}{185.3}\approx 0.4976$

b. $\Pr(\text{Male})=\frac{88.5}{185.3}\approx 0.4776$

c. $\Pr(\text{Female}|\text{Voted})=\frac{49.2}{92.2}\approx 0.5336$

d. $\Pr(\text{Voted}|\text{Male})=\frac{43.0}{88.5}\approx 0.4859$

21. **a.** $\Pr(\text{Officer})=\frac{228.6}{1291.8}\approx 0.1770$

b. $\Pr(\text{Marine})=\frac{183.2}{1291.8}\approx 0.1418$

c. $\Pr(\text{Officer and Marine})=\frac{20.7}{1291.8}\approx 0.0160$

d. $\Pr(\text{Officer}|\text{Marine})=\frac{20.7}{183.2}\approx 0.1130$

e. $\Pr(\text{Marine}|\text{Officer})=\frac{20.7}{228.6}\approx 0.0906$

22. **a.** $\Pr(\text{Business})=\frac{362}{2500}=0.1448$

b. $\Pr(\text{Female})=\frac{1000}{2500}=0.4$

c. $\Pr(\text{Female and Business})=\frac{102}{2500}=0.0408$

d. $\Pr(\text{Male}|\text{Social Studies})=\frac{122}{252}\approx 0.4841$

e. $\Pr(\text{Social Studies}|\text{Female})=\frac{130}{1000}=0.13$

23. $\Pr(\$5|\$5)=\frac{\frac{1}{3}}{\frac{1}{2}}=\frac{2}{3}$

24. $\Pr(\text{Gold}|\text{Gold})=\frac{\frac{1}{3}}{\frac{1}{2}}=\frac{2}{3}$

25. $\frac{4}{52}\cdot\frac{3}{51}=\frac{12}{2652}=\frac{1}{221}\approx 0.004525$

26. $\frac{13}{52}\cdot\frac{12}{51}=\frac{156}{2652}=\frac{1}{17}\approx 0.05882$