Name: Key

Sec. 5.2

Independent/Dependent Events

Determine if the following are dependent or independent events.

1. Hours you study for a test and your grade on that test
   dependent
2. Flipping a coin and rolling a die
   independent
3. Parking in a handicap parking space and getting a parking ticket
   dependent
4. Drawing an ace in a standard deck, put it back and then draw another
   independent
5. Jeremy took the SAT on Saturday and scored a 1350. The following week he took the ACT and scored a 23. independent
6. A card is randomly chosen from a deck of 52 cards, replaced, and a second card is chosen. independent
7. In a game, you roll an even number on a die and then you spin a spinner numbered 1 through 5 and get an odd number. independent
8. An ace is drawn, without replacement, from a deck of 52 cards. Then, a second ace is drawn. dependent

List event A and event B. Then determine if the following events are independent using the formula:

$$P(A \text{ and } B) = P(A) \cdot P(B).$$

9. Use the sample space from number 14 to determine whether randomly getting a head on the coin and a purple marble are independent events.
   Event A: Head
   Event B: purple

   $P(\text{head and purple}) = P(\text{head}) \cdot P(\text{purple})$

   $\frac{2}{6} = \left(\frac{1}{2}\right) \cdot \left(\frac{4}{6}\right)$

   $\frac{1}{3} = \frac{1}{3}$

   Independent

10. Use the sample space from number 17 to determine whether randomly drawing two black marbles are independent events.
    Event A: Black on first draw
    Event B: Black on second draw

    $P(\text{Black and Black}) = P(\text{Black on first}) \cdot P(\text{Black on second})$

    $\frac{12}{42} = \left(\frac{24}{42}\right) \cdot \left(\frac{24}{42}\right)$

    $\frac{4}{14} \neq \left(\frac{4}{7}\right) \cdot \left(\frac{4}{7}\right)$

    not independent

11. Use the sample space from number 18 to determine whether randomly spinning blue and then green are independent events.
    Event A: Blue on first spin
    Event B: Green on second spin

    $P(\text{Blue and Green}) = P(\text{Blue}) \cdot P(\text{green})$

    $\frac{1}{16} = \left(\frac{4}{16}\right) \cdot \left(\frac{4}{16}\right)$

    $\frac{1}{4} \cdot \frac{1}{4}$

    $\frac{1}{16}$

    independent

12. Use the sample space from number 19 to determine whether randomly selecting a green apple first and randomly selecting a green apple second are independent events.

$P(\text{green and green}) = P(\text{green}) \cdot P(\text{green})$

$\frac{6}{12} = \frac{9}{12} \cdot \frac{9}{12}$

$\frac{1}{2} = \frac{3}{4} \cdot \frac{3}{4}$ $\quad \frac{1}{2} \neq \frac{9}{16}$

Event A: green apple first

Event B: green apple second

Not independent

13. Use the sample space from number 20 to determine whether randomly guessing question 1 correctly and question 2 correctly are independent events.

$P(a \text{ and } b) = P(a) \cdot P(b)$

$\frac{8}{32} = \frac{16}{32} \cdot \frac{16}{32}$

$1/4 = 1/4$

independent

Event A: correct on question 1

Event B: correct on question 2

14. Use the sample space from number 21 to determine whether randomly selecting a white rose first and randomly selecting a white rose second are independent events.

$P(\text{white and white}) = P(\text{white } 1^{st}) \cdot P(\text{white } 2^{nd})$

$\frac{12}{20} = \frac{16}{20} \cdot \frac{16}{20}$

$\frac{3}{5} = \frac{4}{5} \cdot \frac{4}{5}$ $\quad \frac{3}{5} \neq \frac{16}{25}$

Event A: White Rose First

Event B: White Rose second

Not independent

Determine if the events are independent or dependent. Then use the appropriate formula to determine their probability.

Independent Events: $P(A \text{ and } B) = P(A) \cdot P(B)$

Dependent Events: $P(A \text{ and } B) = P(A) \cdot P(B \mid A)$

15. You play a game that involves drawing two numbers from a hat. There are 25 pieces of paper numbered from 1 to 25 in the hat. Each number is replaced after it is drawn. Find the probability that you will draw the 3 on your first draw and a number greater than 10 on your second draw.

$P(3 \text{ and } 10) = P(3) \cdot P(\# > 10)$

$\frac{1}{25} \cdot \frac{15}{25}$

$\frac{1}{25} \cdot \frac{3}{5} = \frac{3}{125}$

Event A: drawing a 3

Event B: drawing a number > 10

Dep/Ind: independent

Probability: 3/125

16. A drawer contains 12 white socks and 8 black socks. You randomly choose 1 sock and do not replace it. Then you randomly choose another sock. Find the probability that both socks are white.

