3.10: Chapter 3 Solutions

1.

1. $P(L') = P(S)$
2. $P(M \cup S)$
3. $P(F \cap L)$
4. $P(M|L)$
5. $P(L|M)$
6. $P(S|F)$
7. $P(F|L)$
8. $P(F \cup L)$
9. $P(M \cap S)$
10. $P(F)$

3. $P(N) = \frac{15}{42} = \frac{5}{14} = 0.36$

5. $P(C) = \frac{5}{42} = 0.12$

7. $P(G) = \frac{20}{150} = \frac{2}{15} = 0.13$

9. $P(R) = \frac{22}{150} = \frac{11}{75} = 0.15$

11. $P(O) = \frac{150-22-38-20-28-26}{150} = \frac{16}{150} = \frac{8}{75} = 0.11$

13. $P(E) = \frac{47}{194} = 0.24$

15. $P(N) = \frac{23}{194} = 0.12$

17. $P(S) = \frac{12}{194} = \frac{6}{97} = 0.06$

19. $\frac{13}{52} = \frac{1}{4} = 0.25$

21. $\frac{3}{6} = \frac{1}{2} = 0.5$

23. $P(R) = \frac{4}{8} = 0.5$

25. $P(O \cup H)$

27. $P(H|I)$

29. $P(N|O)$

31. $P(I \cup N)$

33. $P(I)$

35. The likelihood that an event will occur given that another event has already occurred.

37. 1

39. the probability of landing on an even number or a multiple of three

41. $P(J) = 0.3$

43. $P(Q \cap R) = P(Q)P(R)$

$0.1 = (0.4)P(R)$

$P(R) = 0.25$

45. 0.376

47. $C|L$ means, given the person chosen is a Latino Californian, the person is a registered voter who prefers life in prison without parole for a person convicted of first degree murder.

49. $L \cap C$ is the event that the person chosen is a Latino California registered voter who prefers life without parole over the death penalty for a person convicted of first degree murder.

51. 0.6492

53. No, because $P(L \cap C)$ does not equal 0.

55. $P(\text{musician is a male} \cap \text{had private instruction}) = \frac{15}{130} = \frac{3}{26} = 0.12$.

57. The events are not mutually exclusive. It is possible to be a female musician who learned music in school.

58.

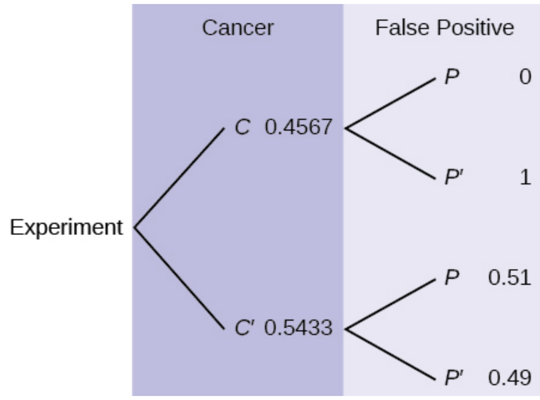

Figure $3.10.1$

60. $\frac{35{,}065}{100{,}450}$

62. To pick one person from the study who is Japanese American AND smokes 21 to 30 cigarettes per day means that the person has to meet both criteria: both Japanese American and smokes 21 to 30 cigarettes. The sample space should include everyone in the study. The probability is $\frac{4{,}715}{100{,}450}$.

64. To pick one person from the study who is Japanese American given that person smokes 21-30 cigarettes per day, means that the person must fulfill both criteria and the sample space is reduced to those who smoke 21-30 cigarettes per day. The probability is $\frac{4715}{15{,}273}$.

66.

