Chapter 13 Exercise Set A

1
a) There is a bug in the program.
b) This won't happen
c) This may happen, but it's not likely
d) This is as likely to happen as not
e) This is very likely to happen, but it's not certain
f) This will happen, for sure!
g) There is a bug in the program.

2 We expect half to be heads $\frac{1}{2}(1{,}000) \approx 500$

3 An ace is a "1" this happens 1/6 times so $1/6\,(6{,}000) \approx 1{,}000$.

4 A full house happens .14% of the time so. $.0014(10{,}000) \approx 14$

5 ii is better. You would expect to get 1/2 of one ticket and 1/2 of the other. The 3's pay more so it is the better option.

Chapter 13 Exercise Set B

$\boxed{1a}$ If we don't know what happens on the first draw, pretend it didn't happen. so 1/4.

$\boxed{1b}$ The two is gone so there are 3 tickets left so 1/3.

$\boxed{2a}$ 1/4, same logic

$\boxed{2b}$ 1/4, we put the two back in.

$\boxed{3a}$ 1/2, it doesn't matter what happened before.

$\boxed{3b}$ 1/2, it doesn't matter what happened before still.

$\boxed{4a}$ If we don't know what happened on the first four draws, pretend they didn't happen. so 1/52

$\boxed{4b}$ 4 cards are gone from the deck. $(52-4)=48$ so 1/48.

Chapter 13 Exercise Set C

$\boxed{1a}$ If the first card was a heart, then one heart is gone $13-1=12$, one card is also gone $52-1=51$ so $12/51$

$\boxed{1b}$ *AND* $P(A) \times P(B|A)$

A = 1st is a heart
B|A = 2nd is a heart if 1st is a heart

$$\frac{13}{52} \times \frac{12}{51}$$

$\boxed{2a}$ There is one ace side to a die out of six so $1/6$

$\boxed{2b}$ *AND* $P(A) \times P(B) \times P(C)$ one event doesn't affect the others like in 1.

$$\frac{1}{6} \times \frac{1}{6} \times \frac{1}{6}$$

A = Ace B = Duece C = Trey

$\boxed{3a}$ Four kings in one deck so $\frac{1}{52}$

$\boxed{3b}$ *AND* $P(A) \times P(B|A) \times P(C|B \text{ and } A)$

A = 1st is a King
B|A = 2nd is a Queen if 1st is a King.
C|B&A = 3rd is a Jack if 1st is a king and 2nd is a Queen.

$$\frac{4}{52} \times \frac{4}{51} \times \frac{4}{50}$$

$\boxed{4}$ Choose option one getting 1 ace in six rolls is more likely to happen than getting six aces in six rolls.

$\boxed{5}$ Yes. It's an awkward way to think about it, but it does work.

$\boxed{6}$ The phrase is "A cat-o-nine-<u>tails</u> can be used to punish <u>heads</u> of state, but this is seldom done."

The coin has to get both blanks right to be correct.

BOTH $P(A) \times P(B)$ one event doesn't affect the others.

$$\frac{1}{2} \times \frac{1}{2}$$

A = Getting Tails first
B - Getting Heads second.

$\boxed{7a}$ $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$

$\boxed{7b}$ Not getting three heads is the opposite of getting all heads like in a. When we use "opposite" we take 1 minus the chance it happens.

$$1 - \left(\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}\right)$$

$\boxed{7c}$ Getting at least one tail is the same as not getting 3 heads.

$$1 - \left(\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}\right)$$

$\boxed{7d}$ This is tricky *AT LEAST ONE* is 1-NONE. So

$$1 - (\text{No heads}) = 1 - \left(\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}\right)$$

Chapter 13 Exercise Set D

1 a) independent

b) Independent

c) Dependent, knowing color changes the odds of the numbers.

2a Independent, the ones and fours are the first numbers only, the twos and threes are the second numbers only, each combination is present so they are independent.