$P(A \text{ and } B) = P(A) \cdot P(B \mid A)$

$\frac{12}{20} \cdot \frac{11}{19}$

$\frac{3}{5} \cdot \frac{11}{19} = 33/95$

Event A: white sock first

Event B: white sock second

Dep/Ind: Dependent

Probability: 33/95

17. A word game has 100 tiles, 98 of which are letters and 2 of which are blank. The numbers of tiles of each letter are shown. You randomly draw 1 tile, set it aside, and then randomly draw another tile. Find the probability that the first tile is a consonant and the second tile is a vowel.

A – 9	H – 2	O – 8	V – 2
B – 2	I – 9	P – 2	W – 2
C – 2	J – 1	Q – 1	X – 1
D – 4	K – 1	R – 6	Y – 2
E – 12	L – 4	S – 4	Z – 1
F – 2	M – 2	T – 6	
G – 3	N – 6	U – 4	Blank

Vowels: $9+12+9+8+4 = 42$

Consonants: 56

Blanks: 2

Event A: Consonant

Event B: Vowel

Dep/Ind: Dependent

Probability: 196/825

$P(A \text{ and } B) = P(A) \cdot P(B \mid A)$

$\frac{56}{100} \cdot \frac{42}{99}$

$\frac{14}{25} \cdot \frac{14}{33} = \frac{196}{825}$

18. Events A and B are independent. Suppose $P(B) = 0.4$ and $P(A \text{ and } B) = 0.13$. Find $P(A)$.

$P(A \text{ and } B) = P(A) \cdot P(B)$

$0.13 = P(A) \cdot (.4)$

$.325 = P(A)$

19. Events A and B are dependent. Suppose $P(B \mid A) = 0.6$ and $P(A \text{ and } B) = 0.15$. Find $P(A)$.

$P(A \text{ and } B) = P(A) \cdot P(B \mid A)$

$0.15 = P(A) \cdot (0.6)$

$.25 = P(A)$

20. Events A and B are independent. Describe and correct the error in finding $P(A \text{ and } B)$.

✗ $P(A) = 0.6 \quad P(B) = 0.2$

$P(A \text{ and } B) = 0.6 + 0.2 = 0.8$

Probabilities should have been multiplied

$(.6)(.2) = .12$

21. A shelf contains 3 fashion magazines and 4 health magazines. You randomly choose one to read, set it aside, and randomly choose another for your friend to read. Describe and correct the error in finding the probability that the first magazine is fashion and the second magazine is health.

✗ $P(A) = \frac{3}{7} \quad P(B|A) = \frac{4}{7}$

$P(A \text{ and } B) = \frac{3}{7} \cdot \frac{4}{7} = \frac{12}{49} \approx 0.245$

Dependent events. Denominator should have decreased by 1

$\frac{3}{7} \cdot \frac{4}{6} = \frac{2}{7}$

22. You randomly select three cards from a standard deck of 52 playing cards. What is the probability that all three cards are face cards when…

a. you replace each card before selecting the next card.

$\frac{12}{52} \cdot \frac{12}{52} \cdot \frac{12}{52} = \left(\frac{3}{13}\right)^3 = \frac{27}{2197}$

b. you do not replace each card before selecting the next card.

$\frac{12}{52} \cdot \frac{11}{51} \cdot \frac{10}{50} = \frac{3}{13} \cdot \frac{11}{51} \cdot \frac{1}{5} = \frac{33}{3315}$

23. At a school, 43% of students attend the homecoming football game. Only 23% of students go to the game and the homecoming dance. What is the probability that a student who attends the football game also attends the dance?

$P(A \text{ and } B) = P(A) \cdot P(B \mid A)$

$.23 = .43 \cdot P(B \mid A)$

$\approx .53 = P(B \mid A)$

Event A: attend football Game 43%

Event B: attend the dance

Ind/Dep: Dependent

Probability: .53

24. A meteorologist claims that there is a 70% chance of rain. When it rains, there is a 75% chance that your softball game will be rescheduled. Your friend believes the game is more likely to be rescheduled than played. Is your friend correct? Give a mathematical explanation using the formulas for independent or dependent events.

$P(A \text{ and } B) = P(A) \cdot P(B \mid A)$

$P(\text{rain and reschedule}) = (.70) \cdot (.75)$

$P(\text{rain and reschedule}) = 52.5\%$

Event A: Rains .70

Event B: Game is rescheduled

Ind/Dep: Dependent

Probability: 52.5%

Yes 52.5% chance it is rescheduled