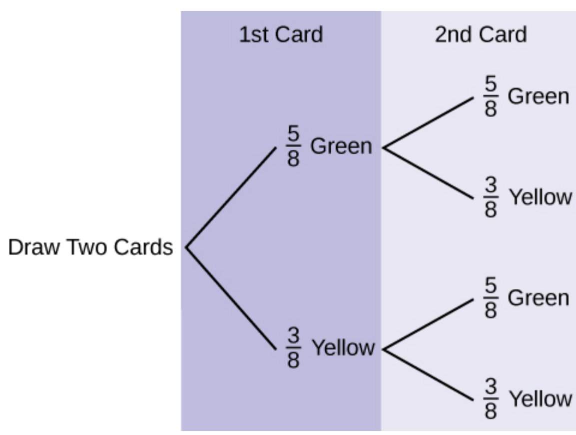

Figure $3.10.2$

1. $P(GG) = \left(\frac{5}{8}\right)\left(\frac{5}{8}\right) = \frac{25}{64}$
2. $P(\text{at least one green}) = P(GG) + P(GY) + P(YG) = \frac{25}{64} + \frac{15}{64} + \frac{15}{64} = \frac{55}{64}$
3. $P(G|G) = \frac{5}{8}$
4. Yes, they are independent because the first card is placed back in the bag before the second card is drawn; the composition of cards in the bag remains the same from draw one to draw two.

68.

	<20>	20–64	>64	Totals
Female	" class="lt-biz-79015">0.0244	0.3954	64" class="lt-biz-79015">0.0661	0.486
Male	" class="lt-biz-79015">0.0259	0.4186	64" class="lt-biz-79015">0.0695	0.514
Totals	" class="lt-biz-79015">0.0503	0.8140	64" class="lt-biz-79015">0.1356	1

Table $3.10.1$

1. $P(F) = 0.486$
2. $P(> 64|F) = 0.1361$
3. $P(> 64 \text{ and } F) = P(F) * P(> 64|F) = (0.486) * (0.1361) = 0.0661$
4. $P(> 64|F)$ is the percentage of female drivers who are 65 or older and $P(> 64 \cap F)$ is the percentage of drivers who are female and 65 or older.
5. $P(> 64) = P(> 64 \cap F) + P(> 64 \cap M) = 0.1356$
6. No, being female and 65 or older are not mutually exclusive because they can occur at the same time $P(> 64 \cap F) = 0.0661$.

70.

	Car, truck or van	Walk	Public transportation	Other	Totals
Alone	0.7318				
Not alone	0.1332				
Totals	0.8650	0.0390	0.0530	0.0430	1

Table $3.10.2$

1. If we assume that all walkers are alone and that none from the other two groups travel alone (which is a big assumption) we have: $P(\text{Alone}) = 0.7318 + 0.0390 = 0.7708$
2. Make the same assumptions as in (b) we have: $(0.7708)(1,000) = 771$
3. $(0.1332)(1,000) = 133$

73.

1. You can't calculate the joint probability knowing the probability of both events occurring, which is not in the information given. The probabilities should be multiplied, not added, and probability is never greater than 100%.
2. A home run by definition is a successful hit, so he has to have at least as many successful hits as home runs.

75. 0

77. 0.3571

79. 0.2142

81. Physician (83.7)

83. $83.7 - 79.6 = 4.1$

85. $P(\text{Occupation} < 81.3) = 0.5$

87.

1. The Forum Research surveyed 1,046 Torontonians.
2. 58%
3. 42% of 1,046 = 439 (rounding to the nearest integer)
4. 0.57
5. 0.60.

89.

1. $P(\text{Betting on two line that touch each other on the table}) = \frac{6}{38}$.
2. $P(\text{Betting on three numbers in a line}) = \frac{3}{38}$
3. $P(\text{Betting on one number}) = \frac{1}{38}$
4. $P(\text{Betting on four number that touch each other to form a square}) = \frac{4}{38}$.
5. $P(\text{Betting on two number that touch each other on the table}) = \frac{2}{38}$
6. $P(\text{Betting on } 0 - 00 - 1 - 2 - 3) = \frac{5}{38}$
7. $P(\text{Betting on } 0 - 1 - 2;\text{ or } 0 - 00 - 2;\text{ or } 00 - 2 - 3) = \frac{3}{38}$

91.

1. $\{G1, G2, G3, G4, G5, Y1, Y2, Y3\}$
2. $\frac{5}{8}$
3. $\frac{2}{3}$
4. $\frac{2}{8}$
5. $\frac{6}{8}$
6. No, because $P(G \cap E)$ does not equal 0.

