Section 12.2

1.) {HHH, HHT, HTH, THH, HTT, THT, TTH, TTT}

2.) {11, 12, 13, 14, 15, 16, 21, 22, 23, 24, 25, 26, 31, 32, 33, 34, 35, 36, 41, 42, 43, 44, 45, 46, 51, 52, 53, 54, 55, 56, 61, 62, 63, 64, 65, 66}

3.) {{1,2}, {1,3}, {1,4}, {1,5}, {2,3}, {2,4}, {2,5}, {3,4}, {3,5}, {4,5}}

4.) {{1,2,3,4,5}, {1,2,3,4,6}, {1,2,3,5,6}, {1,2,4,5,6}, {1,3,4,5,6}, {2,3,4,5,6}}

5.) a.) $A \cup B = \{1,2,3,5\}$
b.) $A \cap B = \{1,3\}$

6.) a.) $A^c = \{2,4,6\}$

b.) $(A^c)^c = \{2,4,6\}^c = \{1,3,5\} = A$

7.) $(A \cup B)^c = \{1,2,3,5\}^c = \{4,6\}$

8.) $A \cap B = \{1,3\} \neq \emptyset$, so A and B are not disjoint

9.) $P(1) + P(2) + P(3) + P(4) + P(5) = 1 \longrightarrow$

$P(5) = 1 - P(1) - P(2) - P(3) - P(4)$
$= 1 - 0.1 - 0.2 - 0.05 - 0.05$
$= 1 - 0.4 = 0.6$

10.) a.) $P(A) = P(1) + P(3) + P(5)$
$= 0.1 + 0.05 + 0.6 = 0.75$
b.) $P(B) = P(2) + P(3) + P(4)$
$= 0.2 + 0.05 + 0.05 = 0.3$

11.) $P(A^c) = 1 - P(A) = 1 - 0.75 = 0.25$

12.) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
$= 0.75 + 0.3 - P\{3\}$
$= 0.75 + 0.3 - 0.05$
$= 1$

17.) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ and
$P(A^c \cap B^c) = P((A \cup B)^c) = 1 - P(A \cup B) \rightarrow$
$P(A \cup B) = 1 - P(A^c \cap B^c)$; then $(5 \cup B)$
$1 - P(A^c \cap B^c) = P(A) + P(B) - P(A \cap B) \rightarrow$
$1 - 0.2 = 0.4 + P(B) - 0.1 \rightarrow$
$P(B) = 1 - 0.2 - 0.3 = 0.5$

18.) See formulas in 13.). Then
$P(A \cap B) = P(A) + P(B) - P(A \cup B) \rightarrow$
$P(A \cap B) = 0.4 + 0.4 - 0.7 = 0.1$;

$P(A^c \cap B^c) = 1 - P(A \cup B) = 1 - 0.7 = 0.3$

21.) Sample Space: $\{HH, HT, TH, TT\} \rightarrow$
$P(\text{at least 1 H}) = \frac{3}{4}$

22.) Sample Space:
$\{HHH, HHT, HTH, THH, HTT, THT, TTH, TTT\} \rightarrow$
$P(\text{no H's}) = \frac{1}{8}$

25.) $\underset{1st}{6} \cdot \underset{2nd}{6} = 36$ outcomes possible

Let A: 4 on 1st roll
B: 4 on 2nd roll then
$P(\text{at least one 4}) = P(A \cup B)$
$= P(A) + P(B) - P(A \cap B)$
$= \frac{1}{6} + \frac{1}{6} - \frac{1}{36} = \frac{12}{36} - \frac{1}{36} = \frac{11}{36}$

26.) $\underset{1st}{6} \cdot \underset{2nd}{6} = 36$ outcomes possible;

both even: $\underset{1ST}{3} \cdot \underset{2nd}{3} = 9$ ways,

both odd: $\underset{1ST}{3} \cdot \underset{2nd}{3} = 9$ ways, so

$P(\text{sum is even: both even or both odd})$
$= \frac{9+9}{36} = \frac{18}{36} = \frac{1}{2}$

27.) Sample Space : 36 outcomes, and let A : event that 1st # > 2nd # ; then

$A = \{65, 64, 63, 62, 61, 54, 53, 52, 51, 43, 42, 41, 32, 31, 21\} \rightarrow$

$P(A) = \frac{15}{36} = \frac{5}{12}$

28.) Sample Space : 36 outcomes, and let A : event that each # is > 4 ; then

$A = \{55, 56, 65, 66\} \rightarrow$

$P(A) = \frac{4}{36} = \frac{1}{9}$

29.) (See p. 801) $P(\text{white}) = P(cc) = \frac{1}{4}$

30.) (See p. 801)

a.)

	C	c
c	Cc	cc
c	Cc	cc

b.) $P(\text{red}) = P(Cc) = \frac{2}{4} = \frac{1}{2}$

31.)

	A	a
A	AA	Aa
a	Aa	aa

$P(Aa) = \frac{2}{4} = \frac{1}{2}$

32.)