2b Independent, Same logic but the two appears 1/3 of the time and the 3 appears 2/3 of the time.

2c Dependent, the 2 & 3 appear differently depending on the first number.

3 Each time you play is independent on previous trys.

losing once $= \dfrac{999{,}999}{1{,}000{,}000}$ 10 years $\times \dfrac{52 \text{ weeks}}{1 \text{ year}} = 520$ weeks.

losing for ten years $= \left(\dfrac{999{,}999}{1{,}000{,}000}\right)^{520}$ (power rule of independence)

4 False. This is different than before. Pretending like something didn't happen is not independence.

5a 5%. If you have 100 people 80 are men and 20 women, give all the sophomore status to the men (80/85) and you have 5 more sophomores that have to be women

5b 20% Same logic give all sophomore status to the women.

6a 5% Same logic

6b 20% Same logic

7 False, This is assuming that age and gender are independent, women tend to live longer so that leads to false.

8 No matter what they draw from the small pile, the card from the big pile has to match, there are four suits, equally represented so the answer is

$\dfrac{1}{4}$ we just don't know what the 1 represents til after the first card is drawn.

Chapter 13 Review Exercises

$\boxed{1a}$ False, probabilities run from 0% to 100%, anything outside this range is exaggeration.

$\boxed{1b}$ True.

$\boxed{2}$ One is the better option. *AND*

$i = 1/52$

$ii = 1/52 \times 1/51$

$\boxed{3}$ Two is better. *AND*

$i = \frac{13}{52} \times \frac{13}{51} \times \frac{13}{50} \times \frac{13}{49}$

$ii = \frac{52}{52} \times \frac{39}{51} \times \frac{26}{50} \times \frac{13}{49}$

$\boxed{4}$ $\frac{4}{52} \times \frac{3}{51} \times \frac{2}{50} \times \frac{1}{49} \times \frac{4}{48}$

$\boxed{5}$ Yes. Knowing color does not give away the numbers odds, Knowing number does not give away the colors odds.

$\boxed{6a}$ True

$\boxed{6b}$ True, we don't know what the first card is.

$\boxed{6c}$ False, They are dependent events so the probability is $\frac{1}{52} \times \frac{1}{51}$

$\boxed{7}$ C, because a coin has a $\frac{1}{2}$ chance to land either way, the probabilities work out to be the same.

$\boxed{8a}$ 4 sides have 3 or more spots. Independent rolls.

$\left(\frac{4}{6}\right)^4$

$\boxed{8b}$ Two sides have 2 or less spots. Independent rolls.

$\left(\frac{2}{6}\right)^4$

$\boxed{8c}$ *Not All* 1- NONE

1- ~~none~~ (~~not~~ all have 3+ spots) Double Negative
1- (all have 3+ spots)

$1 - \left(\frac{4}{6}\right)^4$

$\boxed{9a}$ $\left(\frac{1}{6}\right)^{10}$

$\boxed{9b}$ This is the opposite $1-\left(\frac{1}{6}\right)^{10}$

$\boxed{9c}$ 5 sides have 5 spots or less so $\left(\frac{5}{6}\right)^{10}$.

$\boxed{10}$ ii is the better option because you don't lose any money.

$\boxed{11}$ 4 tickets with 1 and 3 on the first side.
The second side has to have the same proportions of numbers.

There is one 1, two 2's, and one 3 in the groups so the box looks like:

$\boxed{1\,|\,1}$ $\boxed{1\,|\,2}$ $\boxed{1\,|\,2}$ $\boxed{1\,|\,3}$ $\boxed{3\,|\,1}$ $\boxed{3\,|\,2}$ $\boxed{3\,|\,2}$ $\boxed{3\,|\,3}$

$\boxed{12}$ Chance of getting 1 number right and a second number right <u>and</u> a third number right.

$$\frac{1}{100} \times \frac{2}{99} \times \frac{3}{98}$$