93. Note: The coin toss is independent of the card picked first.

1. $\{(G,H)(G,T)(B,H)(B,T)(R,H)(R,T)\}$
2. $P(A) = P(\text{blue})P(\text{head}) = \left(\frac{3}{10}\right)\left(\frac{1}{2}\right) = \frac{3}{20}$
3. Yes, *A* and *B* are mutually exclusive because they cannot happen at the same time; you cannot pick a card that is both blue and also (red or green). $P(A \cap B) = 0$
4. No, *A* and *C* are not mutually exclusive because they can occur at the same time. In fact, *C* includes all of the outcomes of *A*. If the card chosen is blue, it is also (red or blue). $P(A \cap C) = P(A) = \frac{3}{20}$.

95.

1. $S = \{(HHH), (HHT), (HTH), (HTT), (THH), (THT), (TTH), (TTT)\}$
2. $\frac{4}{8}$
3. Yes, because if *A* has occurred, it is impossible to obtain two tails. In other words, $P(A \cap B) = 0$.

97.

1. If *Y* and *Z* are independent, then $P(Y \cap Z) = P(Y)P(Z)$, so $P(Y \cup Z) = P(Y) + P(Z) - P(Y)P(Z)$.
2. 0.5

99. iii; i; iv; ii

101.

1. $P(R) = 0.44$
2. $P(R|E) = 0.56$
3. $P(R|O) = 0.31$
4. No, whether the money is returned is not independent of which class the money was placed in. There are several ways to justify this mathematically, but one is that the money placed in economics classes is not returned at the same overall rate, $P(R|E) \neq P(R)$.
5. No, this study definitely does not support that notion; in fact, it suggests the opposite. The money placed in the economics classrooms was returned at a higher rate than the money place in all classes collectively, $P(R|E) > P(R)$.

103.

1. $P(\text{ type O} \cup \text{Rh}-) = P(\text{ type O}) + P(\text{Rh}-) - P(\text{ type O} \cap \text{Rh}-)$

   $0.52 = 0.43 + 0.15 - P(\text{ type } O \cap \text{Rh}-)$; solve to find $P(\text{ type O} \cap \text{Rh}-) = 0.06$

   6% of people have type O, Rh- blood
2. $P(\text{ NOT (type O } \cap \text{Rh}-)) = 1 - P(\text{ type O} \cap \text{Rh}-) = 1 - 0.06 = 0.94$

94% of people do not have type O, Rh- blood

105.

1. Let C = be the event that the cookie contains chocolate. Let N = the event that the cookie contains nuts.
2. $P(C \cup N)=P(C)+P(N)-P(C \cap N)=0.36+0.12-0.08=0.40$
3. $P(\text{NEITHER chocolate NOR nuts})=1-P(C \cup N)=1-0.40=0.60$

107. 0

109. $\frac{10}{67}$

111. $\frac{10}{34}$

113. d

115.

Race and sex	1–14	15–24	25–64	Over 64	TOTALS
White, male	210	3,360	13,610	4,870	22,050
White, female	80	580	3,380	890	4,930
Black, male	10	460	1,060	140	1,670
Black, female	0	40	270	20	330
All others				100	
TOTALS	310	4,650	18,780	6,020	29,760

Table $3.10.3$

Race and sex	1–14	15–24	25–64	Over 64	TOTALS
White, male	210	3,360	13,610	4,870	22,050
White, female	80	580	3,380	890	4,930
Black, male	10	460	1,060	140	1,670
Black, female	0	40	270	20	330
All others	10	210	460	100	780
TOTALS	310	4,650	18,780	6,020	29,760

Table $3.10.4$

1. $\frac{22{,}050}{29{,}760}$
2. $\frac{330}{29{,}760}$
3. $\frac{2{,}000}{29{,}760}$
4. $\frac{23{,}720}{29{,}760}$
5. $\frac{5{,}010}{6{,}020}$

117. b

119.

1. $\frac{26}{106}$
2. $\frac{33}{106}$
3. $\frac{21}{106}$
4. $\left(\frac{26}{106}\right)+\left(\frac{33}{106}\right)-\left(\frac{21}{106}\right)=\left(\frac{38}{106}\right)$

5. $\frac{21}{33}$

121. a