	A	A
A	AA	AA
a	Aa	Aa

$P(AA) = \frac{2}{4} = \frac{1}{2}$

33.) Sample Space:
{GGG, GGB, GBG, BGG, GBB, BGB, BBG, BBB}
P(3 girls) = 1/8

36.) Female X(b1) X

Male	X	X(b1)X	XX
	Y	X(b1)Y	XY

XX: normal female
X(b1)X: normal female
XY: normal male
X(b1)Y: color blind male

P(colorblind male) = $\frac{1}{4}$

40.) Sample Space: 5B, 3G balls;
pick 3 at random, ~~then~~
P(at least 2G) = P(2G) + P(3G)

$$= \frac{C(3,2)\cdot C(5,1)}{C(8,3)} + \frac{C(3,3)}{C(8,3)} = \frac{3\cdot 5}{56} + \frac{1}{56} = \frac{16}{56} = \frac{2}{7}$$

Select 2 cards:

41.) $P(\text{2 spades}) = \frac{C(13,2)}{C(52,2)} = \frac{78}{1326} = \frac{1}{17}$

42.) Select 5 cards:

$$P(\text{4 aces}) = \frac{C(4,4)\cdot C(48,1)}{C(52,5)}$$

$$= \frac{1\cdot 48}{2,598,960} = \frac{1}{54,145}$$

43.) Sample Space: {4G, 6B, 2R}, pick 3 at random, then

$$P(1G, 1B, 1R) = \frac{C(4,1)\cdot C(6,1)\cdot C(2,1)}{C(12,3)}$$

$$= \frac{4\cdot 6\cdot 2}{220} = \frac{12}{55}$$

44.) Sample Space: {3G, 5B, 4R}, pick 3 at random, then:

$$P(3G) = \frac{C(3,3)}{C(12,3)} = \frac{1}{220},$$

$$P(3B) = \frac{C(5,3)}{C(12,3)} = \frac{10}{220} = \frac{1}{22},$$

$$P(3R) = \frac{C(4,3)}{C(12,3)} = \frac{4}{220} = \frac{1}{55}.$$

$$P(\text{3 same color}) = \frac{4}{455} + \frac{20}{455} + \frac{10}{455}$$

$$= \frac{34}{455}$$

45.) Select 4 cards:

$$P(\text{at least 1 A}) = 1 - P(\text{no A})$$

$$= 1 - \frac{C(48,4)}{C(52,4)} = 1 - \frac{194,580}{270,725} \approx 0.281$$

46.) Select 4 cards:

$$\underbrace{C(13,1)}_{\text{pick face value}} \cdot \underbrace{C(4,2)}_{\text{pick the pair}} \cdot \underbrace{C(12,2)}_{\text{pick 2 face values}} \cdot \underbrace{C(4,1)}_{\text{pick card 3}} \cdot \underbrace{C(4,1)}_{\text{pick card 4}} = (13)(6)(66)(4)(4)$$

$$= 82,368 \rightarrow$$

$$P(\text{exactly 1 pair}) = \frac{82,368}{C(52,4)} \approx 0.304$$

47.) (52 cards: 13 red hearts, 13 red diamonds, 13 black spades, 13 black clubs)

Select 13 cards:

$$P(\text{13 red}) = \frac{C(26,13)}{C(52,13)} = \frac{10,400,600}{635,013,559,600} \approx 0.000016$$

48.) Select 4 cards:

$$P(1\heartsuit, 1\diamondsuit, 1\clubsuit, 1\spadesuit) = \frac{C(13,1)\cdot C(13,1)\cdot C(13,1)\cdot C(13,1)}{C(52,4)}$$

$$= \frac{13\cdot 13\cdot 13\cdot 13}{270{,}725} \approx 0.105$$

49.) Select 5 cards: pick exactly 2 pairs →

$$\underbrace{C(13,2)}_{\substack{\text{pick 2}\\ \text{face}\\ \text{values}}} \cdot \underbrace{C(4,2)}_{\substack{\text{pick}\\ \text{pair 1}}} \cdot \underbrace{C(4,2)}_{\substack{\text{pick}\\ \text{pair 2}}} \cdot \underbrace{C(44,1)}_{\substack{\text{pick}\\ \text{5th}\\ \text{card}}} = 78\cdot 6\cdot 6\cdot 44 = 123{,}552 \rightarrow$$

$$P(\text{exactly 2 pairs}) = \frac{123{,}552}{C(52,5)} = \frac{123{,}552}{2{,}598{,}960}$$

$$\approx 0.048$$

50.) Select 5 cards:

$$\underbrace{C(13,1)}_{\substack{\text{pick}\\ \text{triple}\\ \text{face}\\ \text{value}}} \cdot \underbrace{C(12,1)}_{\substack{\text{pick}\\ \text{pair}\\ \text{face}\\ \text{value}}} \cdot \underbrace{C(4,3)}_{\substack{\text{pick}\\ \text{triple}}} \cdot \underbrace{C(4,2)}_{\substack{\text{pick}\\ \text{pair}}} = 13\cdot 12\cdot 4\cdot 6 = 3744 \rightarrow$$

$$P(\text{full house}) = \frac{3744}{C(52,5)} = \frac{3744}{2{,}598{,}960} \approx 0.0014$$

51.) N fish, 100 marked:

a.) 3 marked fish out of 10:

$$\underbrace{C(100,3)}_{\text{pick 3 marked fish}} \cdot \underbrace{C(N-100,7)}_{\text{pick 7 unmarked fish}}$$

Sample Space size: $C(N,10) \longrightarrow$

$$P(\text{3 marked fish out of 10}) = \frac{C(100,3) \cdot C(N-100,7)}{C(N,10)}$$